

# The Colombian Monetary Policy Experience: Attempts at Disinflation, 1990-2002

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## Introduction

This essay provides an in-depth analysis of the way the Colombian Central Bank has conducted monetary policy since the early nineties. There are several reasons why Colombia is an interesting case study. For most of the past three decades, Colombia has maintained a fairly high inflation rate, averaging 24.9% between 1975 and 1992 (see Fig. 1). Economic reforms were implemented in 1991, and from that point on the country followed a process of disinflation that led to the current inflation level of 6-7%. While most Latin American economies were able to stabilize their inflation at low levels in a matter of months or a few years, Colombia took some thirteen years and is still struggling to maintain the lower rates amid changes in policy and in the economic conditions of the country. Implicit in the uniqueness of the Colombian example are two fundamentally interesting questions: first, what factors were most influential in driving down inflation; and second, why did it take so long?

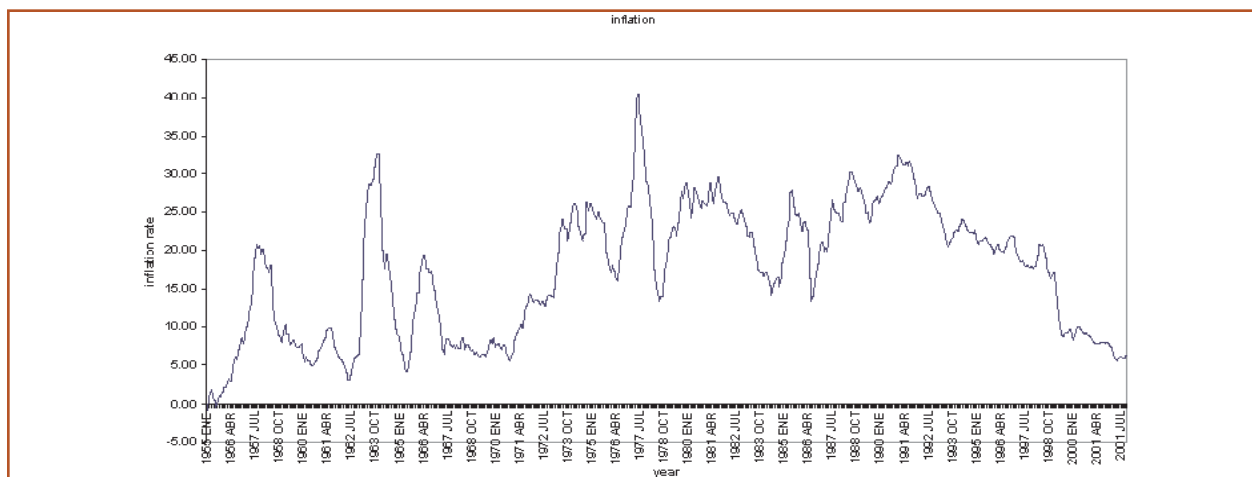


Figure 1. Rate of Colombian inflation (in percentages, left), 1955-2001.

A convincing answer to these questions must take into account several factors. The conduct of fiscal policy has a very important role in determining prices: a spendthrift government is more likely to fuel inflation, or to counteract disinflation, than a fiscally responsible one. Monetary policy also affects inflation by means of complex transmission mechanisms. Furthermore, the structure of the economy must also be taken into consideration. Nominal rigidities such as varying degrees of wage indexation or of union power in wage setting can effectively impede a smooth transition to low inflation even under the presence of strict fiscal policy and brilliant monetary management. Psychology as well must be included in the answer, given that consumer assumptions and expectations can drive rates of inflation in either direction or can keep them static even in the face of shifting economic conditions.

It is not the objective of this analysis to go over each and every one of the elusive parts contributing to the broader answer. Instead, this work focuses exclusively on the role of monetary policy, in the belief that it plays the leading role in affecting prices. This is particularly true in Colombia, where a primary mission of the Central Bank has been to fight inflation.

This essay assesses the Colombian Central Bank's actions in light of its mission of stabilizing prices. It will show that the Bank has maintained a policy that on average is conducive to lower prices, and that the disinflation of the nineties is in many respects the positive outcome of such policies. However, I will also suggest that, although this policy has been mildly successful, its effectiveness is ultimately hampered by the fact that it is a patchwork of different approaches and strategies with limited overall coherence. In particular, I contend that the conduct of monetary policy in the early 1990s was more hawkish against inflation than it has been in the last few years. This claim might come as a surprise, given that it is often suggested that the Colombian Central Bank seriously undertook inflation targeting only after 1999, when exchange rate constraints were eliminated. It might also seem to run counter to the facts, since the bulk of disinflation took place after 1999. Nevertheless, this idea may not be so far-fetched when we consider two facts: first, that the exchange rate peg and crawling band often worked as an implicit inflation target for most of the nineties, and, second, that the expansionary policies of the last five years can be defended on the grounds of hastening a recovery from the terrible 1999 recession, which may well be the true cause of the sudden disinflation.

## Theoretical Underpinnings

### INFLATION

Until a few decades ago, inflation was deemed to be a necessary evil. Keynesian theories of price stickiness and empirical analysis of the relation between inflation and unemployment showed that nominal changes—for example, growth in money supply—had a real effect on the economy. It was widely believed that there was a tradeoff, also known as the Phillips curve, between the level of inflation and economic growth. Eager to exploit such a tradeoff, many governments around the world pursued expansionary monetary policies designed to increase inflation rates and promote high economic growth. These policies were widely favored in Central and South America as well; already in the sixties many countries, including Colombia, were experiencing the dual acceleration of prices and growth.

