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ECONOMIES IN THE 1990S:

INFLATION TARGETS AND EXCHANGE RATE BANDS

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I. INTRODUCTION

In recent years there has been a growing trend toward increased flexibility of exchange rate regimes. According to IMF data, about two thirds of world trade are now conducted under under floating exchange rates, compared to one half in 1980. And about 76 developing countries are operating under managed or independent floating exchange rates. At the same time, a decreasing number of countries are using monetary aggregates as intermediate targets for monetary policy. Rather than reflecting the impact of any new theoretical results in international monetary theory, these changes were primarily due to practical considerations. Recent experience with increasing economic costs of maintaining tight exchange rate pegs, currency crises under highly volatile international capital flows, and financial innovations have all contributed to the gradual change in the nominal regime.

Taken together, these developments have prompted renewed interest in the old, yet never ending, question of what is the optimal exchange rate regime for an individual economy. More generally, the search for nominal anchors is in full force--where these anchors are supposed to play two main roles: (i) to serve as guides for the operational conduct of monetary policy, and (ii) to serve as a coordination device in the wage- and price-setting process and in the formation of inflation expectations by the public at large. While these issues are not new, what is different this time is the economic environment of the 1990s: considerable trade integration and high capital mobility have brought in new policy challenges to vulnerable, volatility-prone open economies.

This paper discusses these issues from the policy perspective of shock-prone developing countries. We do not intend here to explore the choice of nominal anchors in the context of major inflation-stabilization programs. This topic has been covered, to a large extent, in preceding literature.[2] Instead, we plan to focus on moderate inflation cases, such as Chile, Colombia, Israel, and Mexico. Namely, on situations or countries where in spite of a serious disinflation and of a marked adjustment in fiscal and monetary fundamentals, there is still a moderate inflation rate differential vis-a-vis trading partners, and at the same time there is a policy goal to gradually reduce this differential in the near future.

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[2] See, e.g., Bruno (1993), Calvo and Vegh (1994), Dornbusch and Fischer (1993), Edwards (1993), Fischer (1986), Kiguel and Liviatan (1989), Leiderman (1993), and Vegh (1992).

Faced with the policy dilemmas of the 1990s, several large moderate-inflation countries have shifted toward increased exchange rate flexibility in at least one of two modes: the adoption of crawling exchange rate bands (as in Chile, Colombia, and Israel) and/or the adoption of explicit inflation targets (as in Britain, Canada, New-Zealand, Spain, and Sweden). In those countries which adopted them, crawling bands are seen as a regime that partially maintains an anchoring role for the nominal exchange rate yet at the same time provides flexibility to deal with short term shocks and with the marked volatility of international capital flows. If credible, inflation targets are seen as a transparent channel for the authorities to commit and discipline their monetary policy without necessarily engaging in the macroeconomic costs of currency pegs. While some countries in Europe have abandoned previous currency bands in favor of inflation targets, bands and inflation targets coexist in the cases of Chile and Israel.

Because of the increasing policy shift toward crawling exchange rate bands and inflation targets, and given the lack of theoretical work that can unambiguously support these choices, we believe it is important to document and analyze the recent experience of various countries with these regimes--a task that is the main goal of this paper. By providing and discussing background and evidence on the new breed of currency bands and on inflation targets, it will be possible to derive policy implications of these regimes--some of which may apply to other developing countries--as well as to produce a set of "stylized facts" which could serve as the basis for future analytical work on these issues.[3]

The paper is organized as follows. Section II briefly discusses the choice of the exchange rate regime, especially in light of recent developments in industrial countries. Section III introduces crawling exchange rate bands and Section IV deals with inflation targets. New evidence on the degree of passthrough from nominal exchange rates to prices is provided in Section V.

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[3] Since not many developing countries are currently contemplating the adoption of fixed exchange rates, and since in fact the adoption of crawling bands and inflation targets was mainly due to unsatisfactory performance of fixed (but adjustable) exchange rates, we do not elaborate on the latter.

II. CHOOSING THE EXCHANGE RATE REGIME

In this section we discuss various analytical and empirical aspects related to the choice of the exchange rate regime by a single country. An ideal evaluation of exchange rate systems could proceed along the lines of standard welfare economics.[4] It would compare regimes in terms of costs and benefits and derive net welfare gains for each regime choice. Exchange rate systems would then be ranked according to Pareto's criterion in order to see which fare best. This procedure, however, is unlikely to lead to a unique optimal choice, since more than one regime can be expected to top the list. Regimes differ in their distributional implications, some favoring one set of agents and others favoring a different set.

While this selection procedure is rooted in standard economic thinking, it has played only a limited role in discussions of exchange rate regimes. The main reason for this is probably the considerable complexity of the issue, which involves considerations of international trade, pricing policies, financial markets, capital flows, interest rates, monetary and fiscal fundamentals, and more. As in other cases, the treatment of a complex issue involves compromises in research strategies, often in the form of shorcuts in the formulation of the underlying problems. A major compromise in exchange rate economics has been the evaluation of regimes by means of criteria that are only loosely related to acceptable welfare measures. In fact, attention has been focused on performance of various exchange rate regimes in terms of the variability of output, variability of the price level, the competitiveness of domestic products, inflation, and the like.[5] In favor of the compromise approach one may argue that these criteria are important and that they are related to the ultimate measures of welfare, as indeed they are. However, caution must be applied to reaching firm conclusions about the desirability of alternative exchange rate systems based on this approach.

The old debates on floating vs. fixed exchange rates which have been documented

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[4] See Helpman and Leiderman (1991), which served as the basis for some of the discussion that follows.

[5] For survey of some of this work, see Aghevli, Khan, and Montiel (1991). See also Williamson (1982). On the implications of various regimes for inflation, see Quirk (1994).

extensively in the literature reflect the foregoing compromises.[6] The traditional case for floating exchange rates was made on the basis of two major arguments: (i) a float can result in a marked degree of monetary policy autonomy, as the authorities need not defend any specific nominal exchange rate commitment. Enhanced control over monetary policy would allow policymakers to focus on stabilization policies and to choose their own desired long run rate of inflation instead of importing it from the rest of the world. Furthermore, through purchasing power parity, floating would allow single economies to insulate themselves completely from changes in foreign prices. (ii) floating rates can play the role of automatic stabilizers, facilitating internal and external adjustment in response to shocks. Also, they could eliminate the long speculative cycles that were associated with exchange rate realignments under a fixed (but adjustable) peg.

In contrast, the case against floating exchange rates rested on the main arguments that follow: (i) fixed exchange rates could strongly discipline central banks and the fiscal authorities and thus avoid the acceleration of inflation that, in view of various short-term political and economic factors, may occur if policymakers were free from the external constraints imposed by fixed rates. (ii) floating rates could be vulnerable to destabilizing speculation which could result in major instability in the foreign exchange market, instability that may have a disruptive impact on trade, investment, and growth of the country at issue. (iii) the perception that less cross-country coordination is needed under floating may lead individual countries to adopt currency practices that are detrimental to the trading partners and to international trade.

When the various arguments are embodied in formal macroeconomic models, it turns out that there are no simple answers to the question which exchange rate regime would be optimal for a given small open economy. The optimal degree of exchange rate flexibility typically depends on the objectives of the authorities, on the types of shocks impinging on the economy, and on the institutional framework and structure of the economy.[7] Thus, different configurations of these factors can give different results about optimal flexibility. In general, neither of the extremes of a fully fixed exchange rate or a free float is optimal

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[6] For a recent survey of the arguments on both sides of the debate, see Krugman and Obstfeld (Ch. 19, 1991).

[7] See Aghevli, Khan, and Montiel (1991) and references therein.

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in achieving the authorities' objectives.

Although analytical conclusions are useful, we believe (as noted in the Introduction) the recent trend toward increased flexibility in exchange rate regimes has to do with <u>practical considerations</u> rather than with new theoretical results. It appears that the European currency crises in 1992, events in other currency markets such as Mexico, and the advent of growing integration of world capital markets have provided broad lessons which have generated a new "consensus view" about the choice of the exchange rate regime with the following principles:[8]

● **Fragility and vulnerability of fixed exchange rates.** Although fixed exchange rates can play a key anchoring role at the start of a comprehensive disinflation program-- especially when accompanied by tight fiscal fundamentals and by a strong commitment to stabilization--sooner or later they are hard to sustain. With finite foreign exchange reserves, and under high capital mobility, a peg can become vulnerable to capital flow reversals or speculative attacks. Vulnerability may be especially strong if devaluations can not be ruled out, if there are problems with the domestic banking sector which may result in a crisis, and if there is no clear lender of last resort. Since governments of most nations still attach domestic considerations a higher priority than international factors, they may find it excessively costly to tolerate the type of fiscal and monetary policy adjustments needed to defend the exchange rate regime, as e.g. high real interest rates that are accompanied by a relatively high rate of unemployment.

● **Flexibility can enable more rapid and efficient macroeconomic adjustments.** Fixity of nominal exchange rates can slow down the process of real exchange rate adjustment to real shocks, especially in shock-prone economies with short term nominal rigidities in the goods and labor markets. Instead, rapid adjustment could be facilitated by allowing nominal exchange rates to make most of the equilibrating adjustment required for real exchange rates. The marked nominal exchange rate depreciations observed in Italy, Sweden, and the United Kingdom in the last 2-3 years, which brought about equilibrating real exchange rate depreciation, illustrate well this point. Similar considerations apply to the nominal and real

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[8] See, e.g., Crockett (1993), Svensson (1994), and Obstfeld (1995).

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depreciation of the Mexican peso following the December 1994 crisis.[9] However, if excessive, nominal exchange rate volatility can have a detrimental impact on trade and welfare. In that case, it would be desirable for economic agents to have access to those financial instruments that may help them hedge against unexpected exchange rate fluctuations.

● **Enhanced flexibility did not result in uncontrolled inflation and fixed rates did not guarantee low inflation.** In spite of early fears that flexibility and enhanced monetary policy autonomy would lead to uncontrolled high inflation, there has been a substantial decrease in the rate of inflation in most countries.[10] Moreover, the persistence of inflation rates in industrial countries is not much higher now than it was in the Bretton Woods period. And fixed exchange rates have not been necessary or sufficient factors to ensure stability and credibility of domestic monetary and fiscal policies as well as a reduction of chronic inflation in shock-prone developing countries.

● **Capital mobility is a key external constraint under floating rates.** In theory, flexible exchange rates were supposed to remove external constraints from the existence of a limited stock of foreign exchange reserves, and to insulate countries from external nominal shocks. In practice, some external discipline has been generated because countries have found it crucial to conduct restrained domestic monetary and fiscal policies in order to keep continuous access to world capital markets--access that has been a prerequisite for attracting foreign investments. Moreover, exchange rate flexibility has not prevented the transmission of policy shocks across countries. Under considerable world integration in markets for goods, services, and capital, regardless of the prevailing exchange rate regime countries will find it increasingly difficult to become insulated from the potentially strong effects of current account and capital account shocks such as those in the 1990s.

As indicated in the Introduction, these practical considerations, together with

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[9] See, e.g., Leiderman and Thorne (1995). Diaz-Alejandro (1984) draws a similar conclusion in regards to the impact of cessation of capital inflows to Latin America in 1929-1933 in that ..."countries willing and able to devalue their exchange rate moved toward the new constellation of domestic relative prices more speedily and less painfully than those with fixed rates, limiting both price and monetary deflation, containing their negative impact on real output, or reducing presures to depress money wages by extra-ordinary measures."

[10] Helpman, Leiderman, and Bufman (1994) find that the shift from a fixed- to crawling-central-parity band in Israel was not accompanied by accelerating inflation or by increased volatility of exchange rates or interest rate differentials.

increasing dissatisfaction about monetary policy performance under money-aggregates targeting, have played a crucial role in the recent policy shift toward increased exchange rate flexibility and toward explicit inflation targets. The resulting regimes are discussed in the next two sections.

III. CRAWLING EXCHANGE RATE BANDS UNDER MODERATE INFLATION

Although there could be various reasons for the adoption of crawling exchange rate bands, in most countries this adoption can be treated as a resolution of a basic tradeoff faced by policymakers: how to keep a competitive nominal (and real) exchange rate and at the same time avoid acceleration and instability in the rate of inflation.[11] In moderate inflation economies, crawling bands can help resolve this tradeoff by providing a simple and verifiable system to have a policy commitment about the time path of the band's central parity rate (which becomes a key nominal anchor) while at the same time allowing for some flexibility needed to shield the real exchange rate (and domestic competitiveness) from various potential internal and external shocks.

1. Varieties of Initial Conditions

Among the growing number of countries operating under crawling exchange rate bands, there are important differences in the initial conditions prior to the adoption of these bands. These differences can account for some of the observed cross-country diversity in the choice of bands' parameters and mode of operation. While in some countries the shift to crawling bands represented an attempt to introduce increased exchange rate flexibility following a period with fixed exchange rates, other countries moved away from preceding active crawling pegs, with the objective of reducing the rate and persistence of inflation.

Israel and Mexico (before the recent crisis) are among the former, in that bands were adopted several years after the implementation of exchange-rate-based disinflation programs. Accordingly, the first phase of stabilization relied, typically, on a fixed-exchange-rate anchor whose main role was to break prevailing inflation inertia. Under these conditions, the main role of monetary policy was to defend and support the exchange rate regime. However,

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[11] For a formal model that analyzes this policy tradeoff and its implications for the adoption of unilateral exchange rate bands, see Cukierman, Kiguel, and Leiderman (1994). Crawling exchange rate bands are also discussed by Williamson (1995).

