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MONETARY POLICY IN LATIN AMERICA IN THE 90S

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Resumen

En este trabajo se analiza la política monetaria en Latinoamérica durante la década de los 90. Primero se hace una descripción de las opciones que existen para llevar a cabo una política monetaria, es seguida se discuten, brevemente, cuáles son los mecanismos elegidos por los países analizados. Posteriormente se estudian los determinantes de la política monetaria seguida en seis países de la región: Chile, Colombia, Costa Rica, El Salvador y Perú. Para esto último, se estiman funciones de reacción del tipo estimadas en Taylor (1993), que es ampliado posteriormente por Clarida et al. (1998a) para reglas forward-looking. En este trabajo se usa una nueva modificación permitiendo incorporar en las estimaciones el hecho que estos países se encuentran inmersos en procesos de reducción de la inflación. Para esto último, se usan las brechas entre las tasas de inflación esperada y las tasas objetivo cambiantes en el tiempo. Los resultados muestran que, de los seis países analizados, sólo la autoridad monetaria chilena presenta un claro compromiso anti-inflacionario.

Abstract

This paper analyses Latin America' monetary policy during the 90's. The paper starts discussing the options that exist to carry out monetary policy, following by a discussion of the actual mechanisms chosen by the individual countries. Then, it goes on to study the main determinants of monetary policy in six countries: Chile, Colombia, Costa Rica, El Salvador, Nicaragua and Peru. For that purpose we estimate reaction functions for each country. These estimations are based on reaction functions of the form introduced by Taylor (1993) and extended by Clarida et al. (1998) in terms of forward-looking rules. We modify the framework of Clarida et. al. by using the gap between the expected and a time-dependent "target" inflation. The results show that only in the case of Chile the monetary authority uses monetary policy with a clear commitment to achieve the target inflation.

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1. Introduction

Up to the early nineties Latin America was the region of the world with the highest level of inflation. High inflation was the cumulative result of many decades of economic policies based on a mayor disregard for macroeconomic stability behind activist government policies that resulted in high government deficits that ended up being monetized at Central Banks or in balance of payment crisis that resulted in sharp adjustments in exchange rates. During this period there was fiscal dominance, in the sense that monetary policy was primarily dictated by fiscal considerations. In what was a substantial departure from previous policies, the quest for stability that moved into industrial countries in the early eighties reached Latin America by the end of that decade. As a result, in the last decade country after country set in place mechanisms aimed at reducing inflation towards one-digit annual levels. The results have been dramatic. While in the 80s four countries had average rates of inflation over 200% per annum (the average annual inflation for the region reached 145%), by the end of the 90s only two large countries, Mexico and Venezuela, had inflation rates above 15% per annum, and the average inflation rate for the region was below 10%. From these two countries, Mexico is well on the way toward achieving one-digit annual inflation.

Many factors have been behind the decision to make a frontal attack on inflation. First, the poor inflation record of the 1980s and the high political and economic costs it entailed. Second, the overwhelming analytical and empirical evidence which indicates that trying to achieve a permanent reduction of unemployment through monetary policy results, eventually, in an acceleration of inflation without much of a permanent effect on the unemployment rate.[1] That is, the short term Phillips curve trade-off between inflation and unemployment -so popular in the 1960s and early 1970s- tends to vanish in the long run. Third, the increasing awareness that, with forward-looking expectations and credible policies, the cost of reducing inflation is much lower than what had been previously thought (Sargent, 1982). Fourth, the widespread consensus among economists that sensible macroeconomic policy contributes to sustainable growth, although it does not ensure it. As a

[1]For recent references to these developments, see Goodhart (1994b), Fischer (1995) and (1996).

corollary, there is widespread agreement that the best contribution that monetary policy can make to long term growth is to make a low and predictable inflation possible.[2] Fifth, the increasing awareness that inflation gives rise to regressive taxation and results in non-negligible welfare effects, which mainly affects the poorest groups in the population which are less able to deal with inflation and hold an unusually high ratio of non-interest earning monetary assets to income (Bulir and Gulde, 1995). Sixth, the realization that inflation costs are highly non-linear with respect to the level of inflation making the reduction of high inflation a worthwhile undertaken in high inflation countries (Bruno, 1991). Seventh, the emergence of a large group of well trained economists and their success in reaching high level positions in the governments of their countries.

Once the decision to reduce inflation to one-digit annual levels has been taken, the issue is how to go about getting the work done. This is the question of the inflation reducing strategy and it is directly related to the question of the most appropriate monetary policy regime or framework. Here there are three options to be considered: an exchange rate anchor, a money anchor, and an inflation target anchor. The elements to consider in the choice of a monetary framework are studied in section 2. Then, once a framework has been chosen, it has to be decided how to conduct monetary policy within the chosen framework. This issue is the subject of section 3 where we start analyzing the institutional underpinnings of monetary policy in five countries: Chile, Colombia, Costa Rica, El Salvador and Peru, and then we study the practice of monetary policy in a wider group of nine countries that include the five above plus Argentina, Bolivia, Brazil and Mexico. Then, in section 4, we characterize empirically how the central banks of Chile, Colombia, Costa Rica, El Salvador and Peru have conducted monetary policy during recent years. In this empirical section we investigate, in particular, if the central bank behavior has changed after they became independent. For this purpose we estimate monetary policy reaction functions for the five countries. Finally, section 5 presents the main conclusions.

[2] Some of these factors have also been behind policy change in developed countries geared to achieve price stability. See Fischer (1996) and Bernanke et. al. (1999).

2. The Choice of a Monetary Policy Regime[3]

Three basic strategies can be envisaged for the choice of a monetary policy regime to anchor inflation. The first would be fully orthodox: monetary targeting, relying on a pre-committed path for the money supply to anchor inflation. The second, exchange rate targeting, would use the nominal anchor of the exchange rate. The third, is the increasingly popular use of inflation targeting, where the anchor for inflation is the publicly announced inflation target and the commitment of the Central Bank to gear monetary policy towards the objective of achieving this target.

In all these cases, in the initial stages, the stabilization attempt would probably induce slower growth, more so in the first and third cases. The exchange rate anchor is usually first accompanied by an expansion, followed by a recession (Calvo and Vegh, 1999). In choosing between these three approaches, it is important to take into account the degree of openness of the economy and the stability of the relationship between monetary aggregates and inflation. Now we discuss in more detail the elements to consider while selecting a monetary framework with a special emphasis on the characteristics of the Latin American countries.

2.1 An Exchange Rate Anchor.[4]

Setting a value for the exchange rate, in a small open economy, provides an anchor for the price level through its direct effect, through arbitrage forces, on the price of tradable goods. That is, the price of tradable goods becomes the nominal anchor for the whole

[3] On monetary anchors, see Calvo and Vegh, 1999; Bernanke, B. S. and F. S. Mishkin, 1997; and Bernanke et al. 1999.

[4] Following the Mexican and the Asian crises, the debate on the most appropriate exchange rate system has taken a new twist. Now the discussion is framed more in terms of feasibility than of optimality. (See in particular, Obtsfeld and Rogoff, 1995 and Eichengreen, 1999).

economy[5]. If the exchange rate is fixed with respect to the currency of a low inflation country and the peg is credible, then it also serves to reduce inflation expectations towards the inflation level of the country to whose currency, the exchange rate has been pegged. Another advantage of using an exchange rate anchor is that it is directly observable and therefore the public can understand it much easily at large than a monetary rule.

However, the use of an exchange rate anchor also has some disadvantages. The first is that with an open capital account the pegging country can not run an independent monetary policy. As a consequence, it loses the ability to use the monetary policy to respond to domestic and external shocks; especially the ones that affect aggregate demand. Losing the ability to carry out an independent monetary policy is not a minor cost for intermediate and large countries that are exposed to frequent aggregate demand shocks (mostly terms of trade) and that have the technical and institutional capacity to carry out an independent monetary policy. But these costs could be less important for countries that do not have the possibility to carry out an independent monetary policy. The latter could be the case in countries where there exist high degrees of currency substitution and/or where a high proportion of the liabilities of the financial system are foreign currency denominated[6]. Second, domestic interest rates (adjusted by country risk) become determined by the interest rate of the anchor country and therefore interest rate shocks in the anchor country are transmitted directly to the pegging country. In cases where the economic cycles are far apart, this monetary shock would have real costs in the pegging country. Third, as has become increasingly clear in the recent crises in emerging countries, with perfect capital mobility, the use of an exchange rate anchor exposes the country to speculative attacks. The defense against these attacks involves the use of high interest rates for a protracted period of

[5] In this system, given a trajectory for the price of tradable –assuming that it obeys the law of one price- the trajectory of domestic inflation is obtained dividing the nominal price of tradable goods (expressed in local currency) by the real exchange rate (a real variable).

[6] In some cases, the Central Bank could lack the technical capacity to carry out an independent monetary policy different from just using an exchange rate anchor. This could be the result of a deliberate decision based upon the advantages that could be obtained from Mundell's optimum currency area.

time. High interest rates are costly in terms of the high unemployment and the deterioration of bank portfolios. They also set the stage for the abandonment of the peg as economic agents weight in that due to the high costs of its defense, the pegging country could decide to abandon the peg. There are also, in most cases, highly non-linear costs when a peg is abandoned in favor of a large devaluation. (Obtsfeld and Rogoff, 1995; Eichengreen, 1999).

But this is not all. The fixing of the exchange rate also requires that other indexation mechanisms in the economy be discarded and that an appropriate institutional structure be developed to prevent the financial system from becoming too vulnerable to an eventual exchange rate correction. The latter could be developed through appropriate financial sector regulation. Potential problems along these lines are best illustrated by the experience of Chile in the late 1970s (Corbo and Fischer, 1994), Mexico in 1994 (Dornbusch, 1994), the Asian countries in 1997 (IMF, 1997) and Russia in 1998. However, Brazil in 1999 is the exception that confirms the rule. In Brazil, the devaluation corrected an accumulated real appreciation -that build up while the exchange rate was used as an anchor to reduce high inflation- and set the stage for a recovery instead of setting in place a large crisis.

Another potential side effect of exchange rate fixing, with an open capital account, is undue risk taking and, as a consequence, an unsustainable expansion of credit which could result in a financial bubble, increasing financial fragility in the process (Corbo and Fischer, 1995; Edwards and Vegh, 1997; and Mishkin, 1997). This problem is illustrated by the experience of Chile in the early 1980s, of Mexico in the first half of the 1990s, and by the recent experience of Asia (Thailand, Korea, Malaysia and Indonesia). In all these cases, following the fixing of the exchange rate, the initial spread between the domestic and the foreign interest rate --adjusted for the expected rate of devaluation-- rose sharply, providing substantial encouragement for capital inflows and credit expansion. The increase in the spreads between the domestic and foreign interest rates could be due also to an inconsistent fiscal policy. But in all these cases, the final result was a combination of large capital inflows, an expenditure boom, and a sharp real appreciation. In these cases, a sudden reversal of capital flows is all that it took to set the stage for a major crisis. Also fixing the

exchange rate, in the presence of nominal rigidities could distort resource allocation if the observed real exchange rate departs from the equilibrium real exchange rate.

In practice, the exchange rate anchor usually takes the form of a predetermined nominal path for the rate of currency devaluation, but it could also be a fixed rate against the currency of another country[7]. Fixed rates come in three varieties: (1) just fixed; (2) fixed within a stronger institutional framework; and (3) the abandonment of the local currency in favor of a common currency or the currency of another country. Examples of the second type are Argentina and Hong Kong's currency boards. Examples of the third variety are the European countries that decided to participate in the EMU and the abandonment of the local currency in favor of the US dollar in Panama. In the latter case, the probability of an adjustment in the peg (a devaluation of the local currency) is negligible. A precondition for a successful implementation of the last two varieties is to have the fiscal accounts in order, to have a robust financial system, and to have enough foreign reserves to back the monetary and financial (local currency denominated) liabilities of the central bank (IMF, 1999). It could be argued that if all these conditions are fulfilled, there is not much to be gained from a currency board or full dollarization**.**

For medium-size and large economies in which exports are not very diversified, and with rigid labor and commodity markets, fixed rates could make the adjustment to a demand shock unduly costly. In particular, for this type of country, a real depreciation -when a change in fundamentals requires one- could become too costly, given that it depends on the downward flexibility of non-tradable prices. In this case, a more flexible exchange rate regime would be preferable. Indeed, as illustrated by the adjustment to the external shocks of 1999, the combination of prudent monetary policy and exchange rate flexibility has facilitated adjustment in most countries in the region. But for a flexible exchange rate system to be able to function properly it is also required to have a well capitalized, regulated and supervised financial system**,** otherwise, changes in the market value of the exchange rate could result in serious difficulties due to the mismatch in the currency denomination of

[7] Predetermined rates of devaluation were used in the 70s in the ill-fated "tablita" experiments of the southern cone countries (Corbo and de Melo, 1987).

assets and liabilities, with severe macroeconomic consequences. But this is not all, it is also necessary to have in place the institutions and procedures for the developing of a market for hedging exchange rate risks.