The positive relationship between inflation and economic growth, however, proved to be short-lived; the seventies and the eighties left most countries with high inflation rates and sluggish growth. The so-called monetarists, led by Lucas, were able to prove that rationality of the agents in the economy could explain the breakdown of the Phillips curve. Lucas's critique led to the important theoretical conclusion that an increase in the money supply caused by expansionary monetary policies has a dual effect on the economy. First, it causes a permanent increase in prices; second, it causes a temporary economic expansion, soon replaced by a return to the steady state of the economy. It directly follows from this

conclusion that monetary policy in the long run has no effect on output but leaves its permanent mark on the inflation rate.

Once the party caused by inflation's short-term benefits to the economy was over, policymakers were left with the broken dishes. Inflation has many liabilities, as explained by Bernanke, Laubach, Mishkin and Posen (1999). In their book *Inflation Targeting*, they offer several reasons why even moderate levels of inflation can be harmful for an economy, and why countries experiencing high inflation usually experience poor economic performance. In periods of high inflation, the purchasing power of money falls steadily, forcing people to hold less cash. Often this means a smaller money demand and an overextension of the financial system as people use checks and other financial transactions more often than simple cash transactions.<sup>1</sup> High inflation is also a central cause of uncertainty in an economy, and thus a source of market inefficiency. For example, it may be responsible for the poor functioning of product and labor markets, as prices lose their meaning and people find it difficult to assess what constitutes a "fair price" for merchandise or for services. More compelling to the case of Colombia, inflation has grave distributional effects; higher inflation can erode savings of the middle classes if the savings are kept in low-yielding current accounts. Whereas wealthier and more educated households may be able to avoid those costs by employing somewhat complicated financial tools, many people belonging to the lower classes or living in rural areas lack either the knowledge or the access to those tools and are unable to maintain the purchasing power of their savings. Under those circumstances, inflation acts like a regressive tax that hits those at the bottom of the economic ladder the hardest.

One way governments have sheltered their constituents from these unwanted consequences is by indexing prices—especially wages—to inflation. Colombia in particular has employed indexation widely throughout its economy, from wages to prices of selected commodities. Nonetheless, no indexation is widespread enough to truly counterbalance the effects of the inflation "tax." In particular, the tax system is never fully indexed, and thus inflation erodes a key component of government revenues. Perhaps more importantly, wage indexation does not necessarily apply to the informal sector, which is problematic for a country like Colombia where the informal economy is large.

This analysis is not the right place to discuss the merits of these arguments, in particular of the view that low inflation is preferable because it increases the efficiency of the economy and therefore allows for faster economic growth. It is worth noticing that, in the words of Bernanke *et al* (1999), "obtaining direct empirical confirmation of a link between inflation and the overall economic performance of the economy is very difficult." Sarel (1996) found that negative effects increase sharply at higher rates of inflation but are not significant at rates of inflation below 8% or so; other research points out that most of the costs associated with high inflation are derived from the greater unpredictability of price changes associated with inflation (Judson and Orphanides, 1996; Hutchison and Walsh, 1996). In any case, early estimates of a growth effect caused by Colombian disinflation suggest that decreasing inflation by 10% would increase the long-term rate of growth by 0.5% (Uribe, 1994).<sup>2</sup>

#### THE ROLE OF THE CENTRAL BANK

It is safe to conclude that central banks ultimately are unable to provide for long-term economic growth, and that their usefulness is limited in the long run to the control of inflation. The proviso *in the long run* needs to be stressed. Central banks have a very important role in stabilizing the economic cycle. Expansionary monetary policy does help the economy to exit a recession faster and less painfully. But these short-term benefits must be weighted against long-term effects, where expansionary pushes invariably lead to accelerating prices and where growth is not determined by central bank actions.

Experience shows that often times this balance is not maintained. The pressure to obtain short-term gains while disregarding the potential for long-term losses has been so widespread that economists talk

of an endemic *inflation bias* among central banks. This bias is dynamically inefficient, and therefore it needs to be corrected in one way or another. The literature on this subject is very large, and discussion on the best measures needed to effectively manage central banking is vigorously ongoing. In this discussion I will focus on two solutions that have been quite popular among economists and Colombian policymakers.

The first solution is based on the assumption that, in order to reduce the risk of inflation bias, the central bank needs on the one hand to be alleviated from the pressures coming from groups interested in short-term solutions, and on the other to have a stronger incentive to focus on the long run. One way to achieve the first objective is to induce the government to relinquish its control over monetary policy, and to set up a body—a central bank—with the capacity and the independence necessary to control this side of policy. This step is necessary because the government is often too dependent on the political cycle. Elections are won if the ruling party has brought prosperity to the country, and prosperity can often be achieved (for a short period of time) with a monetary expansion. An independent central bank, free from the political cycle, is thus more likely to be free from inflation bias; furthermore, its policies will be viewed with greater confidence and the bank itself will gain greater credibility. However, this is just one of many issues that have been (and still are) fiercely debated. For example, a former Vice Chairman of the Federal Reserve claimed, “I do not know a shred of evidence that supports [the credibility hypothesis]. ...[T]he available evidence does not suggest that more independent central banks are rewarded with more favorable short-run trade-offs” (Blinder, 1998). Another issue that is vigorously debated involves the conditions that define *independence* for a central bank. According to Blinder (1998), *independence* means two things: that the bank is free to pursue its goals, and that its decisions are not easily overturned by any branch of the government. The benefits of an independent central bank have been analyzed in the literature, suggesting through econometric analysis that the more independent a central bank is, the lower the inflation rate. Other theories suggest that disinflation is less costly when pursued by an independent institution.

The second solution to inflation bias is that a central bank openly aligns its monetary policy with the long-term goal of price stability. Inflation targeting has received considerable attention as a tool to assist a central bank in reaching this goal. By publicly declaring a certain target for the inflation rate, the central bank exposes itself to criticism in case of failure, and therefore enforces discipline while at the same time improving communication between policymakers and the public (Bernanke *et al*, 1999). Setting targets for the inflation rate may also lower costs as the bank pursues its deflationary policies, and may therefore be well suited to countries that are searching for ways to reduce inflation and build up credible monetary institutions.