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throughout this initial phase of disinflation there was commonly a loss of competitiveness, as reflected in cumulative real exchange rate appreciations, and it became clear that domestic inflation would remain above foreign inflation for some time into the future. Experience indicates that sooner or later policymakers began to perceive this erosion in competitiveness as a serious risk to the ultimate success of the whole program.

It is under these circumstances--and under the assumption that fiscal and monetary fundamentals have been properly adjusted and that major disinflation is being achieved--that the above-mentioned countries entered a second phase in which they relaxed the fixity of the nominal exchange rate.[12] Thus, the adoption of crawling exchange rate bands was seen as introducing some flexibility into the nominal exchange rate policy commitment--flexibility that applies to both the trend behavior of nominal exchange rates (in economies with domestic inflation above foreign inflation) as well as to the short-term deviations from the trend induced by either internal or external shocks.

In contrast to the foregoing cases, the transition to crawling bands in Colombia originated in a preceding active, and accommodative, crawling peg. For about twenty five years with such a peg, and with considerable monetary accommodation, Colombia had inflation rates in the range of 20 to 30 percent per year.[13] A major change of regime occurred in the 1990s, when a new constitution was established which included a provision for legal independence of the central bank under the specific mandate to preserve the purchasing power of money. Initially, this was taken to mean reducing the rate of inflation to the range of 20-25 percent per year. The crawling exchange rate band adopted in January 1994 was aimed at introducing some degree of nominal exchange rate anchoring with the objective of reducing the rate of inflation, and more importantly reducing the degree of nominal accommodation of the previous regime. Similar conditions preceded the adoption of a crawling exchange rate band in Poland in May 1995.

The introduction of the exchange rate band in Chile, in 1984, was preceded by a period of debt crisis and turbulence in the foreign exchange market, as reflected in frequent

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[12] On the need for flexibility in this second phase of stabilization, see e.g., Fischer (1994), Helpman, Leiderman, and Bufman (1994), and Leiderman, Liviatan, and Thorne (1994). The Mexican band is discussed in detail by Schwartz (1994).

[13] See Carrasquilla (1995).

discrete devaluations. Initially, the main emphasis was on generating a rate of crawl that could improve competitiveness and could relax the external constraint of limited access to world capital markets. Yet the emphasis changed after 1990, when a newly independent central bank placed an increasing weight on the importance of reducing inflation.

2. The Choice of Bands' Characteristics: Operational Issues

When a currency band is adopted, the authorities have to specify several important operational issues: (i) the behavior of the central parity (or reference) exchange rate; (ii) the width of the band; (iii) the degree and form of intramarginal intervention; (iv) the allocation of adjustments among interest rates, exchange rates, and foreign reserves in supporting and defending the band under various shocks.[14]

It is only natural to expect countries to differ in their choices about these band policy parameters. For example, Chile's current band has a crawling central parity (defined in terms of a basket of foreign currencies) and fluctuation limits of 10 percent around that rate; see Figure 1. As explained below, the crawl is mainly backward looking, and in most of the sample period there has been little intramarginal intervention. Instead, it has been quite common to observe the exchange rate positioned at either the upper or lower limit of the band for a considerable amount of time.[15]   In the case of Israel's band, shown in Figure 1 as well, the crawl is forward looking; i.e., it is preannounced together with official inflation targets--see Helpman, Leiderman, and Bufman (1994). Typically, there has been heavy intramarginal intervention by the authorities.

(i) Central parity characteristics: A first choice in this context is the denomination of the target exchange rate. That is, should the central parity exchange rate be defined against the U.S. dollar, the DM, or a basket of foreign currencies? For economies with diversified trade in goods and services, it seems logical to use a basket of foreign currencies, where each foreign currency receives a weight based on the relative importance of the corresponding foreign country in these trade flows. Basket-type central parities are presently used in Chile, Israel, and Poland. On the other hand, bands in Colombia and Mexico have been using their exchange rates against the U.S. dollar as central parity rates. Interestingly,

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[14] This subsection considers the case of unilateral bands. For a discussion of operational issues in the context of multilateral currency bands, see Frenkel and Goldstein (1986).

[15] On Chile's band, see Vergara (1994).

the advent of relatively high capital mobility has not affected yet the choice of specific weights in baskets of foreign currencies. The issue is relevant because capital flows have become increasingly important factors in foreign exchange market fluctuations, and because the foreign currency composition of these flows may differ from that of goods and services. For example, the weight of U.S. dollar transactions in Israel's capital account is much larger than in the current account, a fact that may call for raising the weight of that currency in the basket as capital flows become more important sources of fluctuations. Another issue has to do with periodic adjustment of the basket weights; namely, it would be useful if clear guidelines are provided as to how and when these weights could be changed to capture the changing market trade and capital flow patterns.

Another important choice is whether the central parity will be fixed or will vary with time. In countries with rates of inflation above those of their trade partners, a permanently fixed central parity is not feasible. Thus, for such countries the real choice is between infrequent realignments (as in the EMS) and a crawl. As evident in Israel's experience from 1989 to 1991 and in recent European experience with currency bands, infrequent realignments may generate substantial uncertainty, produce interest rate volatility, and damage the credibility of the band. On the other hand, there is the danger that crawling bands may weaken the role of the exchange rate as a nominal anchor and may elicit inflationary expectations. Once a crawling band is adopted, there are two main criteria for determining the crawl's pace; one is backward looking and the another one is forward looking. In the forward-looking scheme (as e.g. in Israel) the authorities announce at a given point in time the rate of crawl of the central parity for a subsequent period, such as the next six or twelve months. A plausible option in this context is to set the rate of crawl equal to the difference between the authorities' inflation target and a forecast of foreign inflation over the same time horizon. Alternatively, in the backward-looking mode (as e.g. in Chile) the announced rate of crawl for sometime into the future--say the next month--is a function of the difference between past inflation (say in the previous month) and a forecast or the past behavior of foreign inflation.

The main virtue of the forward-looking scheme is that--if credible--it can provide a strong nominal anchor for inflation expectations, in spite of the enhanced exchange-rate flexibility. Moreover, the crawling central parity can support the authorities' preannounced

inflation target. For both these virtues to work, it seems reasonable to keep some distance in time between the dates of announcements, such that these are made only once or twice a year. The main limitation of this scheme is that it does not allow for automatic adjustment of the crawl's pace in response to what may turn out to be persistent deviations of inflation from target. Thus, if due to unexpected disturbances the rate of inflation continuously overshoots the official target, this scheme may result in both ex-ante and ex-post real exchange rate appreciations, which may damage the competitiveness of exports and the country's external equilibrium.

As far as the backward-looking mode is concerned, it has the advantages and drawbacks of any indexation scheme (or a real exchange rate peg). In particular, this system embodies a greater degree of nominal accommodation than the preceding one and it can easily transform one-time changes in the price level (or the exchange rate) into permanent changes in the rate of inflation (or currency depreciation). To illustrate, in the case of Chile if inflation accelerates in month t, central parity depreciation is increased in month t+1, which then may impact inflation in month t+2, etc.

Based on the analytics of both these schemes, and on the experiences of Chile and Israel, it seems that the choice among the foregoing schemes--or of an intermediate scheme-- should be mainly a function of the relative weight the authorities place to the goals of keeping nominal discipline and reducing inflation vs. maintaining external competitiveness in the short run even at the cost of increased monetary and exchange rate accommodation, which may result in a higher rate and persistence of inflation. Other things equal, the stronger the desire to reduce inflation, and maintain it at low rates, the more appropriate it would be to choose the forward-looking system. Alternatively, the backward-looking system would be more appropriate when smoothing the short-run behavior of the real exchange rate is a key policy objective. Yet, as indicated above, in that case there may be a higher degree of inflation inertia and a higher rate of inflation than otherwise.

Last, the frequency of adjustments in the rate of crawl needs to be specified. While the authorities in Israel and Mexico (before the recent crisis) announced only once a year the upward slope of the crawling exchange rate band--and in Mexico this announcement was part of a broader "Pacto" commitment--in Chile the path of the central parity exchange rate is announced once a month. Colombia features an even more frequent pattern of

announcements than Chile; i.e., each day there is an announcement of the rate at which the band as a whole will be devalued in the next ten-day period.

(ii) **Band width:** Existing currency bands exhibit a whole variety of widths around the central parity: 7 percent in Colombia, Israel, and Poland; 10 percent in Chile; and 15 percent in several countries in Europe. There are five main factors that in principle should affect the choice of band width.[16] The first factor is the variability of underlying real and financial shocks. The higher the variance of these shocks, the stronger the need for wider bands. It is perhaps in this context that the European experience after 1992 can be recalled, whereby following the elimination of capital controls, and given an increased degree of financial integration and capital mobility, the authorities found it not feasible to defend previous narrow bands; see Svensson (1994).

Second, the authorities' perception of how well private market participants could manage with exchange rate volatility can certainly affect the choice of band width. In the presence of well functioning credit markets, and under availability of derivatives to cope with exchange rate risk, it is reasonable to opt for relatively wide bands. If that is not the case, but the economy in question is evolving toward increased financial sophistication, then a gradually expanding band (such as Mexico's before 1995) could be appropriate. A third factor is the desired degree of monetary policy autonomy. Clearly there is a tradeoff between exchange rate flexibility within the band and monetary autonomy. Other things equal, increases in the latter can be brought in only if increases in the former are accepted. Fourth, other things equal the more narrow a currency band is, the higher the probability that the authorities will have to renege on the current band's parameters (and to realign) at some point in time in the future. Put differently, narrow bands are likely to be subject to frequent realignments. Accordingly, the higher is the political/credibility cost to the authorities from reneging on the existing band, the greater the attractiveness of adopting relatively wide bands. Fifth, initial conditions matter. That is, if there is a perception that the initial central parity exchange rate is close to the "market equilibrium" rate, then a more narrow band width could be set than in the case in which a sharp appreciation or depreciation of the exchange rate is expected immediately upon adoption of a currency band.

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[16] For a formal model of optimal policymakers' determination of band width, see Cukierman, Kiguel, and Leiderman (1994).

(iii) Intramarginal intervention: One extreme case is when the authorities allow for relatively free movement of nominal exchange rates within the band, based on market forces, and restrict their intervention (especially in the foreign exchange market) to cases in which nominal exchange rates tend to approach, and even exceed, the band's margins. Alternatively, active intramarginal intervention can be conducted via foreign exchange purchases and sales by the central bank, aimed at supporting some inner intervention band whose characteristics are typically kept as confidential within the central bank. Obviously, the parameters of this inner band are likely to change from time to time. Previous empirical work by Helpman, Leiderman, and Bufman (1994) indicates that that there was a substantial degree of intramarginal intervention in Israel and Mexico, while in Chile the authorities allowed the exchange rate to fluctuate quite freely within the band. These differences show up in a comparison across the graphs in Figure 1 where it is seen that the nominal exchange rate in Chile has been allowed to fluctuate all the way through the width of the band, including considerable periods in which it was actually positioned at either the upper or lower limit of the band.

These differences may well reflect disparities in the authorities' own perception of their band's credibility with the public at large. Extensive intramarginal intervention may be needed when the central bank is concerned that the currency band has relatively low credibility, in which case there may be a destabilizing role of wide exchange rate fluctuations--even if within the existing band--for inflation and devaluation expectations. By helping produce a nominal exchange rate path that is close to the central parity rate (as e.g. in Israel), the authorities may hope to gradually "persuade" the public that the band is credible and is there to stay. However, the main cost of heavy intramarginal intervention is that it reduces the autonomy of domestic monetary policy and it results in larger variation in international reserves than otherwise. Put differently, such heavy intervention prevents policymakers and markets from getting the full benefit of enhanced flexibility associated with adoption of the band. Moreover, since typically intervention rules are not announced to the public, market participants may get confused about central bank actions. We believe all of these are good reasons for allowing considerable exchange rate flexibility within the band, and for restricting (when possible) policy intervention mainly to the margins.

Another potential problem with the existence of a relatively narrow inner intervention

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band is that--if credible--it may reduce the perceived risk in the foreign exchange market thus providing an incentive for short-term (speculative) capital flows. Some of the evidence for Israel and Mexico points in this direction. We will take up this issue in the next subsection.

(iv) **Supporting and defending the band:** There are various combinations of movements in foreign reserves, domestic interest rates, and exchange rates that can deal with exogenous shocks that give rise to pressure on an existing currency band. To illustrate this, consider a case in which the exogenous shock is a sudden rise in foreign capital inflows. Under a band regime, there could be three alternative policy or market responses to this shock, or various combinations of these:

-(a) nominal exchange rate appreciation within the band;

-(b) purchase of foreign exchange by the authorities; and

-(c) reduction in the domestic nominal interest rate.

In case (a), the responses would pretty much mimic a case of a floating exchange rate; the nominal exchange rate absorbs the shock, and there is no change at impact in central bank's foreign reserves or in the domestic nominal interest rate. Obviously, for case (a) to prevail the authorities must be willing to accept exchange rate flexibility within the band, and the shock must be of a size that potentially does not push the exchange rate beyond the band's limits.

Case (b) represents the case of intramarginal intervention. In an extreme version, the authorities intervene to purchase from the private sector all the increased capital inflow, with no change at impact on the exchange rate. It is in that case that the authorities would have to also decide about the extent to which they may want to sterilize their forex intervention. In the presence of sterilization, the capital inflow will result in a lower domestic monetary base and a higher domestic interest rate than in its absence. There are also quasi fiscal costs of sterilization.