In spite of these actions, many questions still remain open with regard to the most appropriate monetary arrangement for a particular country. Following the "success" of Argentina's currency board system some countries in the region have been giving serious consideration to the introduction of a similar one. But before jumping into a rigid system like this one, it is important to understand that in the case of Argentina, a country with a long history of abusing its monetary and exchange rate policies, there was essentially no alternative. However, for countries that want to follow Argentina's path, it must be remembered that currency boards are not a panacea. To start with, a country has to have sufficient foreign reserves to finance the short-term monetary liabilities of the monetary system; otherwise, the system will not be credible. Furthermore, the financial system must be strong enough to be able to survive without a lender of last resort. If this is not possible, arrangements must be made for access to emergency lending from foreign commercial banks -as in Argentina- or from an external institution, most likely the FED or the ECB. Moreover, wage flexibility and labor mobility must be high enough to facilitate changes in relative prices between tradable and non-tradable goods when a change in the macroeconomic fundamentals calls for such a change. Otherwise, there would emerge substantial welfare losses due to price rigidities.

However, ultimately, the discipline of a currency board requires that a government be ready and have the political support to live with the high interest and unemployment rates that are an integral part of the adjustment dynamics of a country that operates with a currency board and faces a shock that requires a real depreciation.

Countries that are not ready or willing to go into the avenue of currency boards or full dollarization, and decide instead to use a flexible exchange rate system, need to decide on an appropriate monetary framework capable of generating low and predictable inflation. In particular, a monetary framework to be successful in resulting in low inflation requires to give enough independence to the central bank, in such a way that it could focus its

monetary policy towards the ultimate objective of low inflation while lacking the use of the exchange rate peg as an anchor. The options here are the use of a money anchor or other explicit nominal anchor as an inflation target. We discuss these two systems in turn.

2.2 A Money Anchor.

The effectiveness of the use of a monetary aggregate as a nominal anchor for inflation depends, first of all, on the authority and capacity of the central bank to carry out an independent monetary policy aimed at achieving and maintaining low inflation. But this is not all, at a more technical level, the effectiveness of a monetary anchor depends on the stability of the demand for the monetary aggregate that is used as an anchor. It is this stability what provides a link between a money aggregate and the rate of inflation. The stability of the demand for money presents a problem in cases where there is considerable financial innovation or when there is a sudden change in the rate of inflation.

In particular, in an economy that has experienced a period of high and variable inflation, the demand for money becomes very unstable as economic agents develop ways to economize in the use of money balances. And, therefore, when the rate of inflation is reduced, hysteresis effects emerge, generating a breakdown in the old demand for money relationship. In cases like these, predicting the quantity of money demanded becomes very difficult and the use of a monetary target could be a very ineffective way to try to achieve a given inflation objective. Therefore, in these cases, it could be more appropriate to use an exchange rate anchor in the initial stages of the stabilization program, to be followed later on by a more flexible exchange rate system accompanied by a monetary or inflation target.

2.3 Inflation Targeting.

Given the problems with the use of both an exchange rate and a monetary anchor, in recent years some countries have moved to use a third type of anchor: inflation targeting. This type of monetary framework was initially introduced by industrial countries with the objective of keeping inflation close to a long-run low inflation level. New Zealand

introduced the system with the latter purpose first in March 1990. It has since been introduced in Canada (Feb. 1991), the United Kingdom (Oct. 1992), Sweden (Jan. 1993), Australia (Sept. 1994), and the ECB (Oct. 1998). A variety of this system -to adjust inflation towards one-digit annual levels and eventually towards a steady-state low level- have been introduced in a series of non-industrial economies, starting with Chile (Sept. 1990) and Israel (March 1991)[8].

In inflation targeting, the target rate of inflation serves the purpose of a monetary anchor, and monetary and fiscal policies are geared toward achieving the inflation target. The attractiveness of this system is that its effectiveness does not rely on a stable relationship between a monetary aggregate and inflation, and, at the same time, it avoids the problems associated with the fixing of the exchange rate reviewed above. An additional advantage for emerging countries is that the trajectory of the market exchange rate provides important information on the market evaluation of present and future monetary policy which plays the same role that nominal yields on long term government papers play in industrial countries (Bernanke et. al., 1999).

A well-defined inflation-targeting framework goes much beyond just setting a target for the inflation rate and requires a set of steps (Svensson, 1999a and King, 2000). First, a public announcement of a strategy of medium term price stability and an intermediate target for inflation for a period into the future in which monetary policy could affect the inflation level. Second, an institutional commitment to price stability in the form of rules of operations for the monetary authority. Third, a clear strategy of how monetary policy, through the adjustment of interest rates, is going to operate to bring future inflation close to the announced target. A full inflation target strategy usually starts from a conditional interval forecast of inflation for the period utilized for setting the target. It also has to include an operational procedure of what the central bank will do when the inflation forecast is above or below the target. The procedures should be transparent and the monetary authorities should be accountable for the objective that has been set.

[8] See Fry et. al. (1999).

Given the normal lags in the operation of monetary policy, the inflation target has to be set for a period long enough towards the future, such that monetary policy could have a role in determining future inflation. In practice, in industrial countries central banks announce a target for the next twelve or twenty-four months. Then, they develop a conditional forecast of inflation -on the existing monetary policy and a forecast of the relevant exogenous variables- and set a strategy and communicate to the public what they will do when the range forecast for inflation does not include the targeted value. In contrast, in emerging economies, where financial markets are not as well developed and where liquidity constraints are more widespread, there is some evidence that the lags of monetary policy are shorter (Fry et. al., 1999).

In this framework, the established inflation target is the ultimate objective of policy, and an inflation forecast, sometimes not made public, is the intermediate objective. Monetary policy, with appropriate fiscal underpinnings, is the main instrument used to pursue the target. In particular, when the conditional inflation forecast is above the inflation target, the level of the intervention interest rate is raised to achieve an increase in real interest rate with the purpose of bringing inflation to a level close to the target. One advantage of inflation targeting is that inflation itself is made the target, committing monetary policy to achieve the set target and thus helping to shape inflation expectations. However, herein also resides its main disadvantage. As inflation is an endogenous variable that depends also on factors that go beyond the stance of monetary policy (for example terms of trade shocks and supply and demand shocks), the authorities do not directly control it. As a result, it becomes difficult to evaluate the monetary stance on the basis of just the observed path of inflation. Furthermore, as monetary policy works with a substantial lag, to pre-commit an unconditional inflation target --independently of changes in external factors which do affect the inflation rate-- and to change monetary policy to bring the inflation rate back to the set target could be costly. In particular, to try to reach the inflation target, when a shock results in an (temporary) increase in the inflation rate, could be costly in terms of a severe slowdown or increased output volatility (Ceccheti, 1998). In contrast, the accommodation of an external shock could result in a loss of credibility.

To address some of these problems, several options have been proposed. First, to set the inflation target in terms of a range rather than a point estimate. Second, to set a target for core inflation rather than for observed inflation. Third, to exclude from the price index the effects of changes in indirect taxes and in terms of trade. Fourth, to set the target for a period long enough in which short-term shocks to the inflation rate do not require a monetary response (on these point see, in particular, the discussion in Bernanke et. al., 1999).

3. The Practice of Monetary Policy in Latin America.

As mentioned in the previous section, to have a successful exchange rate anchor system requires, first of all, to have in place a credible peg. In contrast, to operate a successful monetary target or inflation target strategy requires having a Central Bank with enough autonomy to run its monetary policy. Given the crucial role that the institutional arrangement of an independent central bank has within a monetary policy framework, we start this section by reviewing the progress made by some Latin American countries in providing their central banks with a higher degree of autonomy.

Table 1 presents information obtained from five Latin American countries' central banks charters that we consider useful in order to assess the degree of central banks' legal autonomy. As can be observed from the table, the reforms aimed at enhancing central banks independence were mostly implemented during the first half of the 1990s. Chile, where a law creating an independent central bank was enacted in October of 1989, was the pioneer in the introduction of this type of reforms within the region and among emerging economies. In the rest of Latin America similar steps were taken later in Colombia (1991), El Salvador (1991), Peru (1993), and Costa Rica (1995). Although in all countries the reforms had as its common aim to provide a greater degree of independence to their central banks, they varied considerably with respect to the deepness with which they pursued their objective. Following Cukierman (1992) one could identify four broad dimensions over which legal autonomy is defined : (1) Clarity of the mandate;

(2) The appointment and dismissal procedures for the members of the Board of Directors; (3) The provisions for the resolution of conflicts between the executive branch and the CB and the degree of influence of the CB in the formulation of monetary policy, exchange rate policy and the budgetary process; and (4) The existence of legal restrictions on the ability of the public sector to borrow from the CB.

A review of central banks' charters with respect to these four dimensions helps to clarify the extent to which Latin American countries have progressed in enhancing central banks' autonomy. As table 1 shows, in the five countries a law sets price stability as one of the key objectives of their central banks. However, in only one of them (Peru) this is the sole legal objective of the central bank. In the other cases, the Central Bank also has other objectives that vary in the degree of potential conflict that could entail with the price stability objective. At one extreme, the objective of promoting the stability of the financial system –found in the CB's charters of Colombia and El Salvador- do not represent an explicit conflict with the price stability objective if it is interpreted as having an appropriate regulatory and supervisory framework. However, it could enter into conflict if is interpreted as avoiding too high a level of the (real) interest rate or to restrict the adjustment of the nominal exchange rate. At the other end, the objective of full employment, which it is present in the Costa Rica's CB charter, could enter in conflict with the price stability objective when it is defined as a short-term objective.

The countries studied also vary significantly within the second dimension of CB's legal independence -the appointment and dismissal procedures of the Board of Directors. In all of the countries, with the exception of Chile, the President of the Board is named directly by the President of the Republic for a term of office that coincides with the presidential period. Furthermore, in Colombia the President of the board is also the Finance Minister.[9] Only in the cases of Chile and Peru the President of the Board must be approved by Congress; in all other cases, the decision is left entirely to the President of the Republic. The procedure defined by law to name the President of the Board is particularly important if one considers that in all of the five countries the law establishes that in case of conflict within the Board, it is the President's vote

[9] In Costa Rica the Finance Minister is a member of the Board but he or she is not the president..

which resolves the dispute. Thus, the President of the Board has a significant degree of influence over the monetary policy resolutions made by the council.

With respect to the dismissal of members of the Board, in all of the five CB's charters there exist a provision for the removal of the directors. These provisions differ across countries both in the causes that can be invoked for the removal of a director (policy or non-policy motives) and the organisms legally able to determine his (her) dismissal. Among the countries studied, only in Costa Rica the law does not allow to remove a director because of policy motives. However, in Chile, Colombia and Peru, although a member of the Board can be removed because of a policy resolution voted favorably by him (her), the law establishes severely restrictive conditions for this event to materialize in practice. For example, in the case of Peru, the Congress can only proceed to dismiss a director when a serious fault has been committed and proved after a due diligence. Furthermore, the dismissal must be approved by at least two thirds of Congress. Probably El Salvador is the country where these conditions are less restrictive: the CB´s charter establishes that the Council of Ministers has the authority to dismiss a director whenever she (he) has voted favorably a resolution that implies a flagrant deviation from CB's objectives or any other responsibility that the law imposes to them.