## The Case of Colombia

### THE COLOMBIAN DISINFLATION PROGRAM

Although I indicated earlier that Colombia suffered from high inflation for several decades, it should be said that its neighbors have been in far worse shape. Before the 1990s, Brazil had gone through four unsuccessful disinflation programs and had even had spurts of hyperinflation; Argentina was suffering political and social turmoil caused in part by accelerating prices; Bolivia was coping with the worse recession and the highest hyperinflation since those that plagued the German Weimar Republic in the 1920s; and Peru, Venezuela, and Ecuador were also battling high inflation. With an inflation rate of 22-23% per year, Colombia in comparison looked like an island of stability. However, as the nineties progressed the average inflation rate in the region fell dramatically, to the point at which Colombia became one of the highest inflation economies in Latin America (see Fig. 1). In 1991, with an unprecedented push to liber-

alize the economy came also a new commitment to fight an annual inflation rate that had been stuck in the low 20% range for the previous two decades (Clavijo, 2000).

The fight for lower inflation and a more effective monetary policy was included in a far reaching constitutional reform, which incorporated several important provisions aimed at strengthening the credibility of the *Banco de la República*, the Colombian Central Bank. At the time of the reform, the Central Bank was still an integral part of the government, its functions limited to easing macroeconomic policy (Gomez, Uribe and Vargas, 2002). According to the *Banco de la República* website, before the 1991 reform the members of the monetary directorate (*Junta Monetaria*) were also ministers and functionaries in the executive branch (<http://www.banrep.gov.co/banco/histor4c.htm>). Provisions in the 1991 constitution were intended to increase the independence of the *Banco de la República*. It separated the *Banco* from the executive branch and established an independent board of directors (*Junta Directiva*) composed of seven members: a General Director, the Minister of the Economy, and five additional board members. This arrangement sought to guarantee freedom from political pressure (<http://www.banrep.gov.co/banco/histor4d.htm>), even though it will be shown that the end result did not live up to expectations. Perhaps of equal importance, the Bank was given an unequivocal new function from the constitution: "The State, through the Banco de la República, must preserve the purchasing power of the currency." In September 1991, the Central Bank for the first time chose an inflation target of 19.9%. In 1992, Law 32 further clarified that the Bank's responsibility was to stabilize prices and that it must adopt an inflation target that was lower than the observed inflation (Gomez, 2002).

Despite the liberal economic reforms, the new constitution forced new spending from the government, and throughout the nineties the government sustained large deficits that raised its share of spending from 24.4% of GDP in 1990 to 34.8% ten years later (Gomez, Uribe and Vargas, 2002). Such deficits were financed with higher taxes, privatization of government services, and a ballooning debt, conditions that pressured the Central Bank into maintaining low interest rates in order to ease government finances—even when those rates were inconsistent with inflationary objectives.

The lack of support by policymakers for deflationary policies that would hurt government finances was accompanied by a similar lack of enthusiasm from the public. The (arguably) mild Colombian inflation had been remarkably stable, and Colombians were used to it. Widespread wage indexation, both formal and informal, maintained the purchasing power of most citizens. In addition, the costs of disinflation were considered by most to be excessive, and there was little support to institute a disinflationary program, which needs to have widespread support and credibility if it is to succeed. Since both of these prerequisites were absent, any disinflation program would have been a very costly affair.

Perhaps one reason why the *Banco de la República* suffered from low credibility has to do with its institutional structure. Because the independent *Junta Directiva* includes the Minister of the Economy, it is subject to some degree of executive interference. Even the *Junta's* current General Director, Miguel Urrutia, admits that the Minister of the Economy holds a certain power over the Bank's decisions: "[I]f the Minister of the Economy strongly opposes a measure agreed [to] by the majority, the board generally reconsiders the issue, because obviously if [he] publicly declares his disagreement, public controversy and uncertainty in the markets may develop" (Urrutia, 1999).

It comes at no surprise, then, that despite being one of the first countries to make public its target inflation rate, Colombia failed to meet its targets for quite some time. As we can see in Figure 2, inflation did not reach the targeted rate for several years, until 1994. In 1996, the Central Bank missed its objective by 4.6%, but that result was not attributed to a grave policy error (Gomez, Uribe and Vargas, 2002). In fact, reaching the target inflation was not yet the overriding objective of the Bank; rather than inflation targets comprising one part of a more comprehensive program to lower inflation, they instead were being used simply for macroeconomic programming.

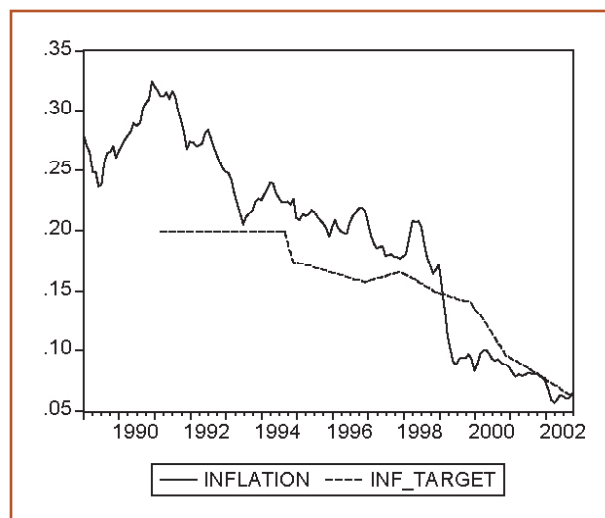


Figure 2. Inflation rates and inflation targets, 1989-2002.