Case (c) duplicates, in some sense, monetary policy under a fixed exchange rate. In that case, domestic monetary policy is subordinated to sustaining and defending the exchange rate system, even at the cost of expanding in the short run the domestic monetary base, and the hope is that ultimately the drop in the domestic nominal interest rate will reduce the incentive for capital inflows based on interest rate differentials.

It is useful to illustrate these alternative modes of adjustment with the evidence at

hand. In the case of Chile, it would be reasonable to assert that in most periods the authorities were close to case (a), with some elements of case (c) too (especially in most recent years). That is, the authorities allowed for sizable exchange rate flexibility as well as for frequent adjustments of domestic interest rates. To some extent, the same is true in Colombia. In Israel, on the contrary, disturbances were primarily met in the short run by foreign exchange market intervention (as in case (b)) with no immediate impact on either exchange rates or domestic interest rates. Thus, in that case monetary policy was awarded a very limited degree of independence in spite the existence of a nonnegligible fluctuation band. Mexico's policies broadly fit this pattern as well.

3. Exchange Rate Bands Under Large Capital Flows

In recent years, there have been remarkable episodes of large capital inflows to these four countries.[17] Moreover, Mexico experienced a substantial reversal in these flows in 1994 and 1995. Capital inflows gave rise to pressures for nominal and real exchange rate appreciation and for booms in private consumption, economic activity, and stock market prices. Here we focus on exchange rate responses to the large capital inflows and outflows under currency-band regimes.

A key stylized fact in these episodes is that as capital flows persisted in one direction, countries gradually increased the degree of exchange rate flexibility in their regime. Thus, a growing share of the adjustment to capital flows was allocated to nominal exchange rate changes. Because of the large size of capital flows, it has become difficult to maintain relatively narrow bands. Consequently, expansions of band width and realignments have become quite common.[18] We now illustrate these trends with examples from various countries.

Consider first the case of Chile. Initial band width, in 1984, was 0.5 percent around the central parity rate. Band width was expanded to 2 percent, 3 percent, and 5 percent around the central parity rate on June 1985, January 1988, and June 1989 respectively; see Figure 1. Following a year and a half with sizable capital inflows and with nominal exchange rates positioned near the lower limit (i.e., most appreciated) of the band, there was

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[17] On capital flows to the Latin American countries, see Calvo, Leiderman, and Reinhart (1993), Gavin, Hausmann, and Leiderman (1995), and Reisen (1995).

[18] These trends are documented in International Monetary Fund (1995).

a discrete realignment of 5 percent in the central parity rate in January 1992, and at the same time band width was expanded to 10 percent around the central parity rate. Given persisting pressures for nominal exchange rate appreciation, there was another realignment in November 1994, when the central parity rate was officially appreciated by 9.5 percent.

In Colombia, where the exchange rate band regime is more recent than in Chile, there have been substantial pressures for nominal exchange rate appreciation. In fact, for most of the second half of 1994 the exchange rate was very close to the lower bound of the band. To deal with these pressures, the authorities realigned the exchange rate band on December 1994 by officially appreciating the central parity rate by 7 percent; see Figure 1. At the same time, the rate of crawl was increased to 13.5 percent per year. Band width remained unchanged at 7 percent around the central parity rate. Following these changes, observed nominal exchange rates in 1995 are quite close to the preannounced (crawling) central parity rate.

In Israel, the most recent capital inflows episode started in 1994; net private (nonbank) inflows amounted to about $5.0 billion from early 1994 to mid 1995. Initially, the authorities intervened and accumulated foreign exchange reserves, which in turn were sterilized via decreases in domestic credit. Although some nominal exchange rate appreciation was allowed, it was relatively small, and the exchange rate remained close to the central parity; see Figure 1. However, in the face of continuing capital inflows--most of which took the form of Israeli agents' increased short-term borrowing abroad--the authorities changed their policy in June 1995, when band width was officially expanded to 7 percent around the central parity, and there was an announcement that the central bank will allow larger exchange rate fluctuations within the official band. It was also stated that the change in policy is aimed at increasing foreign exchange risk with the purpose of diminishing the incentives for short-term capital inflows. Following these measures, there was a marked nominal exchange rate depreciation and a sharp reduction in short term inflows.

In discussing exchange rate responses to capital flows in the case of Mexico, it is important to distinguish the case of inflows from outflows. As long as large capital inflows were entering the Mexican economy, the main adjusting variable was the stock of central bank foreign exchange reserves, which was increasing over time, to reach a peak of about $30 billion in February 1994. To a large extent, the accumulation of reserves was sterilized

by means of decreases in domestic credit. As shown in Figure 1, there was little reaction of observed nominal exchange rates, which remained relatively stable for more than two years from November 1991, in spite of the automatic widening of the exchange rate band. Similarly, when substantial adverse shocks arrived in late March 1994, the authorities' initial main reaction was to sell foreign exchange reserves in order to defend the exchange rate band. However, despite a loss of $10 billion in reserves, the nominal exchange rate reached the upper (i.e., most depreciated) part of the band, including several periods in which it was positioned at the band's upper limit. Although market pressures eased for two months, in June and July the central bank lost about $3 billion, and there was still marked pressure on the nominal exchange rate. Then, in December, there was another adverse shock, more reserves were lost, and the authorities decided to widen the exchange rate band. Only after three days, on December 23, 1994, a major crisis erupted and there was a shift to a float. As a result, the Peso experienced a strong depreciation of about 50 percent against the U.S. dollar between December 20 and 31.

As indicated earlier, the extent to which the authorities allow for nominal exchange rates to vary within the band can have important implications for the foreign-exchange risk perceptions of the public. Consider for example a situation that leads the domestic monetary authority to raise domestic interest rates (i.e., to conduct a more contractionary monetary policy than before) in an attempt to attenuate inflationary pressures. Other things equal, higher domestic interest rates may induce a capital inflow from abroad, as foreigners attempt to take advantage of the higher domestic yields, and as domestic agents find it cheaper to borrow abroad. However, the incentive for this type of capital inflows will depend on perceptions about foreign exchange risk. It seems plausible to hypothesize that the stronger the commitment of the authorities to maintain a relatively narrow inner band of intramarginal intervention, the lower will be the risk of exchange rate fluctuations, and the higher will be the relative size of short-term, speculative, capital inflows. Put differently, the form of intramarginal intervention may affect the composition of capital inflows, which in turn may determine the degree of vulnerability of the domestic economy to capital flow reversals. The fact that most capital inflows to Mexico before the 1994 crisis were of a short-run nature probably reflects, to some degree, the impact of the implicit commitment by the authorities to keep exchange rate fluctuations within a relatively narrow range within the official band

on agents' risk perceptions; see Leiderman and Thorne (1995). Preliminary evidence for Israel suggests that heavy intramarginal intervention probably had similar effects on the composition of capital inflows in 1995.

Increasing the degree of nominal exchange rate flexibility in response to sizable capital inflows is a policy that was adopted in Asian countries as well; see International Monetary Fund (1995). While some countries operate under a float, e.g. the Philippines, in practice there has been some foreign exchange intervention by the authorities, and it is this intervention that has declined in relative importance over time. For example, Indonesia widened its intervention band twice in 1994. Malaysia and the Philippines allowed greater exchange rate variability since 1992. And the Korean authorities have announced a gradual widening of the margins for their daily intervention, with the aim of moving to a free float in about three years.

4. Potential Conflicts with Other Policy Objectives

A well known potential problem with targeting nominal exchange rates--even in the the context of a crawling exchange rate band--is that it may conflict with other objectives of macroeconomic policy such as growth, employment, and inflation. For example, the European currency crisis of September 1992 illustrated that the tight domestic monetary policies that were needed in various countries that were taking their exchange rate vis-a-vis the DM as their key nominal anchor were probably in conflict with their employment or output growth targets. As recessions deepened in these countries, the policy became unsustainable, and it was eventually abandoned by shifting to a float. Since then, most these countries (such as Italy, Sweden, and the U.K.) have experienced marked real exchange rate depreciations, and improvements in economic growth and in the current account of the balance of payments.

Another important potential conflict is between exchange rate and inflation objectives, in particular in countries where the latter are made explicit via official inflation targets such as those discussed in the next section. Events in Israel in 1994 illustrate one possible configuration of this conflict. In the second half of 1993, the authorities announced an inflation target of 8 percent for 1994 together with a crawling band of an upward slope of 6 percent. Although during 1994 there were no substantial pressures on the currency band or the foreign exchange market, there was a substantial buildup of inflationary pressures for

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a variety of reasons such as fiscal, monetary, and wage expansion, and consumers' and investors' optimism in view of progress in the Middle East peace process. This configuration of events called for a contraction of money growth and a rise in domestic interest rates, yet by doing so the authorities would disturb the relative tranquility of the foreign exchange market, to the point of possibly endangering the credibility of the exchange rate band. It was only toward the end of 1994--when it became clear that the rate of inflation had reached close to 15 percent (i.e., about double the inflation target)--that strongly contractionary monetary policy measures were taken, which were then associated with a sharp drop in inflation but together with the emergence of short-term capital inflows and strong pressures for nominal and real exchange rate appreciation.

Developments in Mexico in 1994 provide a reverse pattern of conflicting objectives than that of Israel. As in Israel, the Mexican authorities had announced an explicit inflation target for 1994 together with a continuation of the crawling exchange rate band that prevailed at that time. On the inflation front, the performance of the Mexican economy in 1994 was satisfactory: inflation was at a single digit level close to the target. However, throughout the year there were significant pressures on foreign exchange reserves and nominal exchange rates. The presence of substantial pressures became evident from the persistent position of the exchange rate at the most depreciated level of the exchange rate band and the continuous loss of reserves during the year. Apparently, since there were no major pressures on the rate of inflation, the authorities did not change much domestic nominal interest rates. Yet, at the end of the year there was a run on the currency and the exchange rate band was abandoned, developments which resulted in a temporary acceleration in the rate of inflation.

From the Israeli and Mexican cases it is evident that while the coexistence of explicit inflation targets with an exchange rate band can result in mutual support between exchange rate and price developments, depending on the underlying shocks there could be situations of conflict between these objectives, especially under high capital mobility. As shown in Chart 1, four alternative cases are possible. While cases "a" and "d" in the Chart do not represent a conflict between the inflation and exchange-rate goals of the authorities, in case "b" contractionary monetary measures are needed to defend the exchange rate band despite no inflation pressures, and in case "c" contractionary measures are needed to combat inflationary pressures, but could create pressures on the currency band.

Experience from these and other countries indicates that some of these policy dilemmas could be avoided if the authorities would prioritize among their objectives in a clear and transparent manner. One possible arrangement is to make official inflation targets the key objective of monetary policy, and to allow for relatively free movements of the exchange rate, or to subordinate any implicit or explicit exchange rate targets that may exist to the inflation target. Policies with these characteristics are discussed in the section that follows.

IV. INFLATION TARGETS

The foregoing potential conflicts and other considerations prompted in various countries a shift toward "inflation target regimes." Leading examples are Canada, Finland, Israel, New Zealand, Spain, Sweden, and the United Kingdom. The regimes were adopted after dissatisfaction with the performance of either monetary-aggregates targeting (as in Canada or New Zealand) or nominal exchange rate targeting (as in Sweden's or the United Kingdom's shift to a float in the Fall of 1992).[19] In the new regime, the explicit inflation target can be viewed as having the two main roles of a nominal anchor mentioned in the Introduction. In particular, the inflation target provides a transparent guide to monetary policy, whose commitment, discipline and accountability would be judged based on whether policy actions were taken to ensure that the target is achieved.[20]

Under this regime the authorities typically announce an explicit quantitative inflation target which specifies the following: (i) the index to which the target applies (e.g., the consumer price index, or that index excluding some items such as mortgage interest rates); (ii) the target level and tolerance interval (e.g., an inflation target of 1 percent per year with tolerance levels of plus/minus 1 percent); (iii) the time frame (e.g., a multi-year target, or a target for an indefinite period of time into the future); and possibly (iv) situations under which the inflation target will be modified or disregarded (e.g., large changes in the terms

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[19] On inflation targets, see Leiderman and Svensson (1995). Part of the discussion that follows is based on that source. See also Flood and Mussa (1994) for a broad discussion of nominal anchors.

[20] Notice that in some countries--such as Chile and Israel--official inflation targets coexist with explicit inflation targets, a situation that can give rise to policy conflicts such as those discussed in the last part of the previous section.

of trade, or price-induced changes in indirect taxes). In most cases, the inflation target is not accompanied by the use of intermediate targets, such as those for monetary aggregates or nominal exchange rates. However, there is nothing in principle that prevents the use of an intermediate target which ex-ante is consistent with the inflation target. What is important in that case is to clearly specify that the inflation target has priority over the intermediate target if a conflict between these two arises. This type of arrangement is the one used by the Bundesbank in its use of M3 as an intermediate target.

In many respects, the shift toward inflation targets is consistent with various developments in recent academic theoretical and empirical literature. First is the emphasis on price stability as the primary goal for monetary policy. This (controversial) conclusion follows mainly from research that indicates that monetary policy works with considerable and variable lags and that in the long run it has systematic effects on nominal variables such as the price level but no such effects on real economic activity. Second is the notion that because of the existence of nominal rigidities and because of the possible incentive for monetary policy to exploit these rigidities in an attempt to affect the rate of unemployment a nonnegligible inflation bias may arise. This bias may result in a higher than socially optimal rate of inflation, with general detrimental effects, and without any permanent reduction in unemployment. A credible commitment to an inflation target can help counter some of this inflation bias, especially if in the context of an independent central bank. In fact, the increasing shift toward inflation targeting has been parallel to a growing trend toward central bank independence. The latter is seen as an institutional means to prevent short run political pressure from damaging the chances of attempting to achieve the socially optimal medium- and long-term goals of monetary policy. Central bank accountability serves to ensure the proper incentives are there for the central bank to achieve the monetary policy goal. Third is the body of academic empirical work that suggests that improved inflation performance under central bank independence is not associated with slower output growth. If anything, there is evidence that central bank independence results in lower inflation and lower inflation variability without adverse consequences for economic activity or the rate of unemployment. Although the foregoing results have been influential, there has been (and will be) substantial controversy about them. Hence, practical considerations have also played an important role in the shift toward inflation targets.