Another important dimension of autonomy has to do with the authority given to the central bank to formulate monetary policy and exchange rate policy. Among the countries studied, all of them have the authority to decide over monetary policy. Also, only in the case of Colombia monetary policy makers are constrained by Congress about the election of the exchange rate regime. In all the other countries, the decision over the exchange rate system is left entirely to the central bank.

Finally, none of the five countries allow their central banks to finance the government, which represents an important step towards the enhancement of central banks' independence from fiscal authority.

Table 1: Selected Latin American Central Bank's Charters

Country	Year of the Reform	Legal Objectives	Is the Finance Minister a member of the Board	Has the CB final authority to formulate Monetary Policy?	Has the CB final authority to formulate Exchange Rate Policy?	Is the CB authorized to financed the Government?
Chile	1989	(1) Price Stability (2) Normal functioning of the internal payments system (3) Normal functioning of the external payments system	NO	YES	YES	NO
Colombia	1991	(1) Price stability (2) Financial System's strenght	YES	YES	Partially, the exchange rate regime is defined by Congress	NO
Costa Rica	1995	(1) Price stability (2) Multiple Objectives (including full employment)	YES	YES	YES	NO
El Salvador	1991	(1) Price Stability (2) Stability and competitiveness of the financial system	NO	YES	YES	NO
Peru	1993	Price Stability	NO	YES	YES	NO

The above discussion shows that during the 90's Latin American central banks have gained increasing independence in running monetary policy. Now we examine how they carry out policy in practice. As discussed in the previous section, in choosing a monetary policy regime, three cases can be distinguished: the use of an exchange rate anchor, of a money anchor, and an inflation target. Table 2 provides a broad overview of the monetary policy regimes used by nine Latin American countries. As can be seen from the table, the monetary mechanisms utilized vary a great deal across countries, however, inflation targeting is the predominant framework utilized in these countries: four of the countries (Brazil, Chile, Colombia and Mexico)

have moved during the 90s towards the use of this framework. In these four countries in the initial stages, while credibility was being built and inflation was being gradually reduced, there was a transition period where the inflation target was not explicit and was usually stated as achieving a gradual reduction of inflation towards industrial country's levels. Neither the interim targets nor the duration of the transition was spelled out. Once enough progress was made in reducing inflation, most countries have started to use explicit targets, in the form of annual targets (punctual or ranges) publicly announced at the end of the previous year.

However, it should be mentioned at the outset that none of the countries have a well-articulated inflation targeting procedure. That is, they do not present information on conditional inflation forecasts nor on the procedures to be followed when the inflation forecast lay outside the range of the announced inflation target. The discipline of the inflation reports of the industrial countries' central banks (and now of Israel's central bank also) should be considered as a model to be followed in order to increase the transparency and accountability of the inflation targeting procedures.

Three countries (Bolivia, Costa Rica and Peru) use a sort of monetary target to conduct monetary policy. In the three cases the targets are not publicly announced, but are implicit targets. What is, in some way, striking is the fact that two of these countries (Bolivia and Peru) have experienced hyperinflationary episodes that might have introduced an important degree of instability in the demand for money through hysteresis and currency substitution effects. Also, in the three cases, the development of financial markets -with the associated innovations in financial instruments and intermediaries- that followed the introduction of broadly based reforms, might have contributed to weaken the link between monetary aggregates and inflation. Another interesting point, is that all of the countries that rely in a monetary target do not announce publicly what that target will be for the next period. As has been pointed out by Mishkin (1999), this lack of transparency leads to "confusion in the market place, a lack of accountability of the central bank, and a missed opportunity to focus the public and politicians on the need for a long-run orientation of monetary policy". Several authors have emphasized the importance of transparency of the monetary framework as a way to control discretionary behavior by authorities that could end leading to poor long-run outcomes. As Mervyng King (2000) has recently put it:

“The communication of policy makers’ intentions with a view to enhancing their credibility has come to play a central role in monetary policy”.

Two countries (Argentina and El Salvador) have adopted an exchange rate target, although under radically different institutional frameworks. While Argentinean authorities are committed by law to maintain a one to one parity *vis a vis* the US dollar and established a currency board to comply with its legal mandate, in El Salvador, policy makers adopted a *de facto* fixed exchange rate with no clear commitment to maintain the parity. The particular circumstances that led both countries to adopt their monetary policy regimes is also different. In Argentina the currency board system was adopted in 1991 as a way to deal with the lack of credibility of the monetary authority in the context of a long history of high and variable inflation. In contrast, El Salvador adopted a fixed exchange rate in 1993, when the inflation rate was moderate (the annual inflation rate was near 20%).

Table 2: Monetary Policy in Latin America

Country	Type of target	Is the target implicit or explicit?	Who sets the target?	Single Target or Multiple Targets
Argentina	Exchange Rate	Explicit	Congress	Single
Bolivia	Monetary	Implicit	Central Bank	Single
Brazil	Inflation	Explicit	Central Bank and M. of Finance	Single
Chile	Inflation	Explicit	Central Bank and M. of Finance	Single
Colombia	Inflation	Explicit	Central Bank	Single
Costa Rica	Monetary	Implicit	Central Bank	Single
El Salvador	Exchange Rate	Implicit	Central Bank	Single
Mexico	Inflation	Going from Implicit to Explicit	Central Bank	Single
Peru	Monetary	Implicit	Central Bank	Single

4. Monetary Policy Rules: The Cases of Chile, Colombia, Costa Rica, El Salvador, and Peru

This section investigates, empirically, how monetary policy has been conducted in these countries in recent years. For this purpose, we follow closely the reaction function methodology developed by Taylor (1993) and extended by Clarida et. al. (1998). In general, the monetary authority's reaction function results from an optimization problem where it is assumed that it minimizes a loss function on the squared differences of inflation and its target, and of observed and potential output. The basic specification that we use has the central bank

adjusting the interest rate (the real rate in Chile and the nominal rate in the other countries) in response to the gap between expected inflation and its respective target value. We then add as additional regressors other variables that are spelled out as additional objectives in the central banks charters that we reviewed in section 3. Then, we investigate empirically if, when setting monetary policy, the authorities also consider other variables. Given that monetary policy acts with a lag, monetary policy responds to lead values of the inflation gap. When choosing additional variables that could have played a role when setting monetary policy, we draw on the work on the transmission mechanism for an open economy (Ball, 1999 and , 1999b).

Following Clarida et. al. (1998), the interest rate is set in accordance with the following reaction function:

$$r_t^* = \bar{r} + b \cdot \left[E(p_{t+n}/\Omega_t) - p^*\right] + g_1 \cdot \left[E(y_{t+k}/\Omega_t) - y^*_{t+k}\right] + g_2 \cdot \left[E(z_{t+j}/\Omega_t) - z^*_{t+j}\right] \qquad (4.1)$$

Where the bar over r denotes the long-run equilibrium interest rate, π_{t+n} is the expected rate of inflation between periods t and t+n, y_t is output (in logs), z_t is a generic variable that we measured in different ways: (1) the gap between expenditures and GDP as a share of GDP; (2) the gap between the rate of growth of expenditure and the rate of growth of GDP; (3) the foreign interest rate; and (4) the deviations of the real exchange rate from its trend. The variable r* is the target interest rate set by the central bank, π_t* is the target rate of inflation (which could be time-variant for a country that has as an objective to reduce inflation, gradually, towards industrial country levels) and y_t^* is the log of potential output, which is measured as the trend of GDP.

In this framework, the presence of the output gap in the reaction function could arise directly from a concern of the authorities with output volatility so that monetary policy is adjusted in order to reduce deviations of output from its trend –in this case the output gap is a different final objective in the loss function of the policy makers; or, because the monetary authorities use the information provided by the output gap in their forecast of future inflation –thus, the output gap enters the reaction function as an intermediate objective. In order to

separate between these two motives we used lagged values of the output gap as an instrument for the inflation gap in the GMM estimation procedure. In this way, we can study if the monetary authorities consider the output gap as a separate final objective.

When monetary policy has as its main purpose to keep inflation close to its target level, then the real interest rate should be raised when the inflation gap becomes positive. In a standard transmission mechanism from aggregate demand to price dynamics it is through an increase in the real interest rate that observed inflation is brought back to its target level when the former is higher than the latter. Thus, in the above model, when monetary policy is carried out using the real interest rate, as in Chile, the value of β should be positive and when monetary policy is carried out using the nominal interest rate, as in the other four countries studied, its value should be also greater than one[10]. Thus, the value of β turns out to be a key parameter at the moment of assessing central bank's response.

To complete the model, a partial adjustment equation is added to accommodate the observed behavior of smooth and slow adjustment of interest rates towards its desired level.

$$r_t = \rho \cdot r_t^* + (1-\rho)\cdot r_{t-1} + u_t \qquad (4.2)$$

Where it is assumed that υ_t is iid (0,1).

From (4.1) and (4.2), one obtains the following relation:

$$r_t = \rho \cdot \left\{ \bar{r} + b \cdot \left[E(p_{t+n}/\Omega_t) - p^*_{t+n} \right] + g_1 \cdot \left[E(y_{t+k}/\Omega_t) - y^*_{t+k} \right] + g_2 \cdot \left[E(z_{t+j}/\Omega_t) - z^*_{t+j} \right] \right\} + (1-\rho)\cdot r_{t-1} + u_t \qquad (4.3)$$

Finally, assuming that expectations are rational we replace expected values by realized values obtaining the following equation:

$$r_t = \rho \cdot \left\{ \bar{r} + b \cdot \left(p_{t+n} - p^*_{t+n} \right) + g_1 \cdot \left(y_{t+k} - y^*_{t+k} \right) + g_2 \cdot \left(z_{t+j} - z^*_{t+j} \right) \right\} + (1-\rho)\cdot r_{t-1} + e_t \qquad (4.4)$$

[10] The key assumption here is that the real interest rate is an argument in the real expenditure equation.

Where the error term, ε_t, is a linear combination of the forecast errors of inflation and output and the true disturbance υ_t. As some of the variables considered in the right hand side of the equation are also endogenous, the model is estimated using a method that yields consistent estimates in the presence of simultaneous equation problems. For this purpose, the Generalized Method of Moments (GMM) is used[11]. Now we discuss the estimations for the individual countries.

4.1 Chile

As we saw in section 3, since the beginning of the nineties, Chile's monetary policy has had as its main objective to achieve, gradually, a level of inflation similar to industrial country level. The latter has been defined, recently, as achieving a steady-state inflation rate in the 2% to 4% annual range starting in the 2001. In moving towards the steady-state level, the Central Bank announces in September of each year, an annual inflation target for the following year.

To study how much of a trend change in the rate of inflation -that could also affect expectations- has been implied by the set target, we build a multi-variate model to forecast inflation. The model is estimated using a rolling regression and then a forecast is made for the following year. The comparison of the forecast of inflation with the target set by the Central Bank shows that only in 1993 the target rate was well below the value predicted by the model, however, up to the end of 1996 it was below the forecasted value. From here, we conclude that in most of the 1990s the Central Bank pursued the objective of achieving a gradual reduction of inflation.

As we saw in section 3, the charter of the Central Bank of Chile states that it should have as an objective not only to reduce inflation but also to ensure that the internal and

[11] For a description of this method see Greene (2000), Mátyás (1999), Hamilton (1994) and Enders (1995).

external payments system functions properly. This can be interpreted that for a given gap between expected inflation and its target, the Central Bank should also care for other objectives[12].

Figure 2 compares the trajectory of the inflation gap and the real interest rate. From the figures it appears that interest rates are raised in advance of increases in the inflation gap. But as monetary policy works with a lag of around three-quarters, we compare also the gap between actual inflation and the inflation target with a three quarter lag in the real rate of interest (figure 3). This figure illustrates quite clearly that monetary policy is adjusted to keep expected inflation close to its target.

We proceed now to investigate how monetary policy has been carried out in the 1990s and then we compare it with the period immediately before the Central Bank became independent, that is the period 1985-1989. In the model that we estimate for Chile, the dependent variable is the real interest rate as monetary policy is carried out using central bank bonds indexed to the CPI. In the estimation, we used as a baseline an equation that uses as explanatory variable only the expected inflation gap. To accommodate lags in the operation of monetary policy we explore different leads for the inflation gap, finding that monetary policy responds to a three-quarter lead of the expected inflation gap.