#### MONETARY POLICY STRATEGY

In contrast to Colombia, Brazil and Bolivia were able to complete the disinflation process in a matter of months. As I have argued, the costs of such sudden and decisive disinflation would have been very high in the case of Colombia. To avoid those costs, policymakers chose to use intermediate inflation targets instead of an ultimate inflation target, in order to spread the costs over a longer period of time. Only in January of 2001 did the Bank finally choose an ultimate inflation target of 3%, a rate that the Board must have deemed would be low enough to minimize the costs traditionally associated with inflation (high transaction costs, high uncertainty, erosion of purchasing power) but high enough to allow for expansionary monetary policy during recessions.

The strategies adopted to reach these goals varied over time and had different degrees of success. Initially, the policy strategy had three “anchors.” The first and most important one was the inflation target discussed above. The second anchor was intermediate monetary targets, and the third was the exchange rate.

The coexistence of both monetary base corridors and exchange rate crawling bands was often problematic, and the *Banco de la República* had no clear policy in regard to the ranking between the two. Gomez, Uribe and Vargas (2002) state in a recent internal analysis, “[A]t some point it was announced that, in case of conflict, the highest priority would be given to the monetary targets.” However, in its 1998 briefing to Congress, the Bank admitted that “under certain circumstances there can be a conflict between the fulfillment of the crawling band and the corridor of the monetary base. Under these circumstances this last one can be temporarily sacrificed with the objective of preserving exchange rate stability, just as it happened in 1998” (qtd. in Clavijo, 2000, p. 22).

It is then possible to say that “the big movements in interest rates pursued different objectives at different times” (Gomez and Julio, 2000), and that the strategy of the *Banco de la República* is therefore reminiscent of that employed by the European Central Bank, which, although widely believed to use interest rate targeting, in reality stresses the importance of monetary bases.

### Estimating a Policy Rule for Colombia

#### THE MEANING OF A MONETARY POLICY RULE

The discussion above raises the question of whether Colombia is an inflation-targeting country—that is, whether it conducts monetary policy based on an inflation-targeting framework. With the aid of a policy rule, we can determine an initial answer to the question. We can establish whether the Board of Directors’ decisions can be represented by a single equation, which economists call a *reaction function* or *policy rule*. This equation assumes that the Central Bank, on average, behaves according to a rule. That is, it chooses the interest rate (which it controls) in response to changes in other economic variables such as output, prices and exchange rates, among others (Taylor, 1999). Under specific circumstances that will be tested later, a policy rule works as an “automatic stabilizer” for inflation around its target: if inflation deviates from the target, the Central Bank acts in ways designed to return the rate to its target.

It is important to remember that the assumption that the Central Bank behaves according to a rule is theoretical, since policymakers generally have discretionary powers for their policy choices and respond to external factors not included in the rule. In Colombia's case, policy has been changing as Central Bank objectives, goals and pressures have shifted through time, and therefore the assumption of a time-invariant rule does not accord with actual practice. Nonetheless, the reaction function can be employed to uncover whether *on average* the Central Bank, given its policy objectives and changing goals, behaved in a way that ensured disinflation. We can also mitigate against the effects resulting from the assumption of a changeless rule by considering the possibility that, at some point in time (to be determined within the model), the rule *did* change in a significant way. We can then analyze two different sub-periods and gain some additional insight into the Central Bank's policy stances.

#### THE MODEL

The rationale behind the rule is that, based on information obtained about inflation rate and the overall performance of the economy (summarized by figures on the output gap), the Central Bank chooses a short-term interest rate consistent with the targeted inflation rate and potential output. A very simple formula for this type of rule was first suggested by John Taylor (1993) in his seminal work, and therefore is called the *present-looking Taylor rule*. It takes the following form:

$$r_t^* = \bar{r} + \beta (\pi_t - \pi_t^*) + \gamma(y_t - y_t^*) + \varepsilon_t \quad (1)$$

where  $r^*$  is the interest rate target,  $\bar{r}$  is the long run equilibrium nominal rate,  $\pi_t$  is the inflation rate,  $\pi_t$  and  $\pi^*$  are the inflation and the target inflation rates, and  $y_t$  and  $y_t^*$  are output and potential output, respectively. Note that  $(y_t - y_t^*)$  is, then, the output gap. Note also that the interest rate rule depends only on the output and inflation gaps, a direct consequence of the assumption that the Central Bank operates by a quadratic loss function that has inflation and output gap as its terms.<sup>3</sup>

The analysis of this rule involves looking at two critical values for the  $\beta$  and  $\gamma$  coefficients. A 1% deviation of inflation from its target will prompt the Central Bank to change the interest rate by  $\beta$ ; a similar change in output will also change the interest rate by  $\gamma$ . In particular, we are looking for evidence that  $\beta > 1$  and that  $\gamma > 0$ . A  $\beta$  lower than one is a sign that the policy is ineffective in fighting inflation and that the Central Bank may not be employing an inflation-targeting regime. On the other hand, a positive  $\gamma$  indicates that the Central Bank is concerned with even short-term fluctuations in output and responds to them correctly—lowering interest rates when the economy is in a slump and raising them when it is experiencing a boom.

While John Taylor's model postulates that the Central Bank uses the latest information available on inflation, interest rates, and output to formulate policy, Clarida, Galí and Gertler (1998) hypothesize that the nature of decision-making is forward-looking, meaning that the Central Bank uses its best guess about the *future* run of economic variables to choose the optimal policy. In their study of the behavior of G7 central banks, they postulate a forward-looking model of the form:

$$r_t^* = \bar{r} + \beta(E[\pi_{t+n} | I \Omega_t] - \pi_{t+n}^*) + \gamma(E[y_{t+n} | I \Omega_t] - y_{t+n}^*) \quad (2)$$

where the interest rate at time  $t$  depends on the expected inflation and output gaps at time  $t+n$ , conditional on the information available at time  $t$ .