In evaluating the country experiences, it is clear that there are wide differences across the various inflation target regimes. The status of the inflation target varies across countries, for instance with regard to the target's legal and institutional support, the commitment to and priority of the target, how explicit the target is, and whether it is decided by the central bank, the government, or both. The regimes also differ in terms of the parameters that characterize the target. At one extreme, the targets are part of a thorough institutional reform, with an independent central bank whose main role is to achieve the price stability goal, as in New Zealand. At the other extreme, inflation targets could be a decision of government alone, without obvious commitment and without obvious incentives for the central bank to achieve the target, as in Italy. In most countries there has been a satisfactory performance with inflation targets thus far. In spite of a less-than-full credibility of the targets, judged from ex-ante discrepancies between measures of the public's inflation expectations and the targets, the latter have been generally fulfilled or even undershot. While this performance is impressive, it may reflect the fact that when the targets were adopted there was considerable slack in the various economies. Hence, a nontrivial test for the regime will appear when the business cycle in the various countries turns to a boom, when actual output would approach potential output, and when inflation pressures would mount. Credibility and confidence on the inflation targets regime will be strengthened only if this test is passed successfully.

Operationally, since monetary policy instruments work with long and variable lags, the policy has to rely on a number of indicators in order to evaluate the economy's inflation momentum and thus to choose a time path for the instrument that results in a conditional forecast of inflation that is consistent with the target; see Figure 2 for a schematic description of the whole process. Since the decision making process for monetary policy involves an assessment of current and future inflationary trends and their comparison against the announced inflation target, there is a considerable amount of discretion in that process, which in turn may leave room for substantial debate about the policy. Because of the considerable room for discretion, transparency and openness about the operating model used by policymakers could become an important source of credibility of the regime. Some aspects of the monetary policy process in the United Kingdom such as Bank of England's remarkable Inflation Report and the publication of the minutes of the regular meetings between the

Governor and the Chancellor have become an example that other countries have began to follow.

That substantial debate about monetary policy can arise because there are as yet no simple rules for how such policy should be conducted in the varying economic conditions that may emerge under an inflation target regime can be illustrated with two examples. Consider first the case of Israel in 1994, a year for which an inflation target of 8 percent had been announced back in 1993. While initial conditions were favorable to achievement of the target, a series of unexpected shocks resulted in major inflationary pressures throughout 1994; see Figure 3. Salient among these were: consumers' and firms' optimism in the light of progress with the Middle East peace process, fiscal expansion and substantial rises in public sector wages, monetary expansion in the face of recessionary forces in mid 1993, and the continuation and strengthening of asset price inflation (especially in stock market and housing prices). In fact, during the last five months of 1993 inflation turned into double-digit territory and it reached an average of more than 11 percent in that period. Given that, and the rise in market-based inflation expectations, the central bank acted to raise its monetary auction rate by half-a-percentage point in Novemeber and December 1993; see Figure 4. While the annual rate of inflation remained in the neighborhood of 11 percent in the first four months of 1994, from May 1994 onward annual inflation accelerated to a rate of about 15 percent, and so did market inflation expectations. By August 1994, cumulative inflation in 1994 already had exceeded the 8 percent inflation target for the whole year, and annual inflation was forecast at about 13.5 percent. In spite of the marked deviation of actual from target inflation, the initial policy response was not particularly strong. The short-term (central bank) rate was left unchanged for almost five months. It was only in the second half of May that the central bank began to increase the monetary auction interest rate, by half-a-percentage point on each of four occassions. In these cases, monetary policy was mainly adapting the interest rate to the new inflation neighborhood. Yet, in the last five months of 1994--when there was no doubt whatsoever that inflation had passed the target--the Bank of Israel took a more assertive stance, raising three times the monetary auction rate at the more rapid pace of 1.5 percentage points. Accordingly, toward the end of the year the effective central-bank overnight interest rate reached an annual level of 18.5 percent, while at the same time expected inflation was about 15.5 percent; see Figure 4. Because of these

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measures, and of other favorable shocks, expectations of inflation have fallen to about 10 percent in mid 1995, and there are good chances that the rate of inflation will fall within the 8-11 percent target range stipulated for this year.

Although there was no doubt in the second half of 1994 that inflation was markedly exceeding the official target, see Figure 3, and although central bank's policy was mostly a reaction to that deviation and not so much an anticipatory (or forward looking) policy, there was abundant public debate about anti-inflationary monetary policy. At times, this debate turned into public disagreements between high officials at the Treasury (including the minister himself) and the Governor of the central bank. Moreover, in 1995 two members of the Parliament's finance committee submitted a proposal to effectively limit the degree of central bank independence in the monthly setting of short term interest rates. While some of this debate could reflect different views about the need to combat what seemed to be a slight rise in inflation compared to the previous history with high inflation, a substantial part of it was probably due to lack of full understanding of the operational meaning of the policy commitment embodied in the official inflation target, which calls for contractionary measures as soon as deviations of inflation from target are detected. As a matter of fact, other circumstancial evidence in 1993-94 does suggest that there was considerable ambiguity in Israel about the status of the inflation target--i.e., about whether it was an official forecast or a binding policy commitment--some of which may be due to lack of policy transparency when the targets were first adopted.

Similar, yet less outspoken, controversy exists about interest rate policy in the United Kingdom in recent months, where the institutional arrangement is quite peculiar in that these rates are set by the chancellor and not by the governor of the Bank of England. On May 5th 1995, shortly after the monthly monetary-policy meeting between these two policymakers, the chancellor announced at a press conference that interest rates would remain unchanged. The decision had been in sharp contrast to the Bank of England's recommendation to raise rates. In fact, Bank of England's Inflation Report of May 11th indicated that at current interest rates the government will probably exceed its inflation target of 1-2.5 percent by the end of this Parliament and may struggle to keep inflation below the wider upper limit of 4 percent. Although there were risks in this forecast, the Bank said that these were weighted mainly on the upside. In its assessment of inflation conditions, the Bank stressed the

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inflationary potential of sterling's depreciation of about 5 percent (on a trade-weighted basis) in the four months ending in May. Moreover, there was sharp disagreement between the Treasury and the Bank of England about the rate at which the economy is growing. While the chancellor cited recent figures for manufacturing output and retail sales to conclude that growth was slowing towards a sustainable rate and that there was considerable slack in the British economy, the Bank concluded that growth is strong and that GDP figures were likely to be revised up and not down. In the Bank's view, these considerations together with the recent rise in inflation forecasts (see Figure 5) were enough to trigger a rise in interest rates aimed at ensuring that the inflation target would be achieved, a rise that was not effected by the chancellor.

In short, despite accumulated satisfactory experience with the inflation target regime there are various reasons for believing that there will be substantial political and economic threats to the regime. These are mainly due to lack of consensus about the goals of monetary policy, about how seriously inflation targets should be taken by policymakers, about inflation forecasts and forecasts of other economic variables, and about the specific rules that should govern the setting of short-term interest rates in response to unexpected shocks. Lack of consensus about these matters and of support from fiscal policy and wage policy, and lack of properly functioning institutional arrangements vis-a-vis central bank's policies, can only weaken the credibility of the regime and can ultimately result in materialization of the inflation bias.

Last, we turn to the complications introduced by considerable exposure to large shocks and reversals in international capital flows on the management of policy under inflation targets. In terms of the schematic description in Figure 2, capital flows enter both as indicators and as inputs in the assessment of an economy's inflation momentum. As argued by Crockett (1993), at times capital flows may obscure the signals used to trigger monetary policy changes, and they may conflict with the objectives of domestic monetary policy. These complications clearly depend on whether there are net capital inflows or outflows and on two main (inter-related) factors: the extent of exchange rate flexibility and the degree of sterilization in domestic monetary policy. Consider first the effects of exchange rate flexibility. The arrival of capital inflows to a single economy creates pressure toward nominal appreciation of the domestic currency. If that appreciation is effected, at

least partially, it can attenuate upward pressures on the price level and on the rate of inflation thus facilitating achievement of the inflation target. On the other hand, massive capital inflows have been generally accompanied by asset price inflation, especially in stock and real estate markets. Although such inflation typically is not measured in the consumer price index that serves as the basis for the inflation target, there is a possibility that sooner or later excess-demand pressures in asset markets would be rolled over to goods markets, thus giving rise to standard inflationary pressure. In the case of sizable capital outflows, as in Mexico after the December 1994 crisis, these could result in rapid nominal exchange rate depreciation which depending on various conditions could result in a fast passthrough to domestic inflation, thus endangering the achievement of inflation targets. To a large extent, the final inflationary outcome depends on extent to which monetary policy accommodates the exchange rate depreciation; the lower the degree of monetary accommodation, the higher are the chances that previously-set inflation targets will be met. Hence viewed from the partial perspective of exchange rate impacts on prices, capital outflows probably call for a tighter stance of domestic monetary policy than capital inflows because of the former's higher inflationary potential.

As indicated above, the task of monetary policy can be further complicated by the existence or lack of sterilization. If the authorities of a given country have decided to intervene in the foreign exchange market at times of capital inflows and outflows, they may want to avoid the implications of such intervention for the behavior of the domestic monetary base and money supply, in which case they could sterilize the effects of that intervention. As is well known, the scope for sterilization depends on the degrees of capital mobility and assets' substitutability. The higher these degrees, the lower is the scope for effective sterilization. In the case of net capital inflows, sterilization would require the authorities to absorb liquidity via open market sales of domestic bonds or via rises in reserve requirements. While these measures can directly contribute to the inflation targets strategy by limiting the extent of domestic monetary expansion, they may result in a higher than otherwise interest rate differential (which may in turn provide a persistent incentive for capital inflows to go on), and they may entail nonnegligible quasi fiscal costs, because the interest rate paid on domestic debt generally exceeds the interest rate earned by the central bank on its foreign

exchange holdings.[21] Under capital outflows, sterilization would amount to a more expansionary stance for domestic credit, as it attempts to offset the possible fall in the monetary base due to the decrease in central bank's foreign exchange reserves. Overall, the evidence in the literature suggests that while sterilized intervention could be especially effective in the short run, it may create difficulties and costs in the medium- and long-run.

V. PASSTHROUGH FROM EXCHANGE RATES TO PRICES

A common concern in countries that moved away from tight targeting of nominal exchange rates is that increased variability of exchange rates may be passed on to prices. The concern is especially strong in economies with high-inflation history, such as several of those in Latin America and Israel. Accumulated evidence from chronic inflation episodes indeed indicates a substantial passthrough from nominal exchange rates to prices. In this section we discuss some new evidence on this issue.

Previous theoretical work has suggested that there are several considerations that will determine the degree of passthrough from exchange rates to prices in a given economy.[22] Central among these considerations are market structure, product characteristics, and pricing practices of domestic and foreign firms. In models of imperfect competition and differentiated products, optimal firms' behavior can be characterized by a price-to-market strategy. Accordingly, when exchange rates and costs change, firms will not immediately translate those into price changes, because doing that could reduce market share. Thus, firms' price-marginal cost markups absorb some of these fluctuations. The degree of passthrough will depend on a measure of competition and on the relative number of domestic and foreign firms. Other models directly focus on the existence of costs to entry and exit and to changing prices. Given these costs, a key factor that determines the extent of passthrough is whether exchange rate changes are viewed as permanent or transitory. Other things equal, the degree of passthrough will be higher under permanent than under transitory exchange rate changes. The analysis becomes more complex when the implications at the

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[21] For some evidence on the effects of sterilization in various small open economies, see International Monetary Fund (1995).

[22] For useful surveys of theoretical and empirical work on the passthrough issue, see Dornbusch (1987) and Menon (1995).

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firm level are brought into the broader macroeconomic level, because there could be shocks to fundamentals which may well alter the equilibrium value of the real exchange rate, in which case there will be an incomplete passthrough even under full competition and information. Empirically, most of the evidence suggests that there is a less-than-full passthrough across a broad range of countries and products.

Partial evidence on exchange rate passthrough can be obtained from Figure 6 which plots logs of nominal effective and real effective exchange rates for eight countries. The comovement of these logged variables can be informative because under full passthrough from exchange rates to prices, it can expected that there will be no clear link between movements in the nominal exchange rate and movements in the real exchange rate. On the contrary, when the degree of passthrough is nil nominal exchange rate changes would be closely associated with real exchange rate changes; i.e., there would be a strong comovement between these series. Generally speaking, there are two main patterns of comovements in the Figure. For the European countries plotted and Canada, there seems to be a great deal of comovement of nominal and real exchange rates. This comovement has become stronger in the 1990s, and especially after the European currency crisis of 1992. A different pattern arises in the Latin American countries and in Israel, where there is a much weaker link between nominal and real exchange rates, thus indicating a stronger passthrough than in the foregoing countries. These facts seem to be consistent with the notion that other things equal the degree of passthrough is likely to be stronger in a high-inflation environment than otherwise.