The estimations were carried out using quarterly data for the period 1990:Q1 to 1999:Q4, using a two-period partial adjustment model to accommodate the smoothing process of interest rates and introducing a dummy variable to account for the large increase in the interest rate that took place in the third quarter of 1998, when the exchange rate band was under attack. When a two-period partial adjustment mechanism is used to model the behavior of actual interest rates, the model estimated is a slight departure from the general specification outlined above. Now, the general equation –analogous to equation 4.4- is given by:

[12] Corbo (1998) and Rosende (1998) present two different explanations for the mechanism of transmission of monetary policy and for the effective role played by the Central Bank in the reduction of inflation.

$$r_t = (1 - r_{\cdot 1} - r_2) \cdot \{\bar{r} + b(p_{t+n} - p^*_{t+n}) + g_1(y_{t+k} - y^*_{t+k}) + g_2(z_{t+j} - z^*_{t+j})\}$$
$$+ r_1 r_{t-1} + r_2 r_{t-2} + e_t \qquad (4.4')$$

The set of instruments used in the GMM estimation includes one-period and two-period lags of the explanatory variables, of the interest rate, of the rate of growth of nominal money, of the rate of nominal depreciation, of the rate of growth of nominal wages, of the output gap and of the external inflation.

The results of the estimation, for the period 1990:Q1- 1999.Q4, of the baseline model, are presented in the second half of table 3. In the baseline model, presented in the first row of the table, the coefficient of the inflation gap is positive but it is not statistically significant. This result could be due to a specification error, as the Central Bank has as a declared separate objective to keep the size of the current account deficit, computed at a normal level of the terms of trade, below 4% of GDP. To incorporate this second objective we extended the basic model adding as a separate regressor the gap between a fourth-quarter moving average of the current account deficit and 0.04. The results are reported in the second row of table. The coefficient of the inflation gap is again positive, but now it is statistically different from zero. The coefficient of the current account gap is also positive and (statistically) significantly different from zero. These findings provide some support to the hint that an equation that includes only the inflation gap is wrongly specified. The estimated coefficient of the inflation gap implies that for a one-percentage point gap between expected and target inflation, the Central Bank raises the real interest rate in 68 basis points to bring inflation close to the target. In the same way, the estimated coefficient of the current account gap implies that a one-percentage point difference in this variable results in an increase of 61 basis points in the real interest rate. We also considered as an alternative specification a forward looking version of the Taylor rule where instead of the current account gap we included the gap between the log of GDP and the log of its trend (measured using a Hodrick and Prescott filter) but, as it can be observed in the third line of the table, the GDP gap was not statistically significant. In the latter regression, the inflation gap was not statistically significant either.

Table 3: Central Bank of Chile Reaction Functions

	ρ_1	ρ_2	α	β	γ_1	γ_2	J-Test	R^2
Period: 1985:Q3-1989:Q4								
Baseline	18,64	-1.037	7.00	0.55	_	_	0.271	0.79
	(43,54)	(-19.67)	(18.97)	(3.26)				
Adding:								
Output	1.436	-0.713	4.96	0.56	1.4	_	0.236	0.87
Gap	(14.02)	(-7.83)	(33.85)	(4.75)	(6.95)			
Squared	0.869	-0.005*	6.44	0.0006*	0.698	-0.52*	0.019	0.86
Inflation	(9.89)	(-0.04)	(7.41)	(0.005)	(3.32)	(-1.022)		
Gap								
Dummy	1.161	-0.494	5.225	0.324	1.461	0.163	0.196	0.88
	(7.47)	(-3.89)	(33.39)	(4.58)	(9.22)	(4.28)		
Period: 1990:Q1- 1999:Q4								
	ρ_1	ρ_2	α	β	γ_1	γ_2	J-Test	R^2
Baseline	1.219	-0.322	6.54	1.44*	-	-	0.056	0.83
	(8.96)	(-3.35)	(11.73)	(1.16)				
Adding:	1.162	-0,325	6.24	0.236*	0.36*	-	0.106	0.88
Output	(12.55)	(-3,35)	(24.99)	(1.28)	(1.11)			
Gap								
Current	0.726	-	6.827	0.676	0.61	-	0.05	0.80
Account	(9.87)		(15.63)	(2.31)	(2.56)			
Deficit								
Squared	0.72	-	6.962	0.742	0.559	-0.066*	0.05	0.81
Inflation	(9.99)		(10.76)	(2.21)	(2.57)	(-0.41)		
Gap								
Dummy	0.699	-	7.018	0.675	0.581	-0.35	0.04	0.77
	(8.93)		(13.61)	(2.62)	(2.73)	(-0.66)		

t-statistics in parenthesis.
* Not significant at 10%. All the other variables are significant at 5%.

We also tested for a non-linear response of monetary policy to the inflation gap by introducing the square of the inflation gap as a separate regressor, but its coefficient was not statistically significant. In that regression the coefficients of the inflation gap and of the current account gap did not change much. Finally, we tested also for asymmetries in the response of monetary policy. For this purpose, we introduced a multiplicative dummy for the observations where the inflation gap was negative (14 out of 38 observations in the second

period), but again, as reported in the table, the coefficient of the dummy variable was not statistically significant.

As a further test of the model we estimated it also for the period before the Central Bank became independent. As during this period there was not an explicit inflation target, we use as a target a forward-looking four-quarter moving average of the annual inflation rate. The results of the estimations appear in the first half of table 3. The inflation gap by itself is statistically significant, as it is also the gap between the log of GDP and the log of its trend value.

For this period, we also tested for the existence of asymmetries in the response of the monetary policy. For this purpose, we introduced a quadratic term of the inflation gap, and a multiplicative dummy for the periods when the inflation gap was negative. The coefficient of the non-linear term turned out to be not statistically significant, but the coefficient of the dummy variable was statistically significant and had the expected sign. That is, for the same size of the inflation gap, the monetary authority adjusts interest rate by a larger amount when the gap is negative.

A first reading of the results could make them appear surprising, as much before the Central Bank became independent was already operating with rules that tried to keep inflation close to its forward-looking trend value. But this finding is consistent with the view that the independence of the central bank, granted in 1989, only institutionalized procedures that were in operation since much before (Fontaine, 1989).

Returning to the results for the 1990s, another result that should be mentioned is the high level of persistence of the interest rate, this can be appreciated calculating the sum of the two coefficients of the lagged values of the interest rate, that lies between 0.69 and 0.85. A value in this range implies that for a given change in the target interest rate, the proportion that reflected in the rate for the same quarter is between a 15% and a 30% of the change.

As the Central Bank obtained its independence only in late 1989, we can investigate how the actual monetary policy followed during the pre-1990 period differed from the policy that would have been followed if monetary policy during that period had been governed by

the reaction function of the second period. Figure 4 compares, for the period 1985:Q1 to 1989:Q4, the actual and simulated values for the real interest rate. The latter obtained using the second period reaction function. As can be observed from the figure, up to the first quarter of 1988 the fitted values were above the actual ones, implying that for this period monetary policy was more expansionary than what it should have been if it had been determined in accordance to the reaction function of the second period. From then on, the fitted values were below the actual values, this period is one where the Central Bank introduced a very tight monetary policy to slowdown the acceleration of inflation that was developing (Corbo and Fischer, 1994).

Figure 5 presents, for the second period, the fitted and actual values of the real interest rate. The fitted values were obtained using the equation reported in the third line of table 3. As can be observed from the table, the model tracks quite closely the actual rate. The main exceptions are the periods 1994:Q1 to 1995:Q2, when the equation underestimates the actual values and the end of the sample when interest rates were set more to defend the exchange rate band than to achieve the inflation target.

4.2 Colombia

As we saw in section 3, in Colombia a new Constitution enhancing the legal independence of the Central Bank was approved in 1991. This event provides a natural criterion to separate the sample, as one would expect, in general, a different behavior before and after the Central Bank became independent. Before going into the estimation, in figure 6 we present the evolution of inflation and a three-quarter lag of the real interest rate.

In the estimation, we use quarterly data for the period 1986:Q1-1998:Q4. In a first stage, a baseline reaction function was estimated, using the GMM, in which the only right hand side variable was the deviation of expected inflation from its trend –obtained as a Hodrick and Prescott filter of observed inflation. To account for the empirically observed smoothing of short term interest rates movements; we used a one period partial adjustment model for the adjustment of the observed interest rate towards its desired level. The

dependent variable was measured as the Certificates of Deposits (CD) rate as it is through CDs that the Central Bank carries out its monetary policy.

We start estimating a reaction function for the whole sample, that is 1986:Q1-1998:Q4. The results of this estimation, using a two-quarter lead for the inflation gap, are shown in the top of table 4. The vector of instruments included lags one to four of the inflation gap, of the unemployment gap, and of the short term interest rates. The unemployment gap was measured as the deviation of the unemployment rate with respect to a trend value obtained using a Hodrick and Prescott filter. From the results it is found that all the estimated coefficients are statistically significant at one percent level, with the exception of the inflation gap which is significant at ten percent level (the corresponding p-value is 0.065). The coefficient associated to the deviation of observed inflation from its target value is greater than one. This result suggests that the Central Bank of Colombia would have moved the interest rates aggressively in order to avoid deviation of inflation from its target; the later defined here as a smooth trend of the observed inflation. Nonetheless, using a Wald test, the null hypothesis that $\beta=1$ cannot be rejected at the five percent significance level. In other words, the data do not support a "hawkish" behavior of the Colombian authorities during the whole sample period that is 1986:Q1-1998: Q4. This is not surprising as this period includes the second half of the 1980s, a period for which Colombia's monetary policy has been usually described as accommodative (Cardenas and Partow, 1998). We confirm that monetary policy was accommodative in the sense that the Central Bank adopted a neutral position, accommodating expected shocks to inflation through monetary policy by holding the real interest rates constant.

The estimated coefficient of the partial adjustment process of the actual towards the desired interest rate level also shows that Colombia's authorities were reluctant to introduce abrupt changes in monetary policy. In particular, only one-fifth of a desired adjustment in the interest rate was accomplished during one quarter.

Table 4: Central Bank of Colombia Reaction Function

	ρ	α	β	γ_1	γ_2	J-Test	R^2
Period: 1986:Q1- 1998:Q4							
Baseline	0.176	31.15	2.84*	_	_	0.1	0.61
	(3.61)	(22.11)	(1.89)				
Period: 1986:Q1-1990:Q4							
Baseline	0.78	33	0.71	_	_	0.25	0.66
	(14.21)	(357.3)	(11.4)				
Adding:							0.6
Unemployment	0.81	32.85	0.6	-7.85	_	0.242	
Gap	(15.9)	(427.22)	(14.1)	(-2.53)			
Real Exchange	0.74	32.7	0.67	-7.46	1.75	0.308	
Rate	(17.24)	(870.51)	(0.00)	(0.00)	(0.03)		
Period: 1991:Q1-1998:Q4							
Baseline	0.32	25.62	2.73	_	_	0.15	0.44
	(3.41)	(22.56)	(4.37)				
Adding:						0.15	0.56
Unemployment	0.27	25.57	2.19	-32.86*	_		
Gap	(5.2)	(13.94)	(2.43)	(-1.82)			

t-statistics in parenthesis
*Significant at 10%. All the other variables are significant at 5%.

As in Colombia the only legal objective of the Central Bank -besides the stability of the financial system- is to achieve monetary stability, we proceed directly to search for other hidden objectives. This other objectives could be more important for the first half of the sample when the Central Bank was still not independent. Thus, we proceeded to introduce other possible objectives of monetary policy as arguments in the reaction function. In particular, we added the unemployment gap. As lagged values of the unemployment gap were already used as instruments in the estimation, to introduce the unemployment gap as another regressor in the reaction function is equivalent to test if it enters as a separate objective of monetary policy.