Using model (2) and introducing an interest rate partial adjustment mechanism, Clarida, Galí and Gertler (1998) estimate the following equation:

$$r_t = (1 - \rho) \bar{r} + (1 - \rho) \beta (\pi_{t+n} - \pi_{t+n}^*) + (1 - \rho) \gamma (y_{t+n} - y_{t+n}^*) + \rho r_{t-1} + \varepsilon_t \quad (3)$$

The expected values have been substituted with the realized inflation and output gaps; the error term  $\varepsilon_t$  is a linear combination of the forecast errors and an exogenous disturbance  $v_t$ .

$$\varepsilon_t = - (1 - \nu) \{ \beta (E[\pi_{t+n} | I \Omega_t] - \pi_{t+n}^*) + \gamma (E[y_{t+n} | I \Omega_t] - y_{t+n}^*) \} + v_t \quad (4)$$

The Central Bank in this model is forward-looking: it looks at predictions about future inflation and future output gaps to choose the current optimal interest rate. It has been argued that the forward-looking assumption is a necessary condition for a rational, inflation-targeting Central Bank (Svensson, 1996, 1997; Bernanke and Woodford, 1997). However, it is not wise to completely rule out a present-looking rule; for example, Taylor (1993) has shown that a present-looking rule for the United States closely follows the Fed Funds rate quite closely,<sup>4</sup> and is therefore rich in hindsight. In this essay, I will show that the present-looking analysis replicates the key findings of the forward-looking rule, but it has the added advantage of being robust to changes in specification.

#### THE VARIABLES

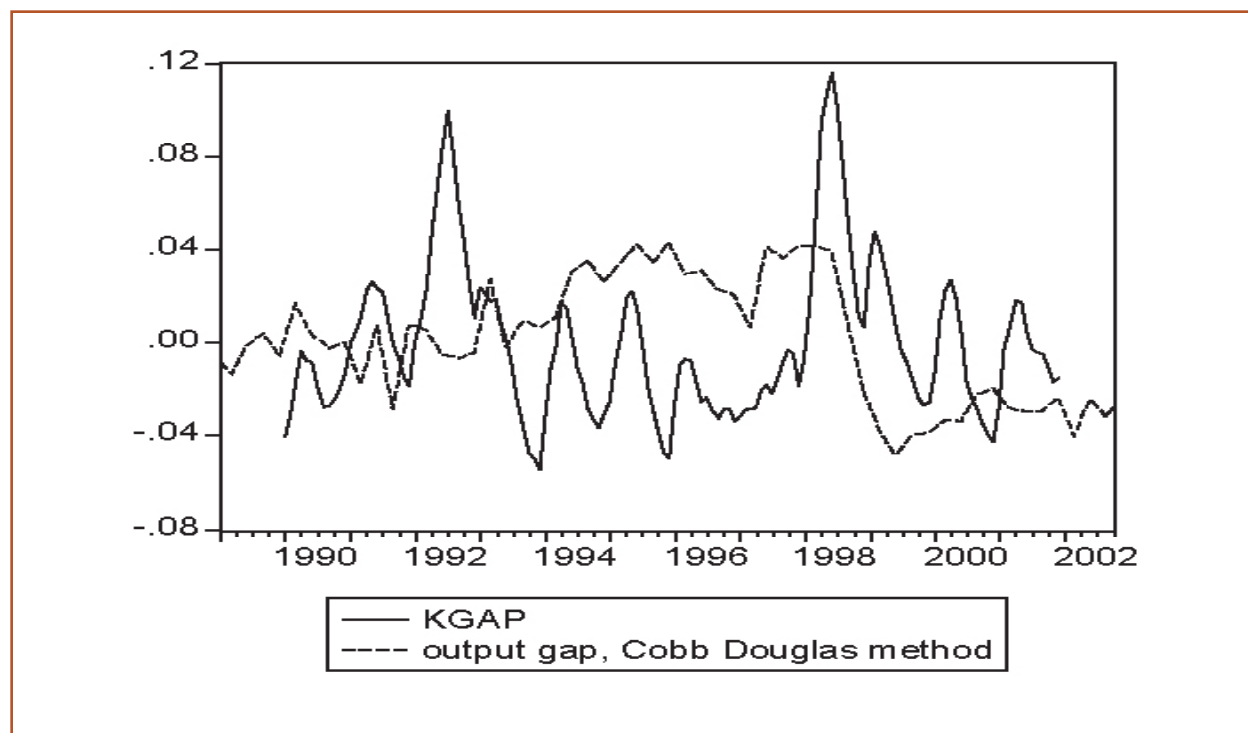
Before we examine the actual estimate based on the model, it is important to look at the data employed. Choosing a certain data series over another has important consequences; foremost among these is that it could lead to biased and inconsistent estimators and invalid confidence intervals. For this analysis, I obtained and am using the same data series employed by the *Banco de la República* in its research and policy-making.

**The interbank interest rate.** The interbank rate regulates the market for overnight loans between banks and financial institutions. In line with the available research on monetary policy rules, I am assuming for the purposes of this analysis that the Central Bank has perfect control over this rate, and uses it to expand and contract the liquidity in the financial markets. Through the yield curve and other complex transmission mechanisms, this change in short-term liquidity reaches the real economy, thereby bringing changes in inflation and output.

**The inflation rate.** The inflation rate that this analysis considers represents core inflation, defined as the level of inflation of all goods excluding food. The important exclusion of food from the CPI of reference is problematic: like most people living in developing nations, Colombians spend a large share on food—a hefty 30% of the Colombian CPI basket (Gomez and Julio, 2000). However, since food inflation is random, and since I am using the same data that the Bank uses, the exclusion is not as important for policy formulations.