The foregoing conclusions are further confirmed in Table 1 that provides summary statistics on nominal and real exchange rates and prices. The Table documents that in the European countries there has been a substantial rise in real exchange rate variability following the 1992 currency crisis and the shift to a float. Most of this variability can be attributed to nominal exchange rate variability, which has risen under the new (post-1992) exchange rate regime. These findings conform with Mussa's (1986). In contrast, recent increases in the flexibility of the nominal exchange rate regime in Chile and Israel were not accompanied by marked increases in real exchange rate volatility. A key factor for this finding is that increased exchange rate flexibility in these countries was introduced only after major disinflation was effected. At variance with some previous fears, this increased

flexibility did not bring about a rebound of either the rate or variability of inflation; see Figure 7 which plots inflation performance for the various countries. Accordingly, from Table 1, less of real exchange rate variability can be attributed now to inflation variability. Nominal exchange rate variability is now the main factor accounting for real exchange rate variability, as in the European countries. This finding possibly indicates that under the new conditions of low inflation the degree of passthrough might have lessened. Additional evidence in this direction is provided by the increase in the correlations between nominal and real exchange rate changes that has taken place in recent years; see Table 1. In addition, the shift to a regime of enhanced exchange rate flexibility was not accompanied by an increase in inflation persistence[23]; see Figure 8.

The notion that nominal exchange rate changes can play a key role in effecting equilibrating changes in real exchange rates can be illustrated by examining recent salient episodes in Canada, Italy, the U.K. and Sweden. As evident in Table 2, there have been substantial nominal exchange rate depreciations in these countries over the last 3 years (for some, this is the aftermath of the 1992 currency crisis). Despite the marked nominal cumulative depreciation of exchange rates in the countries shown in the table, inflation did not accelerate in these countries. To the contrary, the rate of inflation has continued to decline. Consequently, the nominal exchange rate depreciation has come together with real exchange rate depreciation and with considerable improvements on current accounts. Specifically, in three out of the four countries shown in Table 2 the current account shifted from deficit to surplus, and in fourth country there was a reduction in the current account deficit as a percentage of GDP. It is important to note that in all cases mentioned above, real exchange rate depreciation and the marked improvement in current account positions took place under a background of high unemployment.

The evidence shown in Table 2 and a similar episode in Israel are presented graphically in Figure 9. It is interesting to note that the pattern of low degree of passthrough and rapid nominal exchange rate depreciation leading to real exchange rate depreciation can also hold in an economy with a history of high inflation that has gone through major

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[23] The inflation persistence figures are based on recursive least squares estimates of the parameter ß in the following regression: $\pi_t = \alpha + \beta \pi_{t-1} + \epsilon_t$. This approach is based on Obstfeld (1995).

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stabilization--as Israel in 1992. Notice that in all the cases shown in Figure 9, the pattern of a relatively low degree of passthrough coexisted with relatively high rates of unemployment. In the case of Israel, the average rate of unemployment in Israel in 1992 was 11.2 percent. It is plausible to hypothesize that the passthrough coefficient might depend on the state of the business cycle; the closer actual output is to potential output, the higher the degree of passthrough may tend to be.

Since there are lags and dynamics in passthrough effects, we next examine the dynamic relations between domestic currency depreciation and the rate of inflation using an unrestricted vector autoregression (VAR). This would enable taking into account feedback effects in both directions. Specifically, we used time series to estimate bivariate systems of the rate of inflation and the rate of exchange rate depreciation. With the estimated parameters of the VAR systems, it is possible to assess the dynamic effects of shocks to exchange rate depreciation by using impulse response functions. We provide evidence for Italy Canada and Israel in Figure 10. In the cases of Italy and Canada the impulse responses are based on vector autoregressions (VAR) using quarterly data of the rate of inflation and the rate of exchange rate depreciation, and using four lags of each variable. To account for the possible effects of the state of the business cycle, a four-quarter moving average of the rate of unemployment was added to the VARs as an exogenous variable. In the case of Israel, monthly data are used and a bivariate system with twelve lags of inflation and exchange rate depreciation is estimated. In order to compare responses across regimes, we look at two exchange rate depreciation impulses: one based on estimates for a more recent period of low inflation and of increased exchange rate flexibility; the other impulse response is based on estimates for a preceding period with less flexibility and higher inflation. Specifically, in the case of Italy the first subsample starts in 1981 and ends one quarter prior to the exit from the ERM; the second subsample period covers the period after the exit from the ERM. Due to the low number of observations during the second subsample and degree of freedom limitations, the second subsample is extended and starts in 1988. In the case of Canada the first subsample starts in 1981 and ends prior to the period of accelerated exchange rate depreciation the took place from mid 1992 onward. The second subsample covers the period of rapid exchange rate depreciation and as in the case of Italy, this subsample is extended in order to increase the number of observations. In the case of Israel,

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the first subsample covers the high inflation period from the late 70s to mid 1985; the second subsample covers the crawling exchange rate band and inflation target period.

The main finding from analysis of these VAR-based impulse responses is that the response of inflation to a given shock to exchange rate depreciation seems to be weaker in the later subsample. In other words, in the cases shown, even when feedback effects and lags are taken into account, the foregoing finding that increased flexibility was not accompanied by a rise in the rate or the variability of inflation is supported by the data.

While these are useful stylized facts, it would be also useful to examine under what type of structural models they arise--a nontrivial task. We address this issue in an initial and preliminary way by estimating inflation rate equations for Israel and Chile using two main explanatory variables: the rate of exchange rate depreciation--to capture passthrough effects, and the rate of money growth relative to the growth in real economic activity. In order to quantify the notion that the degree of passthrough may depend on the state of the business cycle, we allow for nonlinear dependence of the exchange rate depreciation coefficient on a real variable such as the rate of unemployment and/or other indicators of economic activity such as GDP growth. The following equation was estimated for Israel using quarterly data for the period 1987.II-1995.I,

$$\pi_t = \beta_0 + (\beta_1 + \beta_2 \bar{U}_t)\Delta\log(e_t) + \beta_3 \Delta\log(\frac{M1_{t-2}}{Y_{t-2}}) + \beta_4 \Delta\log(\frac{M1_{t-4}}{Y_{t-4}}) + \epsilon_t$$

where π is the rate of quarterly inflation, $\bar{U}$ is a four-quarter moving average of the rate of unemployment, e is the nominal exchange rate of the Israeli currency vis-a-vis the currency basket and $\log\frac{M1}{Y}$ is the log of the ratio of the monetary aggregate M1 to real GDP.

The regression results are as follows, the t-statistics are shown in square brackets:

$\beta_0 = 0.017$ [3.575] $\beta_1 = 0.912$ [3.732] $\beta_2 = -6.307$ [1.851]

$\beta_3 = 0.113$ [2.407] $\beta_4 = 0.077$ [2.470]

DW = 1.995 $R^2 = 0.445$

The estimates indicate that other things equal an increase in the rate of unemployment tends to decrease the degree of passthrough from the exchange rate to prices. Figure 11 shows a time-varying passthrough coefficient that is based on this equation. The value of the

coefficient is calculated using the parameter estimates of β_1 and β_2 and the moving average of the rate of unemployment. As evident, the rate of passthrough was relatively high during the first few years after the 1985 stabilization program (over 0.5). The rate of passthrough declined continuously from 1989 to late 1992 along with increases in the rate of unemployment. From 1993 onward the degree of passthrough is on an upward trend parallel to a reduction in the rate of unemployment and a boom in economic activity.

In the case of Chile the following equation was estimated using quarterly data for the period 1978.Q1 to 1994.Q2:

$$\pi_t = \beta_0 + (\beta_1 + \beta_2 \bar{Y}_{t-1}) \Delta \log(e_t) + \beta_3 \Delta \log(\frac{M2_{t-1}}{Y_{t-1}}) + \epsilon_t$$

where $\bar{Y}$ is a 4 quarter moving average of the quarterly rate of GDP growth, e is the nominal exchange rate of the nominal effective exchange rate and $\log\frac{M2}{Y}$ is the log of the ratio of the monetary aggregate M2 to real GDP. The regression results are as follows, with t-statistics shown in square brackets:

$\beta_0 = 0.029$ [6.867] $\beta_1 = 0.398$ [2.971] $\beta_2 = -7.943$ [1.636]

$\beta_3 = 0.140$ [2.017]

DW $= 1.554$ $R^2 = 0.432$

As in the case of Israel we calculated a time-varying passthrough coefficient for Chile. Although it is difficult to identify a trend in this coefficient, it is interesting to note that the average degree of passthrough, which is in the order of 0.25, is somewhat lower than in the case of Israel.

The main conclusions from these estimates are that exchange rate changes are only partially passed through to prices, and that the specific degree of passthrough prevailing at a given point in time depends on the state of the business cycle at that time.

VI.   CONCLUDING REMARKS

The changing conditions of the 1990s have prompted a search for new nominal anchors. At the center of the policy dilemma in moderate-inflation countries, with relatively sound fiscal fundamentals, is the choice of a specific nominal commitment by the authorities that is both flexible and credible. Flexibility is needed in order to deal with the considerable

volatility of internal and external shocks. At the same time, credibility and a strong stance are needed to prevent endangering previous achievements of disinflation, and to enable inflation rate convergence to that of industrial countries.

In the new environment, most countries have found fixed exchange rates and tight money-aggregates targeting to be inappropriate and have moved in the direction of increased flexibility. Crawling exchange rate bands and explicit inflation targets have emerged as attractive policy options, whose main virtues and limitations were discussed at length in this paper. Are these policy options mutually exclusive? In principle, they could coexist. For example, the exchange rate band could be an intermediate target in a system in which inflation is the ultimate target. However, we have discussed various important cases (as e.g. Israel and Mexico) where the underlying shocks are such that a conflict may develop between policies required for defending a currency band and those required for achieving the inflation target. On balance, then, we would suggest treating these options as alternatives, or at the very least to form a clear policy-priority ordering among them. For shock-prone economies that have already achieved a moderate rate of inflation and whose authorities have a strong commitment to gradual convergence of the domestic rate of inflation to the levels of industrial countries, there are good reasons to adopt an explicit inflation target and to specify that it has priority over any existing intermediate targets if a conflict arises.

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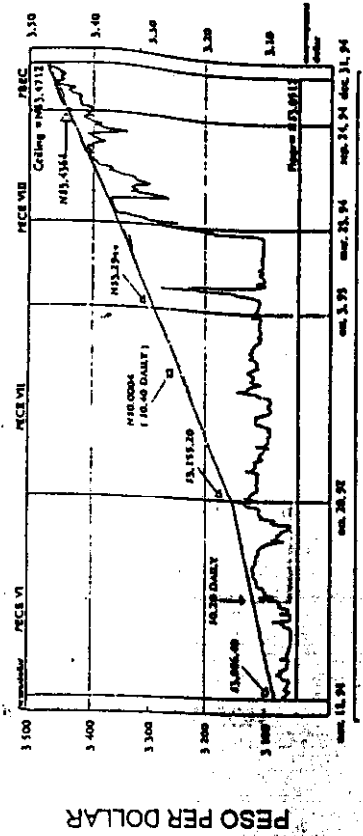Flood, R.P., and M. Mussa. "Issues Concerning Nominal Anchors for Monetary Policy."