The estimation of an expanded equation with the unemployment gap as an additional variable yielded poor results. The coefficient of the unemployment rate was either not statistically significant or had the wrong sign[13]. Similar results were obtained when the deviation of the real

[13] The unemployment gap was measured as the difference between the actual rate of unemployment and its quadratic trend.

exchange rate from its trend was introduced as an alternative variable. The lack of a satisfactory relation to explain the responses of monetary policy to economic shocks during the whole sampling period (1986-1998) may be due to the existence of a structural break, both in the objective function of the Central Bank –as it gained legal independence in the early 1990s and the objective of price stability was only then introduced as its main priority- and in the type of shocks that hit the economy – the access to external financing improved significantly during the 1990s when a broadly based reform program was put into practice. Thus, we proceeded to separate the sample into two periods: 1986:Q1-1990:Q4 and 1991:Q1-1998:Q4.

The results of the estimation for the period 1986:Q1-1990: Q4 are shown in the middle section of table 4. As in the case of the whole period, we started by estimating a baseline equation in which only the deviations of the observed inflation from its trend –again obtained as a Hodrick and Prescott filter- entered as a regressor. The results show that all the variables are statistically significant at the one- percent level and have the expected signs. The coefficient associated to the deviations of inflation from its (implicit) target is significantly less than one, suggesting that the Colombian authorities, during this period, tended to accommodate expected shocks to inflation, letting the real interest rate fall when a rise in future inflation was forecasted. The partial adjustment coefficient also shows that during this period the movements of the short-term interest rates showed less persistence than in the whole period. One must keep in mind, however, that the magnitude of the estimated partial adjustment coefficient for the whole period could be subject to some kind of specification error. Anyway, the estimated coefficient for the period 1986:Q1-1990: Q4 seems to be particularly high: almost four fifths of the desired adjustment in the observed interest rates was obtained in one quarter.

We then introduced the unemployment gap as an additional regressor. The results of the estimation, when this variable enters the equation with a one-quarter lead are shown in the second line. All the coefficients are statistically significant at one- percent level (with the exception of the coefficient associated to the unemployment gap, which has a p-value of 0.02), and are very similar to those obtained when the baseline specification was estimated. Again, the coefficient associated to the deviations of inflation from its target is significantly less than one. The coefficient of the unemployment gap suggests that, during this period, the monetary authorities

also gave some weight to the unemployment gap as an additional objective. In particular, the results imply that the authorities reduced (increased) short-term interest rates when a rise (fall) in the gap between unemployment and its trend was expected. As a next step, we introduced the deviations of the real exchange rate from its trend as an additional variable to the above specification.

The results shown in the mid section of table 4 correspond to the estimation of an specification in which the deviation of the real exchange rate from its trend value enters the equation with a four-periods lead. The instruments utilized include the first to four lags of the deviations of inflation from its target, of the unemployment gap, of the short-term interest rate and of the exchange rate variable. As can be seen from the table, all the coefficients are statistically significant and have the expected signs. Excluding the coefficient associated to the real exchange rate variable, all the others are very similar to the ones obtained when the reaction function included, as arguments, only the inflation gap and the unemployment gap. As a test of the plausibility of this specification one can estimate, under the assumption of a constant inflation target, the coefficient of the "long run" interest rate. The estimated value turns out to be 32.7%, value that it is very close to the average interest rates during the sample period (32.97). The coefficient associated to the deviations of the real exchange rate from its trend suggests that the Colombian authorities were concerned not only about price stability and unemployment volatility, but they also tried to stabilize the expected movements in the real exchange rate, presumably in order to avoid putting the competitiveness of the tradable sectors at risk.

As a final step we included the three months U S treasury bill rate to the last specification in order to investigate the degree of independence (from the stance of foreign monetary policy) with which domestic monetary authorities were able to conduct monetary policy. Nonetheless, the results, not reported here, were very poor, which is not surprising as during the sampling period (1986-1990) Colombia was rather closed to international capital movements.

Now we will study how monetary policy was conducted when the Central Bank became independent. For this purpose, we estimate a reaction function for the period 1991:Q1 to 1998:Q4. During this period, in accordance with the law, the overriding objective of the Central

Bank was to achieve monetary stability. In the transition towards monetary stability the Central Bank announced annual inflation targets. Thus, for this period we define the inflation gap as the deviations of observed inflation from the (linearized) annual targets established by policy makers. The estimation of the baseline equation for this sub-period yielded the results shown in the bottom of Table 4. The coefficient for the inflation gap –when this variable enters the equation with a two period lead- is statistically significantly greater than one, which supports the idea that authorities were determined to avoid deviations of observed inflation from its target. One must notice, however, that this does not necessarily imply that policy makers were hawkish; the observed result could well be explained by the setting of "soft" annual inflation targets. Indeed, if one compares an inflation-forecast -made with an autoregressive model- with the announced target, one finds that only in 1995 the inflation forecast was a hard target. (see figure 7).

Then, we extended the arguments of the reaction function to include the unemployment gap. The results, when the unemployment gap enters the equation with four leads, provide some (weak) evidence that the Colombian authorities considered unemployment stability as a final objective during the period in which the Central Bank was already independent. The coefficient associated to the unemployment gap is statistically significant at a ten percent level (the corresponding p-value is 0.08). When the deviations of the real exchange rate from its trend were included as an additional argument of the reaction function the results were very poor. Finally, as in the case of the first sub-period, the inclusion of the three-month treasury bill rate to the above specification did not provide evidence that foreign monetary policy imposed a constraint on domestic authorities during the 1990s.

Figure 8 compares the evolution of the observed and predicted nominal interest rate, where the latter is computed using equation 2 of table 4. As can be observed from the figure the model tracks quite closely the trajectory of the actual rate.

4.3 Costa Rica.

As discussed in section 3, in Costa Rica the Central Bank became independent only in 1995 and it has as its main objective to achieve price stability. A secondary objective is to achieve full employment. However, as has been the case of Chile, the Central Bank has been concerned with reducing inflation since before it became independent. Therefore, we study the way in which the Central Bank has conducted monetary policy in the 1990s.

In Costa Rica monetary policy is carried out using Monetary Stabilization Bonds (BEMs) which have a typical maturity of six months, and therefore the six months interest rate of the BEM is used as the interest rate intervention variable in the estimation of a reaction function. The trajectory of inflation and of three-quarter lag for the real interest rate is presented in figure 9. From this figure emerges some evidence that interest rates are adjusted to affect the future course of inflation.

As in the other countries, we use a one period partial adjustment mechanism for the adjustment of the actual interest rate towards its desired level. Also, as Costa Rica does not have an explicit inflation-targeting framework, the target inflation rate is unknown and we assume that the objective was to keep inflation around its trend value. The latter is measured using a Hodrick and Prescott filter. As an alternative procedure we could have followed Clarida et al. (1998), assuming that the inflation target is a constant which can be estimated from the constant of the regression. However, the latter procedure could introduce a specification error in cases when the country under study is pursuing the objective of reducing inflation gradually towards a long-run steady state level.

The reaction function for Costa Rica is estimated using quarterly data for the period 1990:Q1-1998.Q4. The results of estimation of a baseline equation, that includes as an explanatory variable only the inflation gap, are presented in table 5. The inflation gap is measured using a two-quarter lead, and the equation is estimated using also the GMM estimation procedure. The instruments utilized are four lags of the inflation gap, of the BEM interest rate, and of the output gap.

Table 5: Central Bank of Costa Rica Reaction Function

	Period: 1990:Q1- 1998:Q4						
	ρ	α	β	γ_1	γ_2	**J-Test**	R^2
Baseline	0.38	22.8	1.47	_	_	0.149	0.61
	(4.4)	(24.4)	(5.68)				
Adding:							
Output Gap	0.68	25.49	0.79	73.77	_	0.208	0.61
	(15.9)	(43.48)	(10.89)	(7.54)			
Real Exchange Rate	0.64	25.59	0.82	58.85	60.29*	0.218	0.61
	(11.49)	(92.88)	(32.31)	(9.6)	(2.49)		

t-statistics in parenthesis
*Significant at 5%. All the other variables are significant at 1%

As can be observed from the table, the coefficient associated to the inflation gap is positive and greater than one. Thus, it appears that the Central Bank of Costa Rica was trying to keep its inflation close to its trend, reacting to a one-percentage point increase in the gap between expected inflation and its trend with a 46 basis points increase in the real interest rate. Nonetheless, as in the Colombian case, the estimated parameter of the inflation gap is not significantly different from one. Thus, policy makers could well have been neutral in the face of expected inflation shocks.

The low value of the partial adjustment coefficient shows that interest rates have a lot of persistence, moving very slowly towards its desired value. The persistence of interest rate movements is of the same order of magnitude as in the Colombian case. Finally, as an indicator of the validity of the model, the estimated value of the "long run" nominal interest rate which turn out to be 22.8%, a value very close to the mean of the interest rate series over the sampling period (24.95%).

The results obtained so far could be subject to a specification error as the Central Bank of Costa Rica has other objectives besides achieving a gradual reduction of inflation. Therefore, the following step considered was the addition of other variables that appear as legal objectives of the Central Bank. As was already mentioned in section 2, the Central Bank of Costa Rica's charter establishes a set of secondary objectives for monetary policy: the achievement of full employment, the promotion of efficiency of the internal and external payments system, the

appropriate management of international reserves, and the stability of the financial system. The only objective that could play an independent role is the full employment one. To account for the full employment objective we introduced as an additional explanatory variable the output gap; measured as the deviation of an industrial output index from its trend –the latter obtained using a Hodrick and Prescott filter. Thus, we estimated a sort of forward-looking version of the "Taylor Rule". In this specification the inflation gap enters the equation with a two periods lead and the output gap with an eight periods lead[14]. The results show that it appears that the monetary authorities tried to stabilize output over the sample period. Another interesting finding is that in this second specification the coefficient associated to the inflation gap turns to be less than one. A Wald test confirms that the coefficient is significantly less than one, suggesting that during the 1990s the authorities accommodated expected shocks to inflation.

In order to introduce the objective of promoting efficiency of the internal and external payments system, we added to the above specification the expected deviation of the real exchange rate from its trend. In this case, the new variable enters the equation with an eight period lead. The results show that the stabilization of the real exchange rate was also considered as a separate objective by authorities. Again, the inflation gap coefficient is (statistically) significantly less that one, confirming the finding that the monetary authorities followed an accommodative policy with respect to shocks to expected inflation. We also introduced as a separate argument the level of foreign reserves, but the results, not reported here, were very poor. Finally, we also considered the six month US treasury bill rate as another variable that could have played a role when setting monetary policy but the results were also very poor.

A comparison between the evolution of the actual and estimated values of the interest rate, the latter obtained with the last equation of table 5, is presented in figure 10. As can be observed from the figure, with the exception of the year 1992, the model describes fairly closely the behavior of the observed interest rate.

[14] The lead utilized for the output gap is much longer that one would have expected a priori as monetary policy works in emerging countries with a much shorter lag than in industrial countries (Fry et. al. , 1999).

4.4 El Salvador.

In El Salvador the main objective of its Central bank is to achieve price stability. A secondary objective, is to ensure the stability and competitiveness of the financial system. However, in setting monetary policy, El Salvador uses a monetary framework closer to a fixed exchange rate as the exchange rate has been *de facto* fixed since the early 1990s. Furthermore, El Salvador also has free capital movements and therefore comes close to the textbook model of a fixed exchange rate with perfect capital mobility. In this type of Mundell model, monetary policy has no role to play in stabilization. Within this setting, the exercise of estimating a reaction function for monetary policy would not make any sense. Nonetheless, it could be claimed that capital mobility is far from perfect, and, consequently, it should be worthwhile to analyze the extent up to which policy makers have room to conduct an independent monetary policy. Indeed, a similar point is made in Clarida et al. (1998), when they study the reaction functions for England, France and Italy at a time when these three countries had their currencies fixed within the Exchange Rate Mechanism of the European Monetary System[15]. In their framework, the stance of monetary policy is a weighted average of the interest rate desired by authorities and the foreign interest rate. In the context of El Salvador, an analog exercise can be performed adding to a baseline specification the rate of the US Treasury bill as a measure of the external constraints faced by Salvadorian monetary authorities.