**The output gap.** The output gap provides a helpful measure of the deviations of output from its potential; potential output generally refers to the level of real GDP (or, for a growing economy, the level of growth of GDP) that allows for a constant inflation level and a constant unemployment rate. Deviations of real GDP from its potential will either increase inflation and decrease unemployment, or decrease inflation at the cost of higher unemployment. Thus, the gap provides a useful tool in determining whether the economy is growing too quickly or too slowly.

Observing the behavior of GDP is not a terribly difficult exercise, since it is generally computed every quarter.<sup>5</sup> However, because potential output can not be observed, it needs to be derived. The *Banco de la República* employs two methods to do so. The first, the Cobb Douglas method, assumes that the economy behaves like a Cobb Douglas production function (see Gomez, Uribe, and Vargas, 2002 for a detailed description of the derivation of the gap). The second, which the Bank's researchers began em-



**Figure 3. Output gap, quadratic trend and Cobb Douglas method.**

ploying in addition to Cobb Douglas in the mid-nineties, is called the Kalman method. Because the use of a Kalman trend does not have significant effects on the estimation of the rule—in particular, it does not change the value of the coefficients—the results in this analysis are based on the Cobb Douglas method (see Fig. 3).

One problem that arises in utilizing the Cobb Douglas structural gap is the frequency of the series. The model assumed employs monthly data, but the gap is available only in quarterly frequency. In order to obtain monthly figures I have linearly interpolated the data; this manipulation is legitimate under the assumption that the output gap does not change significantly from one month to the next.

There are other ways to compute an output gap on a monthly basis; for example, most researchers use the monthly industrial production index (IPI) as a proxy for the GDP.<sup>6</sup> The output gap can then be approximated by the deviations of the log of IPI from the estimated quadratic trend. This method has been employed by Clarida, Galí and Gertler (1998) to measure the gap for the six countries in their study; it has also been used in estimations of policy rules in Mexico and Colombia (“Monetary Policy Rules”; Bernal, 2002). The use of the quadratic trend is justified in the American case by the close relationship with the structural trend developed by the Department of Commerce and by the length of the IPI index, which spans 60 years of economic activity. Use of the IPI in the case of Colombia, however, would be ill-advised. The IPI began to be reported in 1990, and thus it barely covers one Colombian business cycle. The quadratic trend shows itself to be wholly inadequate. The output gap computed using the trend is not even capable of highlighting the profound 1999 recession. Any estimates obtained using this tool would therefore be biased and inconsistent and, as demonstrated in the estimations of policy rules done by Bernal (2002), would likely portray a completely different picture than what is shown here.

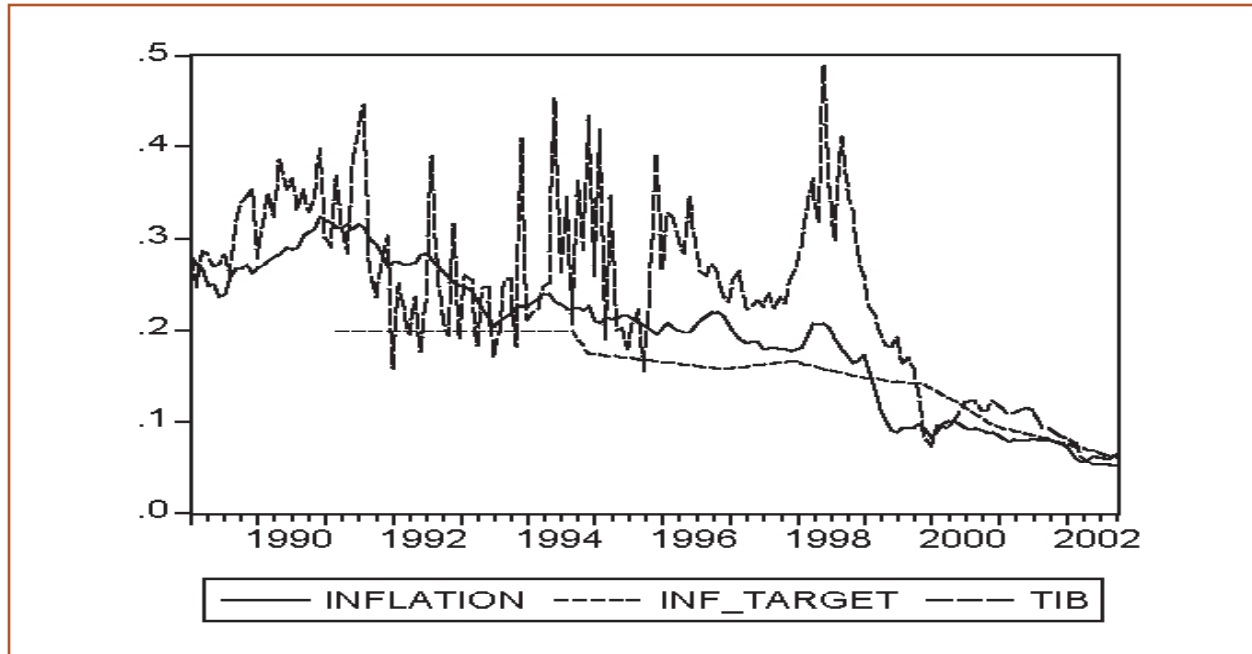


Figure 4. Inflation, inflation target, interest rates.