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FIGURE 1   EXCHANGE RATE BANDS
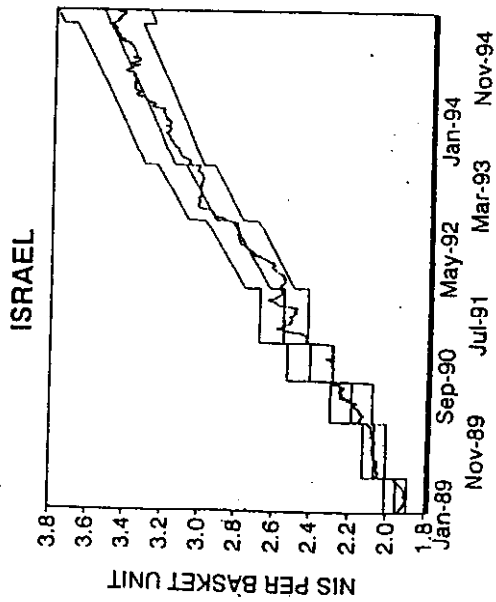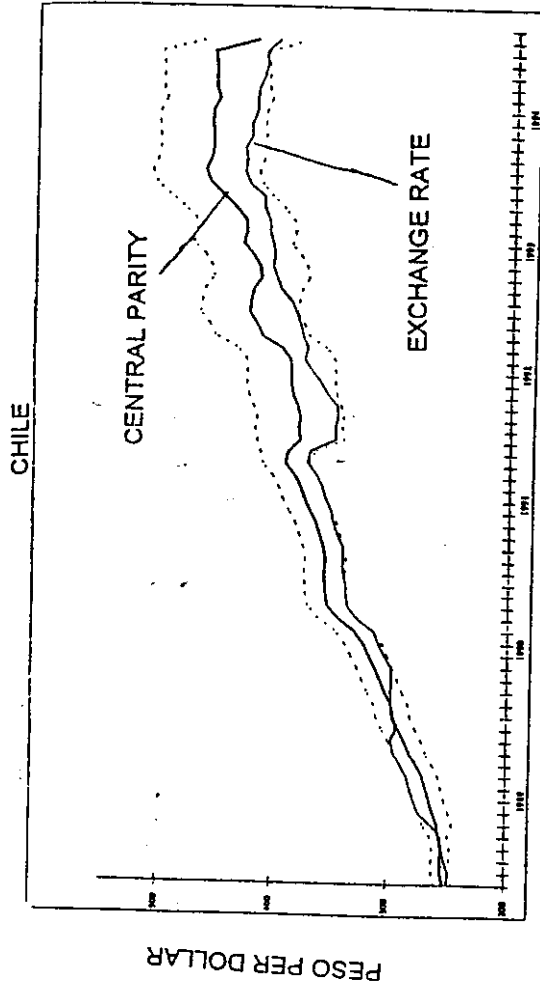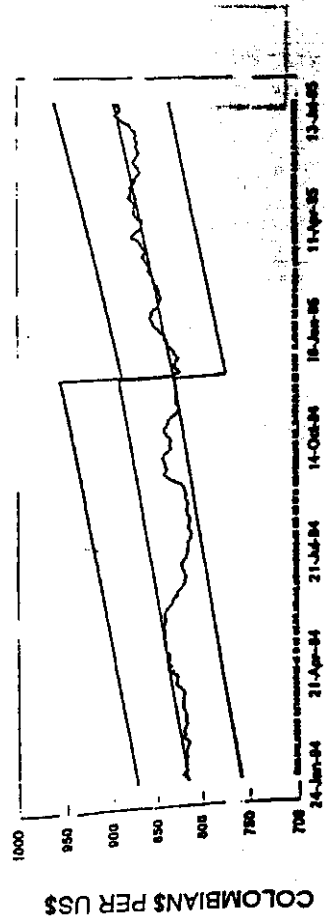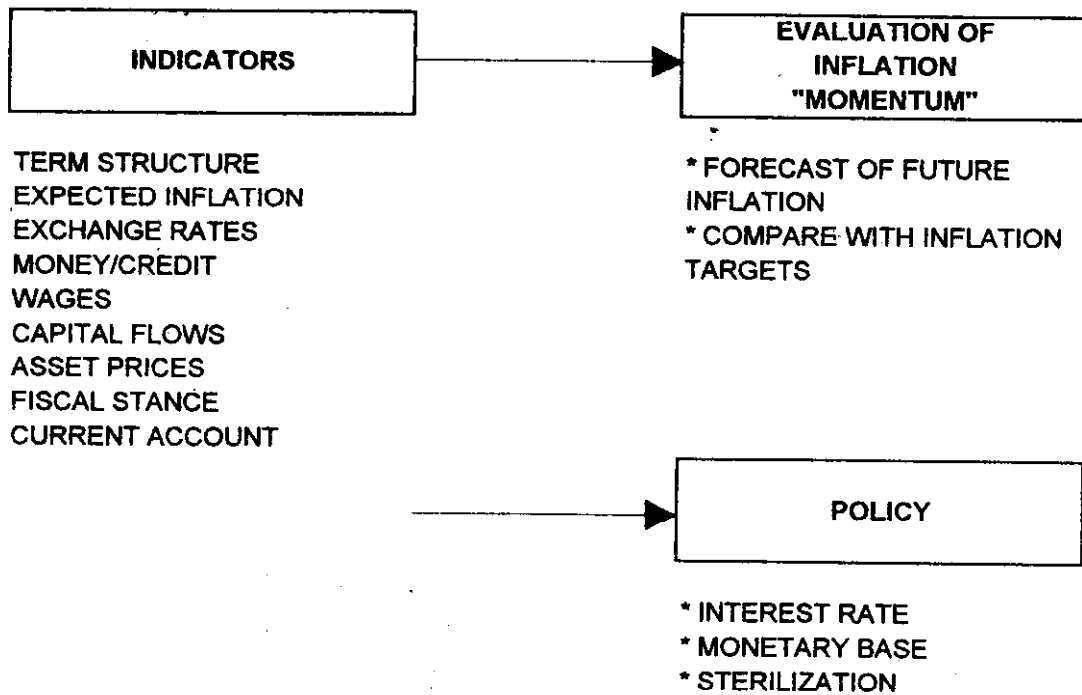
FIGURE 2

MULTIPLE INDICATORS APPROACH

INDICATORS

→

EVALUATION OF INFLATION "MOMENTUM"

TERM STRUCTURE
EXPECTED INFLATION
EXCHANGE RATES
MONEY/CREDIT
WAGES
CAPITAL FLOWS
ASSET PRICES
FISCAL STANCE
CURRENT ACCOUNT

* FORECAST OF FUTURE
INFLATION
* COMPARE WITH INFLATION
TARGETS

→

POLICY

* INTEREST RATE
* MONETARY BASE
* STERILIZATION

FIGURE 3

Israel: Inflation Targets, Actual inflation and Market Based Inflation Expectations (12 month horizon)
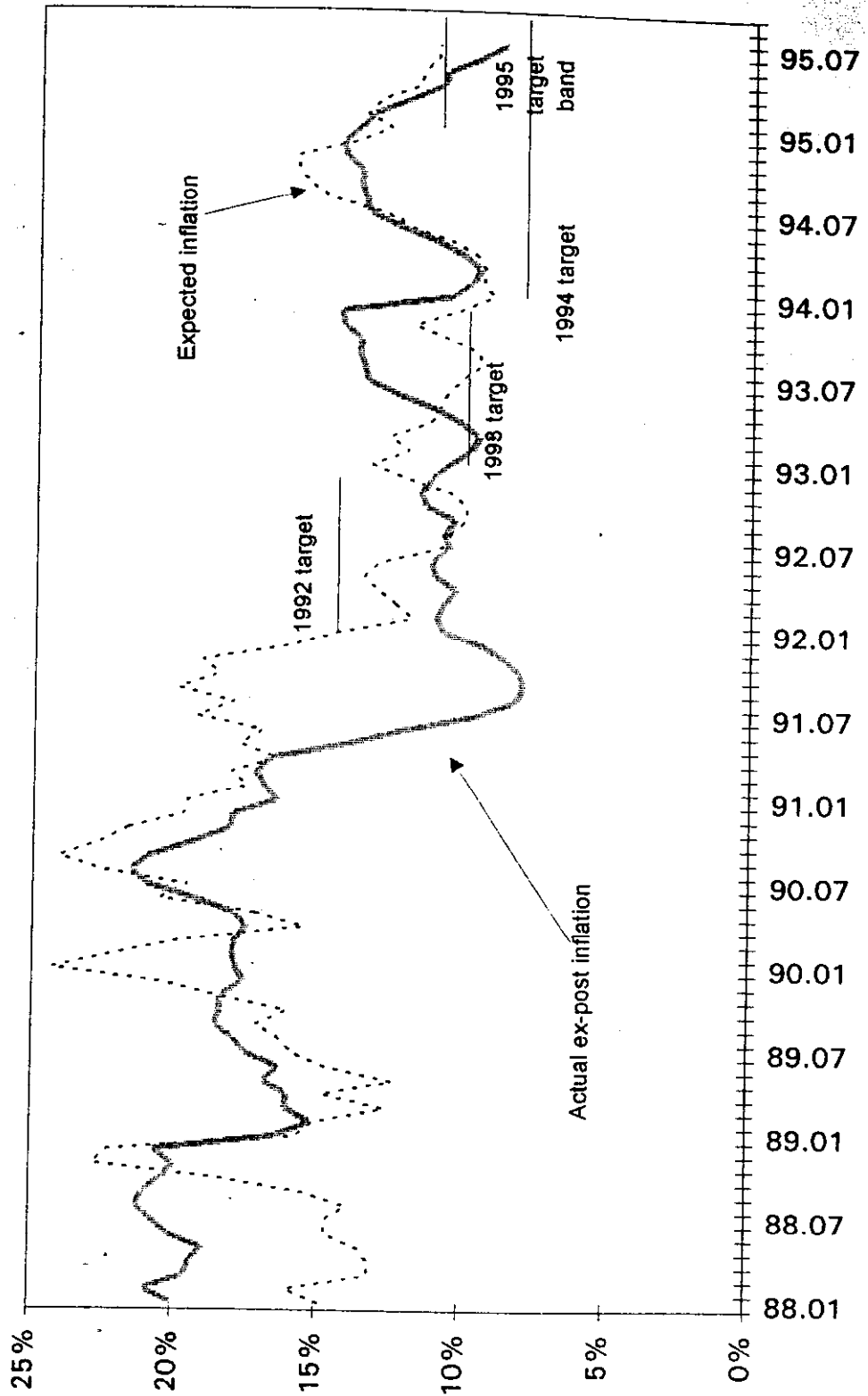
FIGURE 4

Israel: Interest Rate on Monetary Loans
and Inflationary Expectations

Inflationary expectations -12 month horizon

Auction rate - annualized effective terms
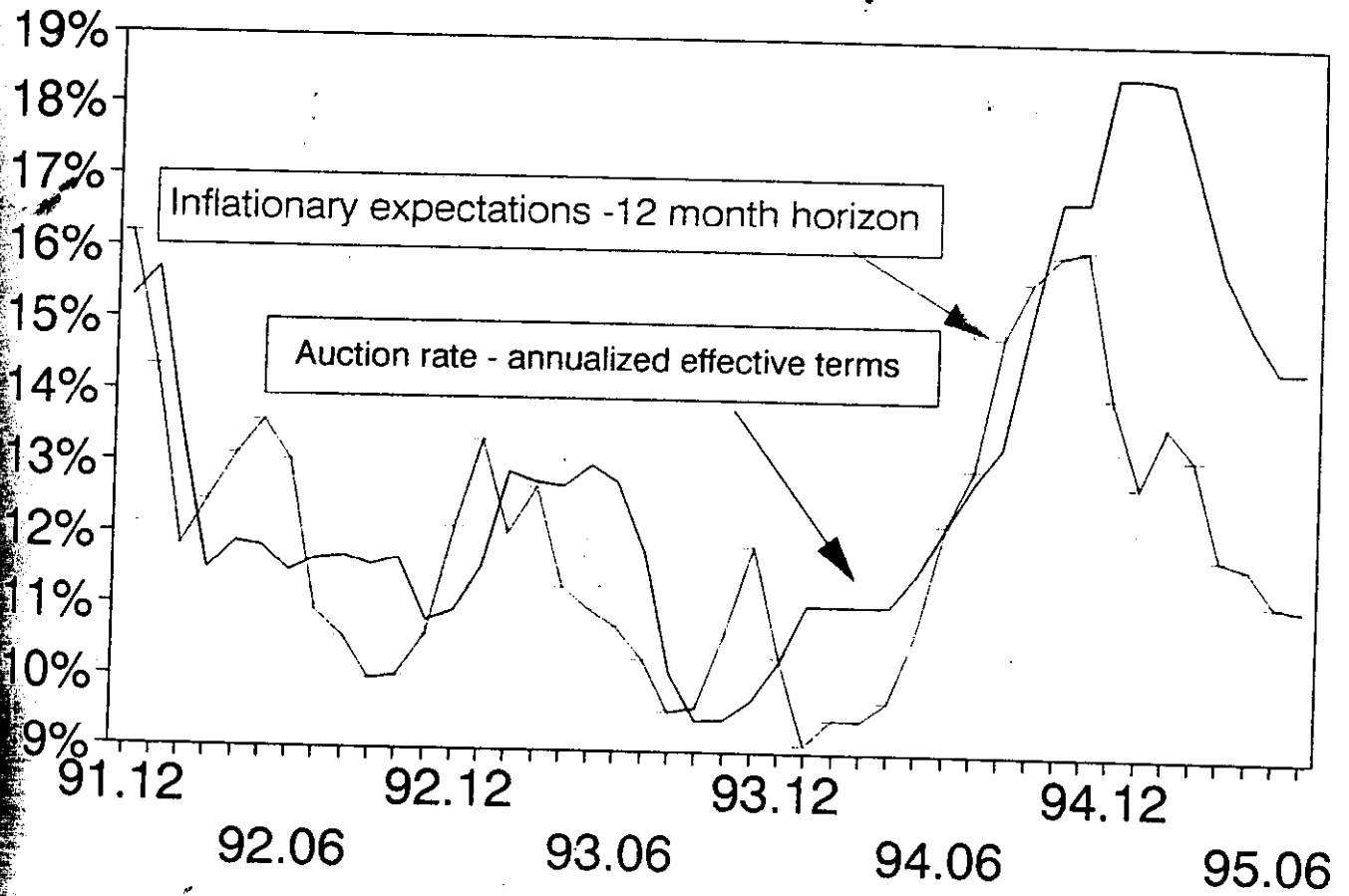
FIGURE 5

UNITED KINGDOM: RETAIL PRICES
PERCENT CHANGE ON A YEAR EARLIER
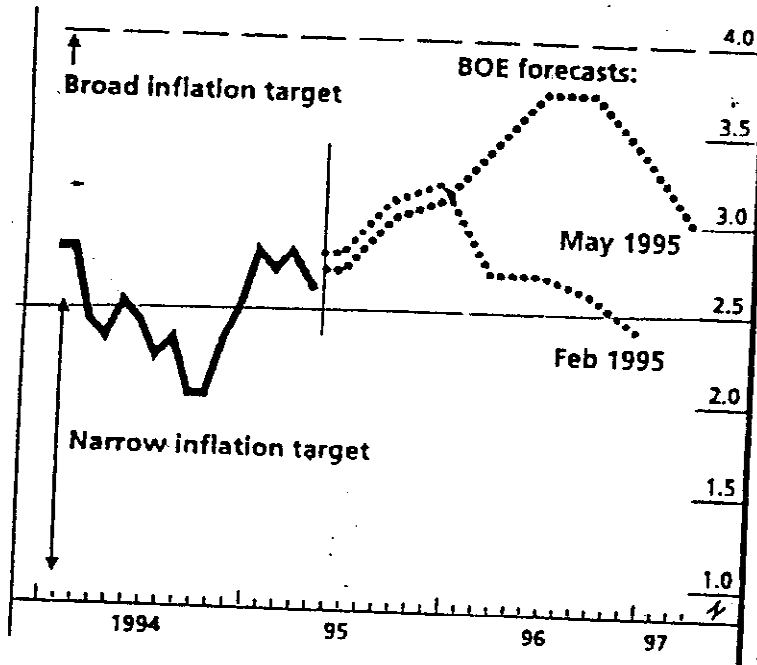
Note: Retail prices excluding mortgage interest payments.
Source: CSO; Bank of England