As in the case of the other countries, we proceeded to estimate a baseline specification in which monetary policy reacts only to the future deviations of inflation from its trend. Then we added as a separate regressor the foreign interest rate. Thus, two explanatory variables entered the extended model: the inflation gap and the six months US treasury bill rate. As the dependent variable, we used the financial system deposit rate. In figure 11 we show the trajectory of the inflation rate and of the real interest rate lagged three-quarters. As can be observed, there is some evidence that interest rate adjustment is related to

[15] Clarida et al. (1998) assess the degree of independence of monetary policy for the members of the ERM adding the Bundesbank policy rate to a baseline specification for the reaction function that includes only domestic variables.

the inflation rate. In the estimation, as in the case of the other countries of the sample, we assumed a first order partial adjustment process for the adjustment of the domestic interest rate. The estimations were carried out using quarterly data for the period 1991:Q1 to 1998:Q4. The results of the estimation appear in table 6. As can be observed from the table, the coefficient for the treasury bill ( ) is not statistically significant, implying that foreign monetary policy did not represent an effective constraint for the conduction of monetary policy in El Salvador. Given this finding we focused on estimating a reaction function for the Central Bank of El Salvador in the same way as we did for the other countries of the sample. The second line of table 6 presents the results obtained for the estimation of a baseline specification in which only the six month forward inflation gap enters as an explanatory variable. The instruments considered included lags one to four of the inflation gap, the output gap and the short-term (six months) interest rate. All the coefficients are statistically significant and with the expected signs. It can be seen that the coefficient for the inflation gap is slightly greater than one, but a Wald test confirms that it is not statistically different from one. This result suggests that monetary authorities were not particularly determined to control inflation shocks; policy makers would have let the real interest rate to remain constant when faced with shocks to inflation. Another interesting result is given by the partial adjustment coefficient. Current short-term interest rate is explained over ninety percent by lagged interest rate, reflecting a high degree of persistence in the interest rates movements.

Table 6: Central Bank of El Salvador Reaction Function

		Period: 1991:Q1- 1998:Q4						
		ρ	α	β	γ_1	θ	**J-Test**	$\mathbf{R^2}$
Baseline	+	0.06	10.07	0.98*	_	0.05**	0.122	0.92
Treasury		(2.4)	(2.52)	(1.84)		(1.1)		
Baseline		0.09	14.05	1.11	_	_	0.102	0.91
		(2.62)	(22.8)	(2.34)				
Adding:								
Output Gap		0.06	13.49	1.39	3.72*	_	0.101	0.93
		(2.26)	(18.8)	(2.1)	(1.92)			

t-statistics in parenthesis
* Significant at 10%
** Not significant at 10%. All the other variables are significant at 5%.

We then proceeded to add other variables as regressors in the reaction function. Firstly, we introduced the output gap as a way to find out if the monetary authorities considered output stability as a final objective. We found that policy maker had at least some concern about output stability during the 1990s. The output gap appears to be significant at 10% significance level and almost significant at 5% (p-value is 5.9%). When we added the real exchange rate as another regressor –either in addition to the output gap or as an alternative to it- we found that it did not enter the reaction function of the Salvadorian authorities.

Finally, figure 12 presents the evolution of the observed and fitted values of the nominal interest rate, where the latter was obtained using the model reported in the last line of table 6. As can be observed from the figure, the model track quite well the trajectory of the observed interest rate.

4.5 Peru

In Peru, the 1980s were a period characterized by the presence of substantial macroeconomic disequilibria and financial repression; including interest rates controls. During the 1990s, substantial progress has been made in restoring macroeconomic stability and, as we saw in section 3, in January of 1993 a new legal framework was introduced giving more independence to its Central Bank. In particular, the new law makes the principal Central Bank's objective to achieve price stability.

In carrying out monetary policy, the Peruvian monetary authorities have used the rate of growth of the money base as an intermediate target. The main instrument utilized to pursue this policy has been the use of open market operations using certificates of deposits of the Central Bank (CDs). In our investigation of how monetary policy is carried out in Peru, we estimate reaction functions with quarterly data for the period 1993:Q1-1999: Q1, period that coincides with a higher degree of legal independence for its Central bank. In a first stage, we used the rate of change in the money base as the dependent variable. The results with this dependent variable were very poor and we continued our estimations using as the

dependent variable the nominal interest rate of 30-days CD's [16]. Figure 13 presents the evolution of the real interest rate, with an n-period lag, and the rate of inflation. From the figure it appears that nominal interest rates were adjusted as a response to inflation.

As in the other countries, we begin by estimating a baseline specification in which the only regressor is the inflation gap. Given that Peru did not have an explicit inflation target, the inflation gap is defined as the difference between the observed inflation and its trend, which is measured using a Hodrick and Prescott filter. Nonetheless, the estimation yielded poor results: the inflation gap was either not statistically significant or had the wrong sign. The same result was obtained when the trend of inflation was measured using a four-quarter moving average of quarter to quarter inflation rates. However, a stable relation was found when the inflation gap entered the equation as the difference between observed inflation and the inflation rate for the sample period or equivalently when the target inflation rate was assumed to be a constant. The results of the estimation using this specification are reported in the first line of table 7. Here the inflation gap enters the equation with a four periods lead (one year), and the vector of instruments used in the estimation includes lags one to four of inflation, of the output gap and of the short term interest rate. The results show that monetary policy appears to have accommodated shocks to expected inflation. The coefficient of the inflation gap is also statistically significantly less than one. The estimated parameter of the partial adjustment process for interest rates implies a high degree of persistence of monetary policy: over seventy percent of the level of the short-term interest rate is explained by its lagged value.

[16] It must be pointed out that the series for the CD's rate presents a problem of missing observations for march and may of 1997. To overcome this problem a least squares regression was estimated, in which the CD rate was regressed on its first lag and the Discount Rate. A first order partial adjustment model was assumed and was supported by data.

Table 7: Central Bank of Peru Reaction Function

	Period: 1993:Q1- 1999:Q1						
	ρ	α	β	γ_1	γ_2	**J-Test**	$\mathbf{R^2}$
Baseline	0.29	28.72	0.75	_	_	0.27	0.72
	(10.18)	(42.81)	(10.81)				
Adding:	0.26	28.25	0.73	23.93	_	0.268	0.73
Output Gap	(5.34)	(46.00)	(14.95)	(3.04)			
Real Exchange	0.28	28	0.65	4.52	73.29	0.298	0.76
Rate	(30.33)	(126.6)	(25.62)	(3.92)	(12.66)		

t-statistics in parenthesis
All the variables are significant at 1%.

As the Central Reserve Bank of Peru charter establishes monetary stability as the only objective of monetary policy, we could conclude from these results that the monetary authority has not been fully committed to the legal objective expelled out in the Constitution. In the following stage we added to the baseline equation the output gap. We found that the output gap with a two periods lead is statistically significant at a one percent level. Again, the coefficient of the inflation gap is significantly less that one pointing to an accommodative behavior of authorities. Finally, the deviation of the real exchange rate from its trend was also introduced as a third regressor. The results show that the real exchange rate also is statistically significant at the one- percent level. Thus, it appears that, during the period of the sample, Peruvian policy makers were not only concerned with output stability but also with the stability of the real exchange rate. Thus, although they have as its main mandate to achieve price stability other macroeconomic considerations also had a bearing when setting the course of monetary policy.

Finally, figure 14 presents the evolution of the actual and fitted interest rate, where the latter is obtained using the last equation of table 7. From the figure can be observed that the model track fairly closely the trajectory of the actual rate.

Summing up the empirical findings, it can be said that in two of the five cases studied (Chile and Colombia) since their central banks became independents, monetary policy has been clearly geared to get inflation closer to its target value. From the other three cases: Costa Rica, El Salvador and Peru, in El Salvador there is some evidence that monetary policy

is at least neutral. That is, shocks to the inflation rate do not result in a change in the real interest rate, while in the other two countries, a higher real interest rate is not the mechanism utilized to bring inflation close to its target.

In general, it is found that when setting monetary policy central banks look beyond just inflation, taking into account other variables that many times are spelled out in their charter. This other variables are not considered because of their predicted power for future expected inflation but as separate objectives of monetary policy. Thus, in the case of Chile it was found that the size of the current account deficit, as a share of GDP, is also a variable taken into account when deciding the stance of monetary policy. In contrast, the output gap was significant only in the second half of the 80s, but not in the 90s when the Central Bank became independent. A similar type of result is found for Colombia, where the unemployment rate is significant only in the 80s but not in the 90s.

In the case of Costa Rica both the output gap and the real exchange rate are statistically significant, while in El Salvador, the output gap is statistically significant and in Peru both the output gap and the real exchange rate are statistically significant.

From the five countries, Chile is the one that has made more progress in reducing inflation towards its target level and also in achieving a target close to the inflation levels of industrial countries. This is not surprising, as the progress in reducing inflation depends also on factors beyond just monetary policy. Among these factors, one should consider the evolution of the equilibrium real exchange rate and the trajectory of the imported inflation.

Finally, one can compare our results with the ones obtained for industrial countries. The most direct comparison can be made with the results of Clarida et. al.(1998). In their empirical work, they find that US, Germany and Japan run a monetary policy where interest rate policy was mostly determined by the expected inflation gap**,** where the latter is measured as the difference between expected inflation and a constant steady-state inflation target. In their results, they find that the real interest rates increases in response to shocks to expected inflation ($\beta>1$ in their framework where the dependent variable is the nominal interest rate). In contrast, the output gap was significant only for Germany and Japan but not for the US. Thus, for the US, the output gap is used only to get a forecast of future inflation. In our empirical results we found that in Chile and Colombia, the output gap and the unemployment

gap, respectively, were not statistically significant in the reaction function, and therefore did not play a role beyond the information content that they provide to forecast future inflation.

For the small countries: Costa Rica, El Salvador and Peru, our results show that foreign interest rates do not play an important role when setting the stance of monetary policy. For El Salvador this result is surprising, as the nominal exchange rate has not changed much during the nineties, with its central bank using a combination of a money and an exchange rate anchor.

5. Conclusions.

After a long tradition with high fiscal deficits and high inflation, during the last decade Latin America made a major effort to achieve a sustainable reduction of inflation. The efforts have paid-off and while the average inflation rate of the 80's exceeded one hundred percent per annum, in 1999 annual inflation achieve the one-digit level. Inflation strategies were initially based on getting the fiscal situation under control as a way of liberating monetary policy from the financing of fiscal deficits, and have subsequently moved into more formal uses of nominal anchors. The choice of nominal anchors utilized as the cornerstone of the stabilization effort has changed through time as rigid exchange rate mechanism were being replaced by more flexible arrangements. The exceptions are Argentina's currency board and the de facto fix exchange rate arrangement of El Salvador. The other countries use a money anchor or an inflation target.

To facilitate the reduction of inflation, and, as a way of protecting the Central Bank from the typical political pressures that give rise to time-inconsistency problems, most countries have granted independence to the their Central Banks. Furthermore, Central Banks have been given a clear mandate and appropriate instruments for achieving a sustainable reduction of inflation.

While the results in terms of inflation reduction have been spectacular, the output costs are not in evidence. This result could be due, in large part, to the effect of the credibility of the new policies on inflation expectations, making-through this mechanism- a reduction of

inflation possible at a much lower cost than anticipated using standard models with high inflation inertia. Moreover, the beneficial effect on growth is not surprising as most studies of the costs of inflation show that these costs are highly non-linear and become very high at high levels of inflation, such as those typical of Latin America in the 1980s.

In general, it is found that when setting monetary policy central banks look beyond just inflation, taking into account other variables that many times are spelled out in their charter. This other variables are not considered because of their predicted power for future expected inflation but as separate objectives of monetary policy. Thus, in the case of Chile it was found that the size of the current account deficit, as a share of GDP, is also a variable taken into account when deciding the stance of monetary policy. In contrast, the output gap was significant only in the second half of the 80s, but not in the 90s when the Central Bank became independent. A similar type of result is found for Colombia, where the unemployment rate is significant only in the 80s but not in the 90s.