#### THE EMPIRICAL EVIDENCE

Examining the inflation and interest rates in Figure 4 reveals some interesting patterns. We can observe that until 1995 the interest rate shows a particularly erratic behavior around the inflation rate. In some years (e.g., in 1990) the interest rate remains above the inflation rate, which means that the real rate is positive. During other periods the interest rate is below the inflation rate, thus implying a negative real rate. It is clear that during this period the real rate, on average, remains very low, raising the possibility that until 1995 the central bank was involved in a prolonged expansionary policy. In 1995, beginning with a 150% rise in interest rates between October and December, the pattern changes drastically. From that date until the last couple of years in the sample the interest rate remains significantly above the inflation rate. The positive real rates suggest that the *Banco de la República*, perhaps aiming to reduce the inflation rate, imposed a tighter control on its supply of liquidity. Based solely on this graph, however, we cannot conclude that there has been a change in policy. Higher real rates might also have resulted from a heated economy that was producing above its potential output. The role of the output gap in the selection of the optimal rate might further explain why real rates fall in 1999 and at some point in the latter part of the graph even turn negative. In order to truly understand the behavior of the *Banco de la República* we then need to turn to the estimate of the model, in both its present and forward-looking models.

#### THE PRESENT-LOOKING TAYLOR RULE

The present-looking Taylor rule has been estimated using ordinary least squares. Table 1 summarizes the estimated output.<sup>7</sup>

The table shows that the coefficients for  $\beta$  and  $\gamma$  behave as expected, with values of 1.09 and 1.56, respectively. The result suggests that the Colombian Central Bank has generally enforced its inflation

**Table 1. Present-looking Taylor rule.**

$\beta$	$\gamma$	$\rho_1$	$\rho_2$	$R^2$
1.09	1.56	0.24	0.42	0.70
(0.16)	(0.214)	(0.07)	(0.07)	

targets by raising the interest rates just enough to offset inflationary pressures. However, because the Wald test rejects the hypothesis that  $\beta$  is statistically different from 1, we cannot confirm that the bank was 'soft.'

Not surprisingly, the *Banco de la República* seems very concerned with output movements. The  $\gamma$  coefficient of 1.56 translates into the interest rate falling 1.56 percentage points for every point fall in the output gap, a ratio that is fairly large compared with the more modest values found in G7 economies. Clearly, the *Banco de la República* is not as conservative as the *Bundertsbank* or the Federal Reserve; however, as mentioned above, there is not a right or wrong value of  $\gamma$ , and the high value of this coefficient can be explained by the status of Colombia as a developing country.

#### FORWARD-LOOKING ANALYSIS

The forward-looking analysis presents several technical challenges that are absent in the present-looking analysis. In order to provide an estimate of a forward-looking rule, equation (3) would need to use the same forecasts that were available to the Bank on the expected output gap and expected inflation. Unfortunately, this information is not available. In order to overcome such a difficulty, Clarida, Gali and Gertler (1998) estimate the forward rule with the Generalized Method of Moments (GMM). The baseline GMM model uses an instrument set  $\mathbf{u}_t$  that includes lagged values of the output gap, inflation and interest rates—all information known to the Central Bank when making policy decisions. The GMM then employs the instrument set to create empirical forecasts of inflation and output, keeping the interest rate exogenous. With these forecasts in hand, it is then possible to estimate a rule. The estimated rule derives again from equation (3), and appears as

$$r_t = (1 - \nu) \bar{r} + (1 - \rho) \beta (\pi_{t+n} - \pi_{t+n}^*) + (1 - \nu) \gamma (y_{t+n} - y_{t+n}^*) + \rho_1 r_{t-1} + \rho_2 r_{t-2} + \varepsilon_t \quad (5)$$

where an extra lag of the interest rate has been added to correct for autocorrelation. Before proceeding to the estimate, the horizon of the inflation and output forecast must be specified, or, in other words,  $n$  must be assigned a value. The forecast horizon employed by the *Banco de la República* is unknown, but an educated guess is that it ranges from one quarter to one year ahead. Clarida, Gali and Gertler (1998) suggest that central banks generally are more likely to employ a one year horizon; in any case, results for  $n = 3, 6, 9$  and  $12$  (where  $n$  is defined in months out of the year, and thus, the estimation is conducted quarterly) are estimated and reported in Table 2.

Clearly, the results vary considerably. The  $\beta$  values range from 0.361 to 1.541, depending on the horizon chosen. Furthermore, an additional lag for the interest rate is needed to obtain non-autocorrelated results. Unfortunately, none of the values are robust to changes in the number of lags; therefore, we can't have confidence in the result because the values are too susceptible to the influence from the number of lags chosen.

**Table 2. GMM estimation,  $t$  periods ahead.<sup>8</sup>**

	$\beta$	$\gamma$	$\rho_1$	$\rho_2$	$J$ - statistic
$t=0$	0.361	1.717	0.362	0.418	0.11
$t=3$	0.884	1.517	0.491	0.362	0.10
$t=6$	1.080	1.122	0.348	0.492	0.11
$t=9$	1.019	1.275	0.412	0.431	0.11
$t=12$	1.541	0.862	0.337	0.474	0.12

This table exemplifies the problems of using GMM for these kinds of calculations. GMM is quite sensitive to changes in specifications of the model, a sensitivity that is problematic given that we know neither what the true model is nor whether the estimated forecasts are unbiased estimators of the true forecasts. Still, some observations are possible: if the *Banco* employs a forward-looking target, then it must employ a horizon that ranges between six months and one year, since for those horizons we obtain a  $\beta$  coefficient above one. Furthermore, the main result of the present-looking Taylor rule does not change: Wald tests confirm that the  $\beta$  coefficient is never statistically different from 1; thus the viewpoint about the “softness” of the central bank remains valid. With this reassurance, from this point forward I assume that the “true” model is a forward-looking Taylor rule with a year-long horizon.

## Further issues

### TESTING STRUCTURAL POLICY CHANGES

Perhaps the most striking element of the experience in Colombia has been the variability in monetary policy. As I argued earlier, Colombian policymakers have changed their stance on policy several times, quite often because their hands were forced either by external forces such as those resulting from international financial crises or by internal pressures coming from the executive branch. Figure 4 suggested that the Bank has become more focused in its task of securing low inflation as prescribed by the constitutional mandate; this possibility might lead us to believe that tougher standards were introduced in the mid-nineties. When I tested this hypothesis, to my initial surprise I reached an entirely different conclusion.