FIGURE 6   NOMINAL AND REAL EXCHANGE RATES
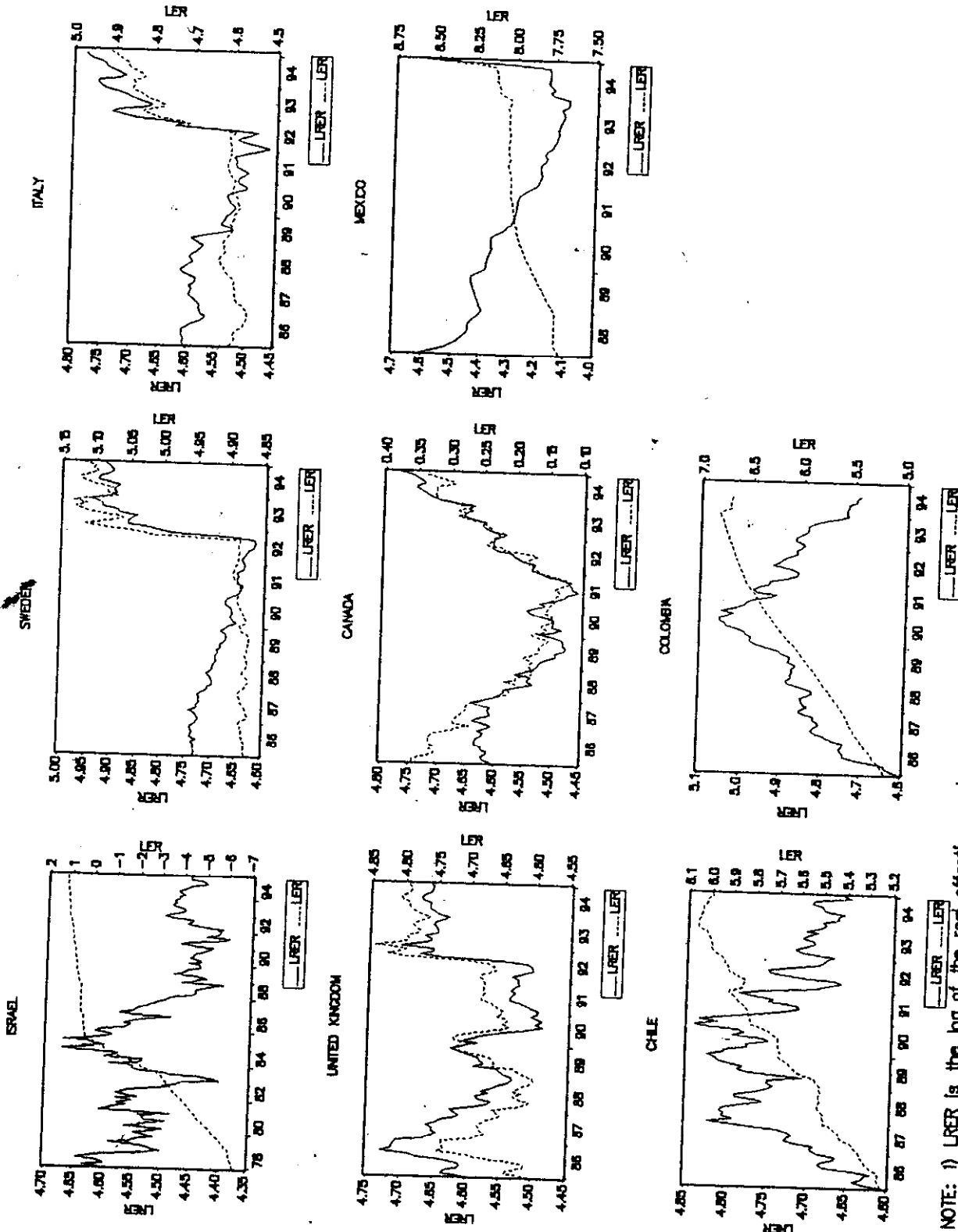
NOTE: 1) LRER is the log of the real effective exchange rate index and LER is the log of the nominal effective rate.
2) An increase in these indices indicates depreciation of the domestic currency.

Source: International Financial Statistics.

FIGURE 7   RATE OF INFLATION
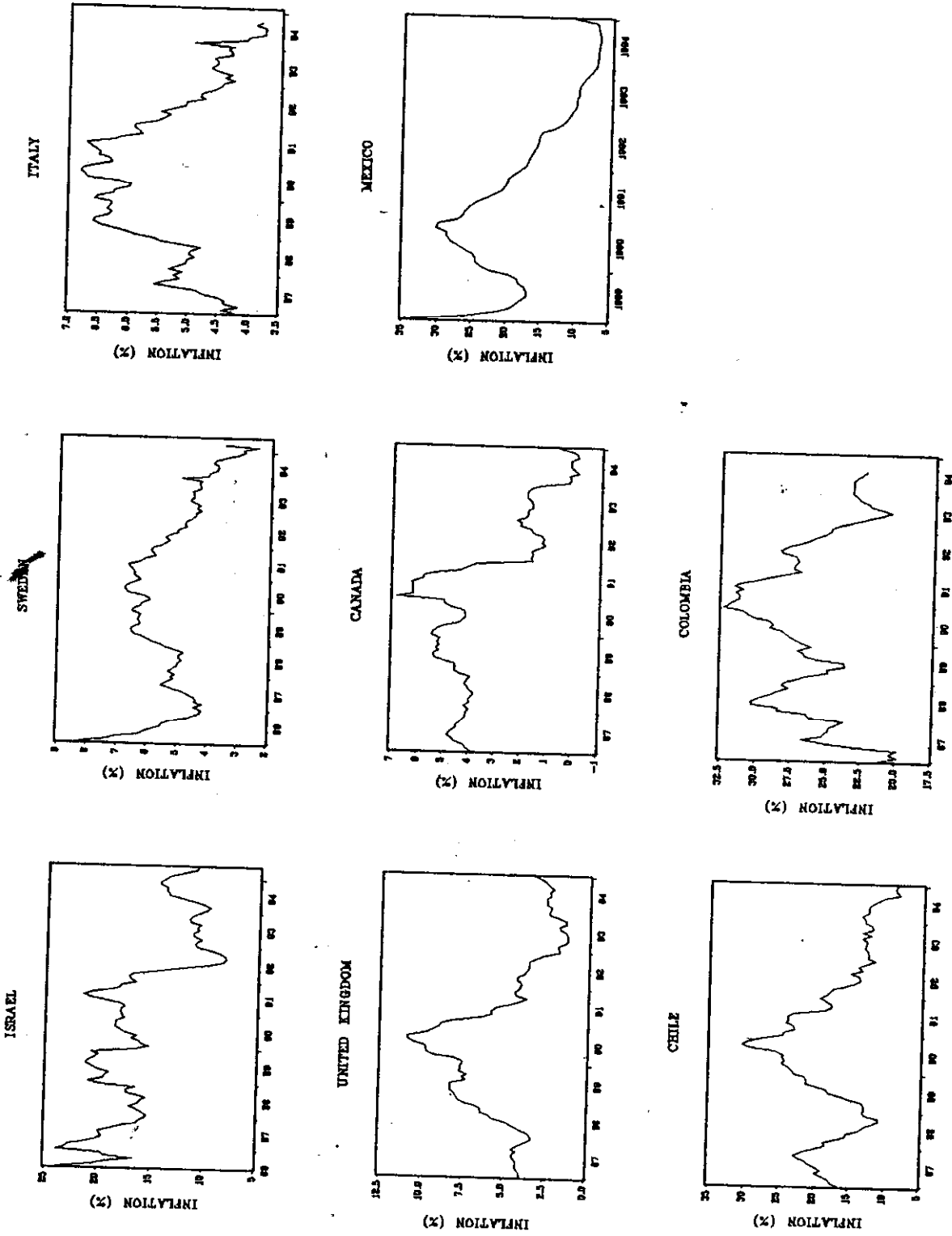
Note: The rate of inflation is the rate of CPI change of each month over the corresponding month in the previous year.

Source: International Financial Statistics, IMF.

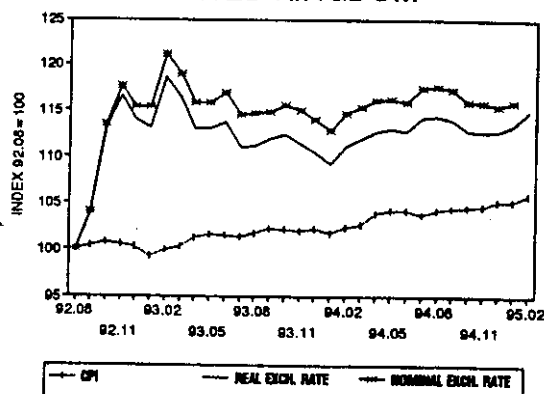**FIGURE 8   TIME VARYING ESTIMATES OF INFLATION PERSISTENCE**
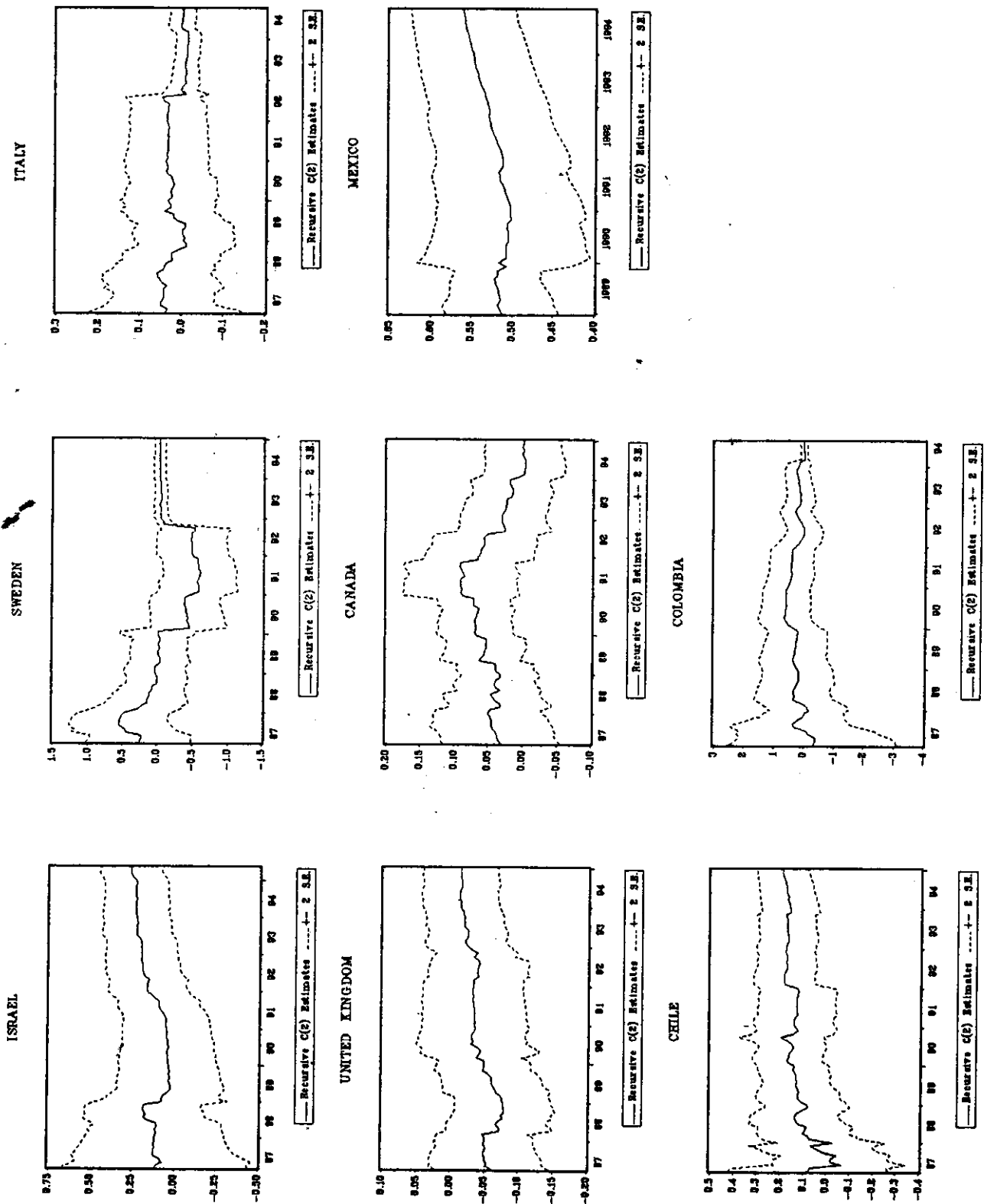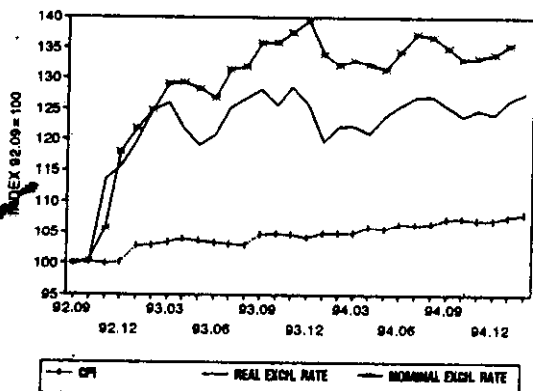
FIGURE 9