In the case of Costa Rica both the output gap and the real exchange rate are statistically significant, while in El Salvador, the output gap is statistically significant and in Peru both the output gap and the real exchange rate are statistically significant.

From the five countries, Chile is the one that has made more progress in reducing inflation towards its target level and also in achieving a target close to the inflation levels of industrial countries. This is not surprising, as the progress in reducing inflation depends also on factors beyond just monetary policy. Among these factors, one should consider the evolution of the equilibrium real exchange rate and the trajectory of the imported inflation.

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Figure 1: Inflation Targets v/s Inflation Forecasts in Chile

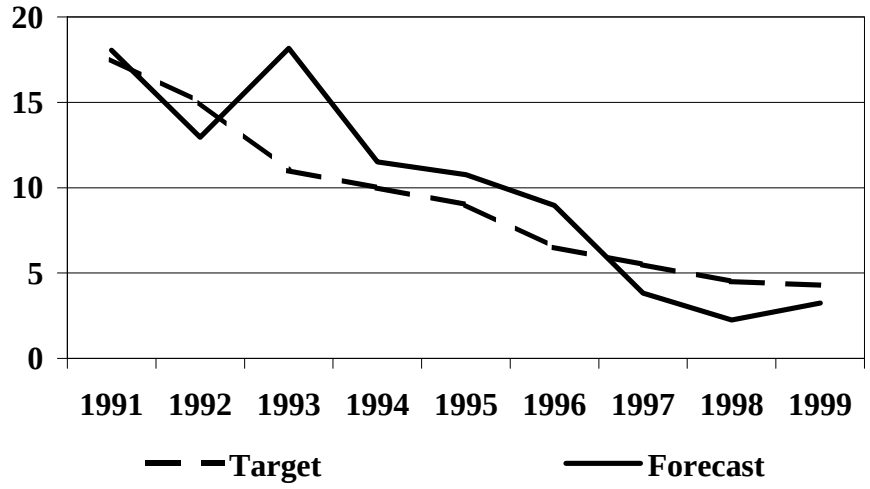


Figure 2: Inflation gap and Real Interest Rate in Chile

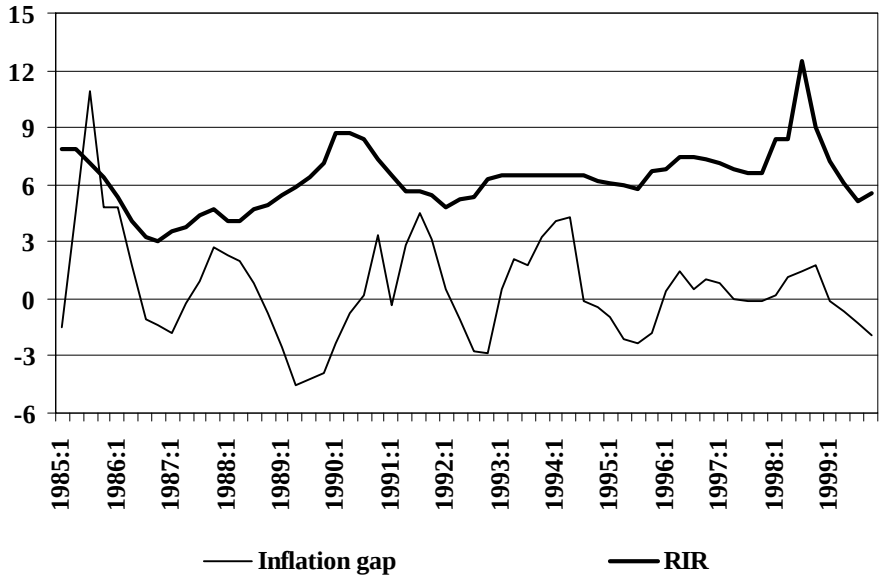


Figure 3: Inflation gap v/s Three-quarters lag of the Real Interest Rate in Chile

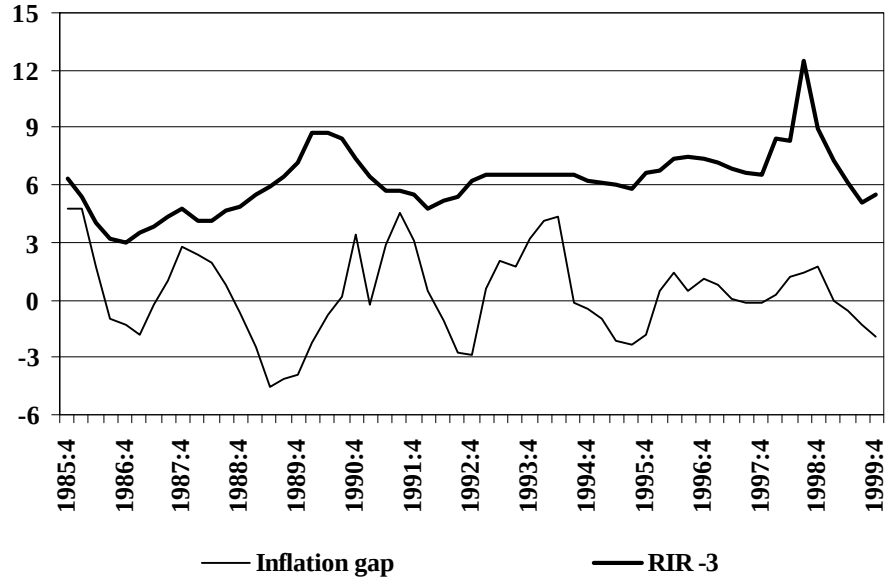


Figure 4: Actual and Simulated values for the Real Interest Rate in Chile (1985-1989)

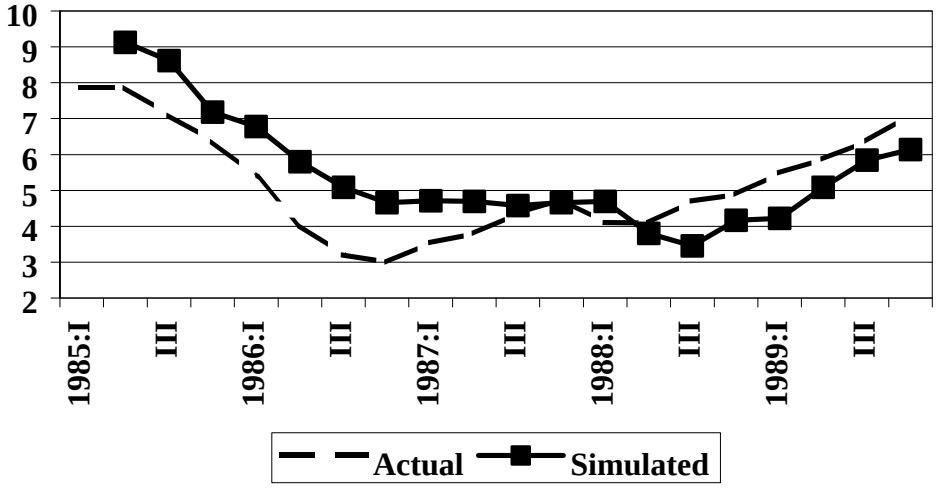


Figure 5: Actual and Simulated values for the Real Interest Rate in Chile (1990-1998)