RECENT EPISODES OF RAPID EXCHANGE RATE DEPRECIATION
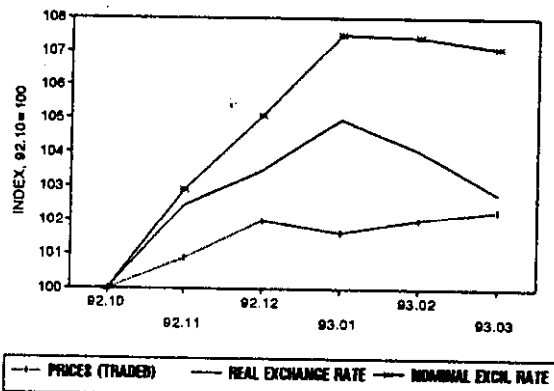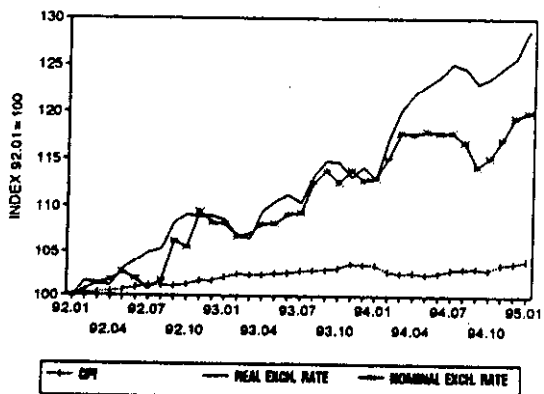
ITALY
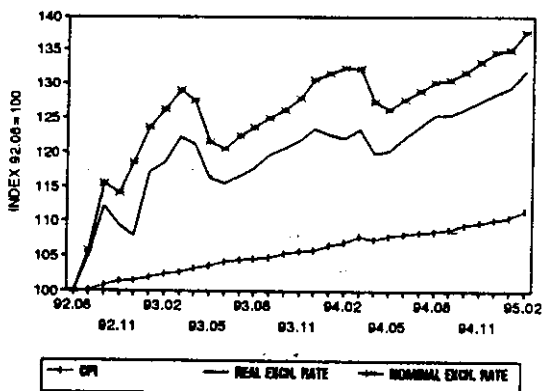
UNITED KINGDOM

SWEDEN


ISRAEL

CANADA

Note: The figures for Italy, Sweden, the UK and Canada plot the CPI, and the real and nominal effective exchange rate indices, following recent episodes of rapid nominal exchange rate depriciation.

For Israel, an Index of domestic prices of traded goods was used instead of the CPI.

Sources: International Financial Statistics and the Bank of Israel.

FIGURE 10

RESPONSE OF THE RATE OF INFLATION
## TO A 1% SHOCK TO THE RATE OF DEPRECIATION
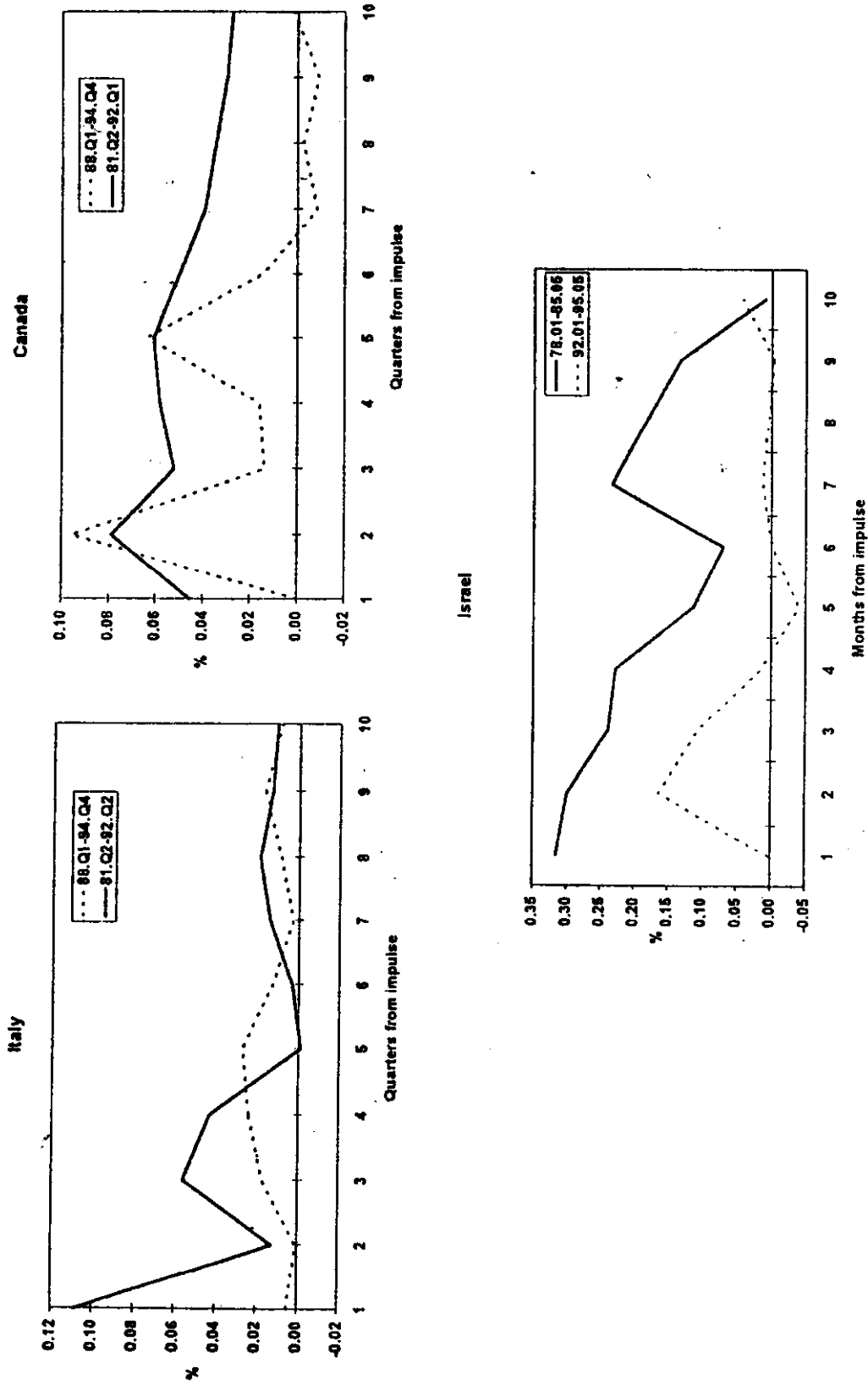
Note: Italy and Canada figures are impulse responses based on vector autoregressions (VAR) using quarterly data of the rate of inflation and the rate of exchange rate depreciation, a 4 quarter moving average of the rate of unemployment was added to these VARs as an exogenous variable. In the case of Israel, monthly data are used and the system is a bivariate VAR of inflation and the rate of exchange rate depreciation. The results for the case of the UK were inconclusive.
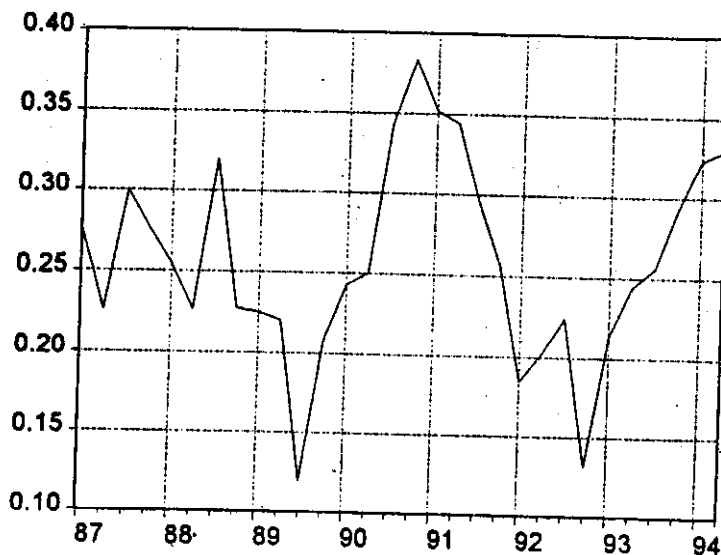
FIGURE 11

TIME VARYING PASSTHROUGH COEFFICIENTS

ISRAEL
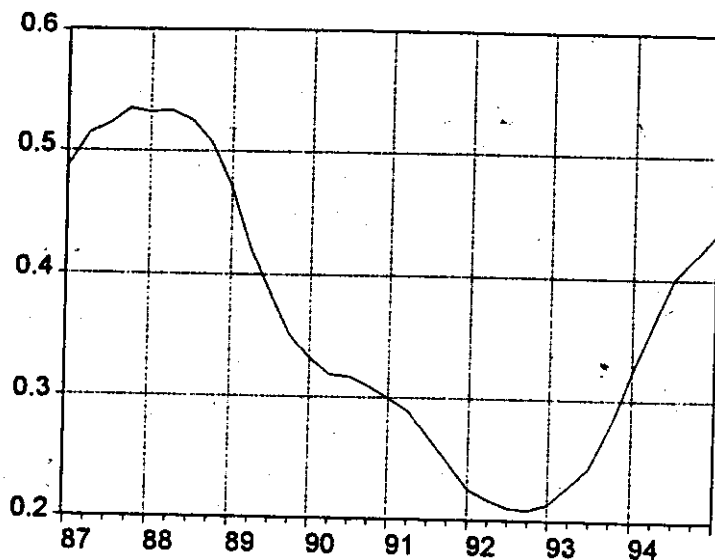
CHILE

Note: The time varying coefficients are based on the estimated equations shown in the text. Time variations are based on the impact of unemployment and GDP growth on the degree of passthrough.

TABLE 1

Nominal and real exchange rate variability - using monthly data

Country	Sample period	Details	Means (%)			Variances (%)			Correlations	
			DE	DP	DRE	DE	DP	DRE	(DE,DP)	(DE,DRE)
Israel	78.01 to 85.05	Rapid inflation	7.543	8.139	0.055	0.253	0.233	0.072	0.812	0.331
	86.01 to 88.11	Stabilization	0.586	1.373	-0.549	0.022	0.008	0.029	0.044	0.855
	89.02 to 95.05	Exchange rate band	0.790	1.091	-0.008	0.014	0.004	0.018	-0.086	0.895
Sweden	86.01 to 92.09	Exchange rate band	0.018	0.486	-0.143	0.001	0.004	0.003	-0.233	0.451
	93.01 to 95.02	Floating Exchange rate	0.383	0.275	0.570	0.051	0.004	0.033	0.236	0.628
Italy	86.01 to 92.08	Exchange rate band	0.266	0.422	0.157	0.019	0.0004	0.028	-0.018	0.879
	92.10 to 94.10	Floating Exchange rate	0.930	0.352	0.913	0.056	0.001	0.068	0.103	0.979
UK	86.01 to 92.08	Exchange rate band	0.099	0.467	-0.102	0.025	0.003	0.026	-0.131	0.982
	92.10 to 95.01	Floating Exchange rate	0.337	0.166	0.413	0.053	0.002	0.054	0.182	0.992
Canada	86.01 to 95.01		-0.002	0.275	0.168	0.016	0.001	0.019	0.002	0.392
Chile	86.01 to 89.05	+/-2% and 3% wide bands	0.788	1.281	0.272	0.012	0.004	0.033	0.206	0.568
	89.06 to 91.12	+/-5% wide band	1.267	1.781	0.280	0.017	0.010	0.053	0.057	0.686
		+/-10% wide band	0.248	0.890	-0.318	0.025	0.004	0.041	0.424	0.703
Mexico	83.01 to 87.12	Rapid inflation	5.326	5.466		0.108	0.048		0.593	
	88.01 to 91.10	Stabilization	0.726	1.890	-0.750	0.003	0.019	0.015	0.328	0.087
	91.11 to 94.11	Exchange rate band	0.323	0.807	-0.256	0.013	0.002	0.018	-0.170	0.926
Colombia	86.01 to 94.08	Crawling rate	1.524	1.922	0.119	0.022	0.009	0.031	0.081	0.132

note:
DE is the rate of nominal exchange rate change.
DP is the rate of inflation.
DRE is the rate of real exchange rate change.

TABLE 2

IMPACT OF RAPID EXCHANGE RATE DEPRECIATION

	Nominal effective exchange rate	Consumer price index	Real effective exchange rate	Current account deficit(-)/surplus(+) - % of GDP			Rate of unemployment - (%)
	Cumulative change (%):			92	94		1993-94 avg.
United Kingdom	11.0	4.7	8.5	-1.6	0.0		10.1
Italy	27.9	9.9	27.3	-2.3	1.5		11.5
Sweden	27.1	7.0	27.2	-3.5	0.5		8.1
Canada	21.6	4.1	24.6	-3.8	-3.3		10.8

Note: The sample periods used in the calculation of the cumulative change of the exchange rate and prices are: UK, Italy, Sweden - 92.10-94.12, Canada - 92.01-94.12.

Sources: International Financial Statistics and OECD statistical publications.

CHART 1

Potential Conflicts

INFLATION PRESSURE

EXCHANGE MARKET PRESSURE	+	-
+	a	b
-	c	d

Note: See text (section III.4) for explanation of chart.