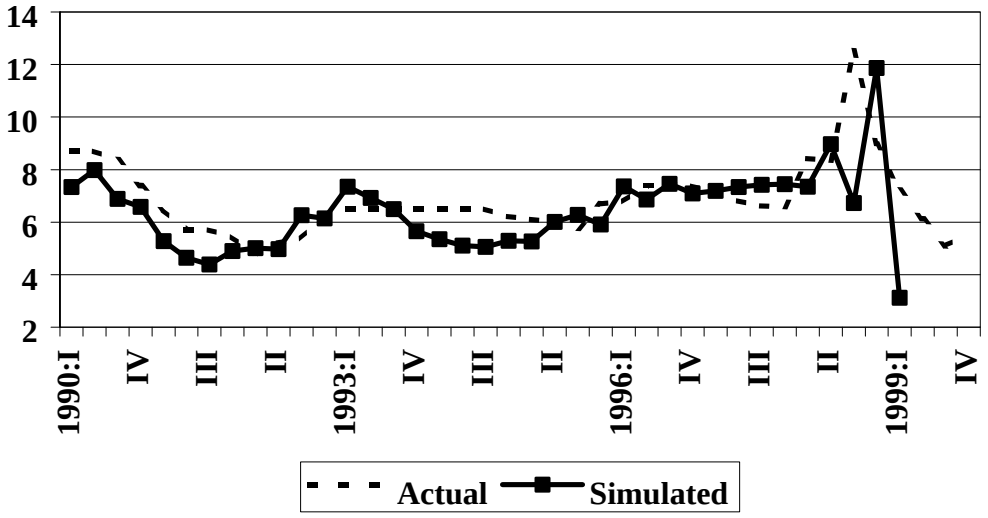


Figure 6: Inflation and Real Interest Rates in Colombia

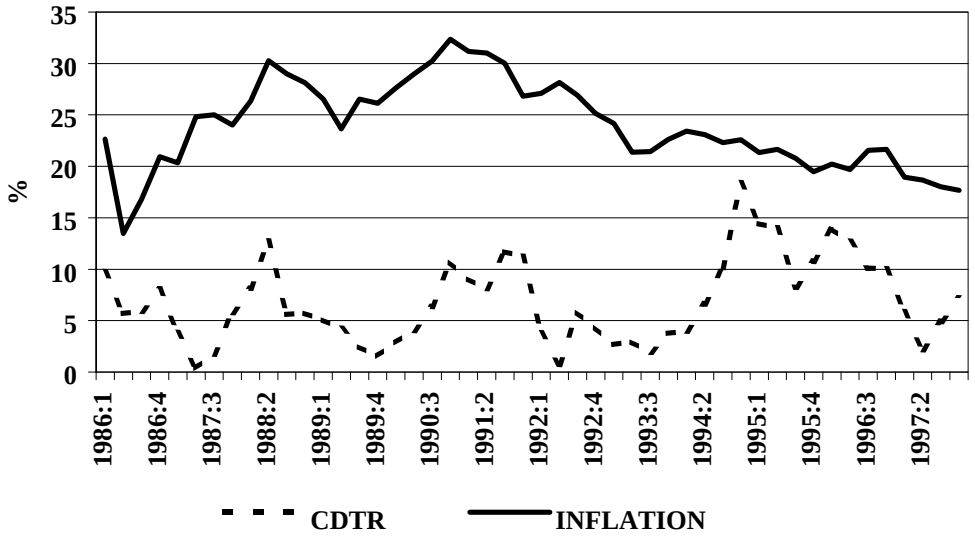


Figure 7: Inflation Targets and Inflation Forecasts in Colombia

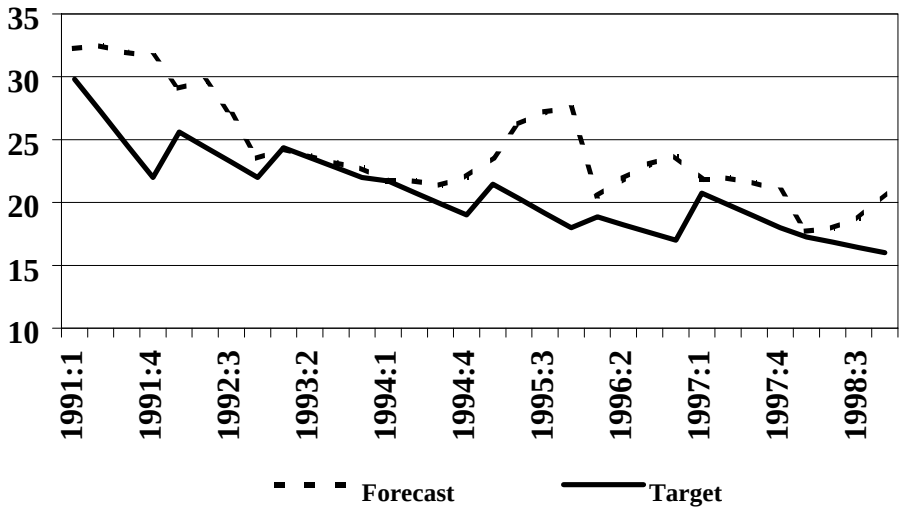


Figure 8: Actual v/s Fitted Nominal Interest Rates in Colombia

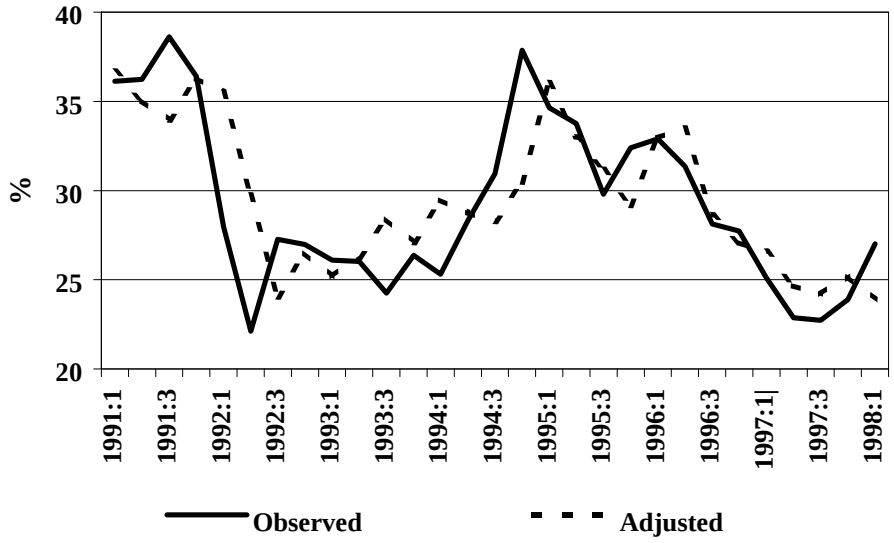


Figure 9: Inflation and Three-quarter lag of the Real Interest Rate in Costa Rica

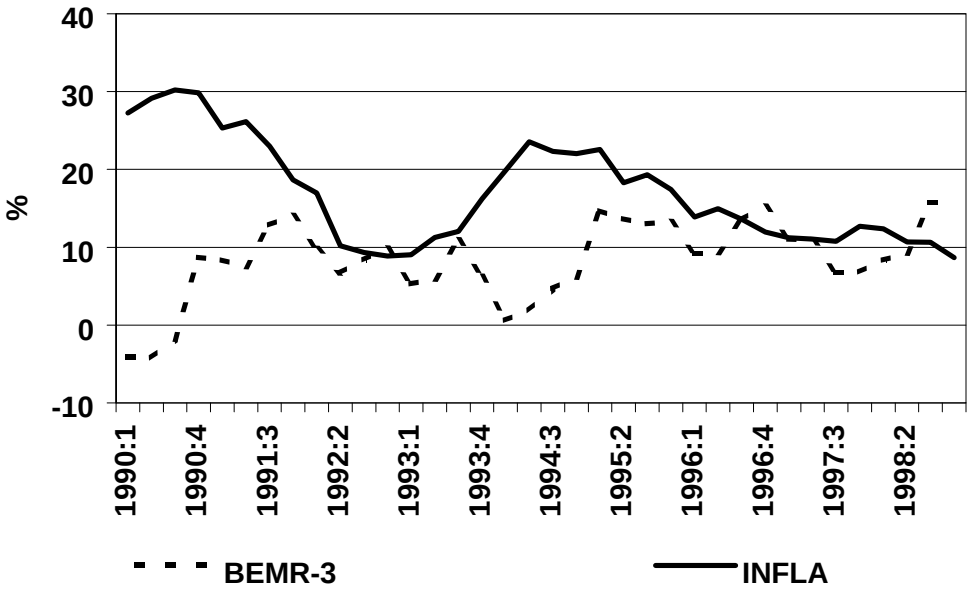


Figure 10: Actual and Fitted Nominal Interest Rates in Costa Rica

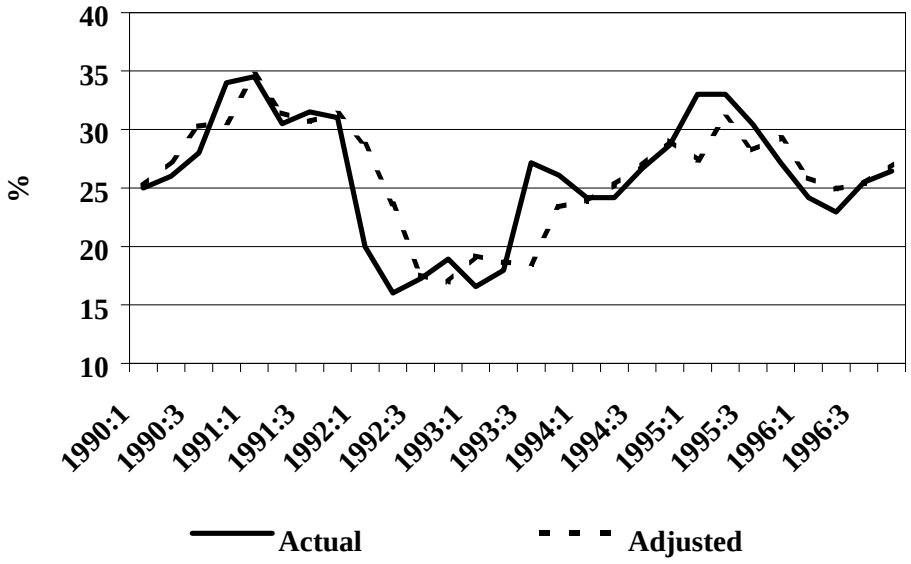


Figure 11: Real Interest Rates and Inflation in Costa Rica

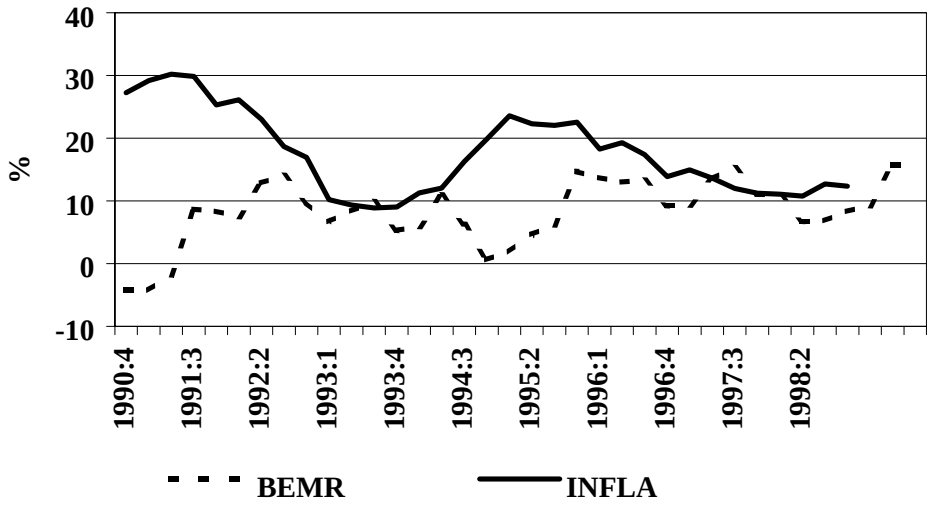


Figure 12: Actual and Fitted Nominal Interest Rates in El Salvador

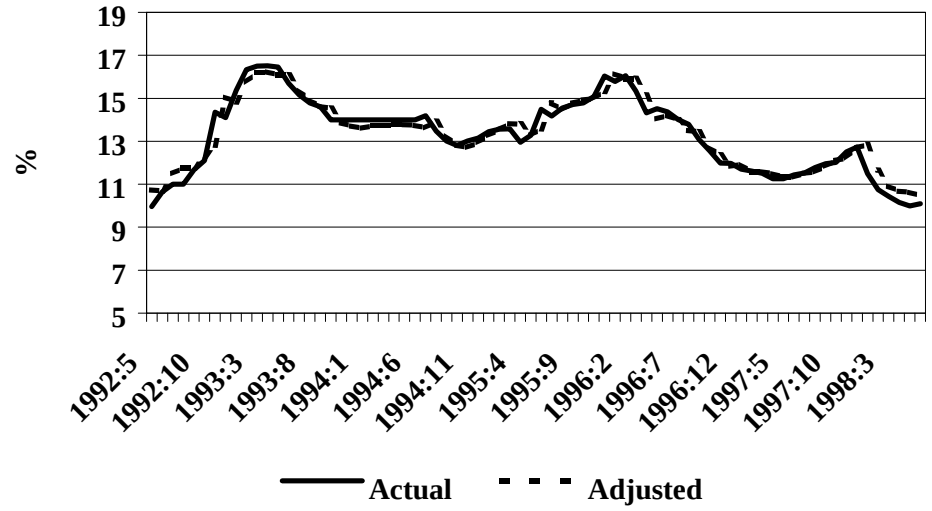


Figure 13: Inflation and Four-quarter lag of the Real Interest Rate in Peru

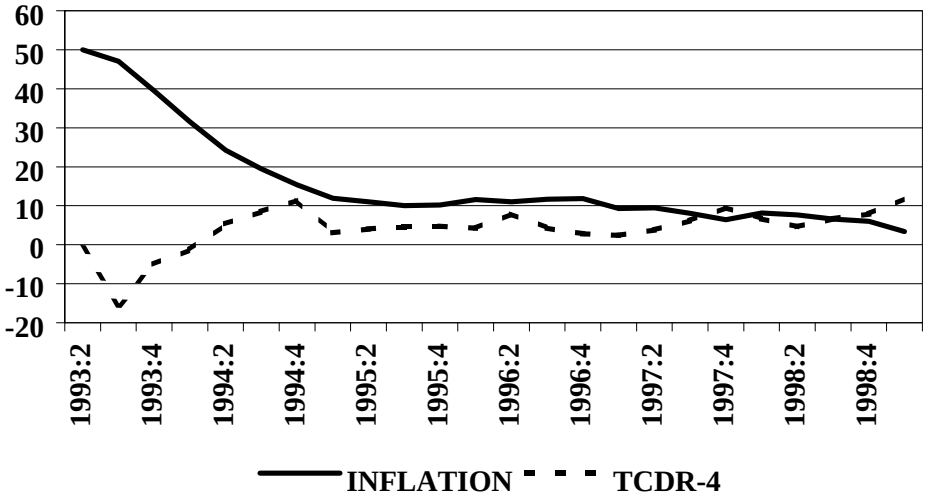
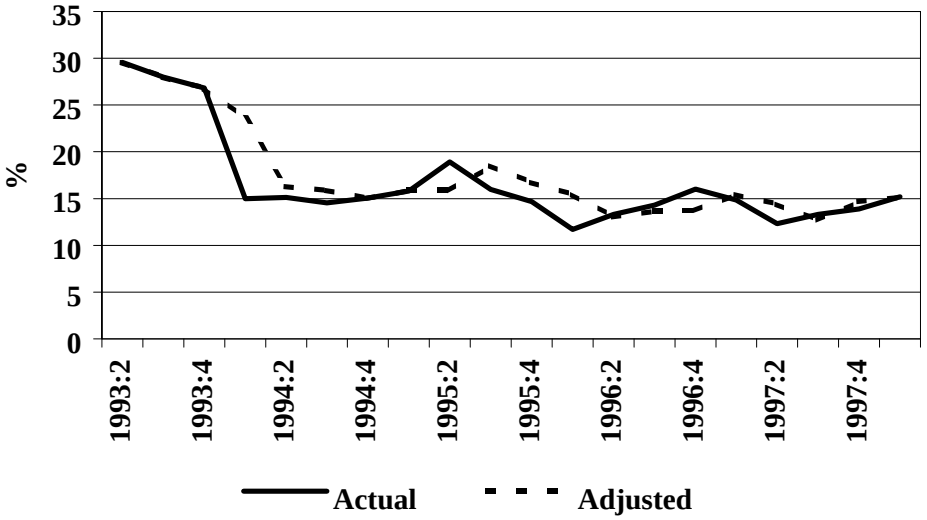


Figure 14: Actual and Fitted Nominal Interest Rates in Peru



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