The Taylor rule presents itself as a handy tool to analyze changes in the stance of policymakers. The analysis uses a very simple procedure, in which the sample is divided into two sub-periods; a Chow test for structural changes is performed to test the hypothesis that the two sub-periods had two different rules; and then the two sub-periods are independently analyzed. Important care needs to be taken in choosing the date upon which the break is supposed to have happened. Ideally, we would know the specific date that marked the change in policy. If that is not possible, it would be helpful to have in mind several possibilities for that date, such as the date on which a new Minister of the Economy was introduced, or the date on which several members of the *Junta Directiva* were replaced, or perhaps more obviously the month in which the currency was allowed to float. Once these possibilities are identified, they can be tested with statistical processes and the best candidate can be chosen.<sup>9</sup>

Lacking the resources or the knowledge to avail ourselves of either of these two alternative meth-

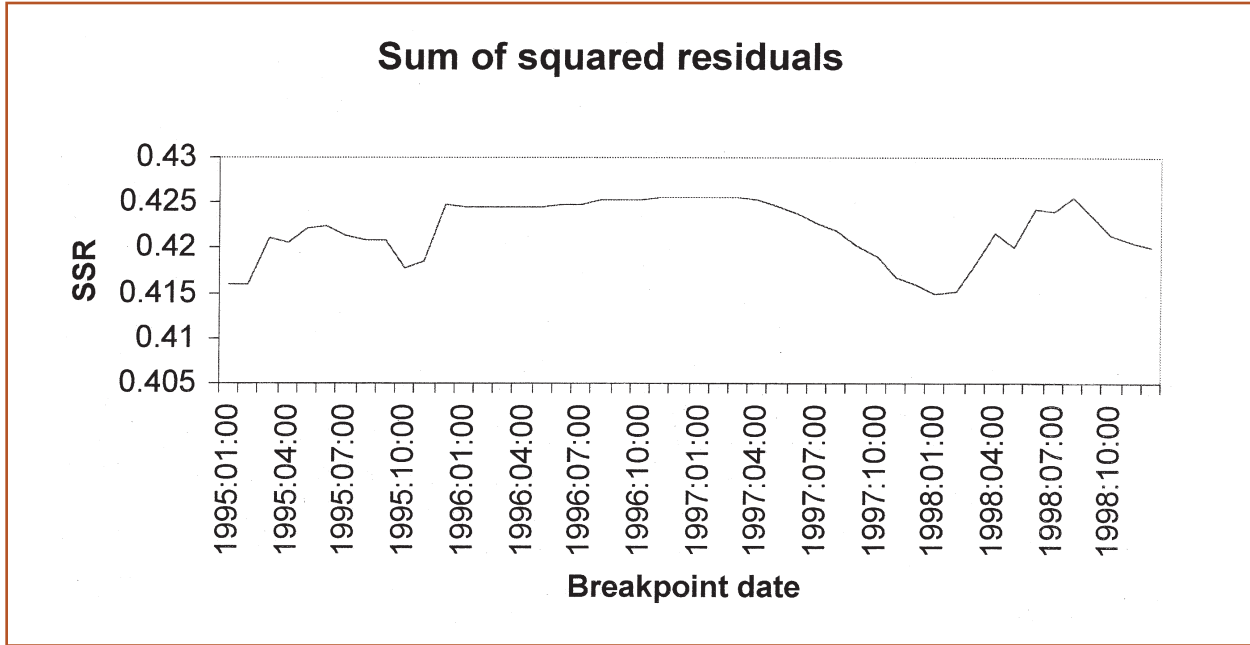


Figure 5. Sum of Squared Residuals for Regression 13.

Table 3. Estimation output for regression.		
	$\beta$	$\gamma$
Pre 1997:12	1.0556 (0.3665)	0.9804 (0.5339)
Post 1997:12	-1.4479 (0.270)	5.382 (0.3205)

ods, we can rely on a third option, which is to let the data guide the selection of the breakpoint.<sup>10</sup> In this case I considered every point between January 1995 and December 1998 as a possible candidate for the selection. The choice of the two endpoints was somewhat arbitrary, but included the years '96-97, which are the years, I would argue, where it is most likely that a break occurred. For each point, the following regression is estimated:

$$r^*_t = \bar{r} + \beta_1(\pi_t - \pi^*) + \beta_2 D(\pi_t - \pi^*) + \gamma_1(y_t - y_t^*) + \gamma_2 D(y_t - y_t^*) + v_t \tag{6}$$

where  $D$  is a dummy variable that takes the value of 0 if the observation falls before the breakpoint  $\tau$  and takes the value of 1 for every point after it ( $\tau \in (1995:01, 1998:12)$ ).

As an example, assume that we believe that a change in policy happened in March 1996. The above equation then will tell us that, before that date, the Central Bank reacted to inflation and output gap according to the estimated parameters  $\beta_1$  and  $\gamma_1$ . However, from that point on, the new policy of the Central Bank kicks in, and policymakers react according to the parameters  $\beta_1 + \beta_2$  and  $\gamma_1 + \gamma_2$ .

In order to determine the most likely point at which such an event took place, I have collected the sum of squared errors for each one of the 49 regressions conducted and organized them in Figure 5. The equation with the lowest sum of squared errors is the equation with the correct breaking point. Such a point falls in December of 1997, at a time of strong international turbulence and uncertainty.

The estimation output is shown in Table 3.

A Wald test shows that this point is significant, and allows us, with 99% confidence, to reject the null hypothesis that there is no break.

This estimation output tells an interesting story. Before the end of 1997, the Central Bank tried to maintain some sort of nominal anchor (even though the result is statistically very weak). In the mind of policymakers, inflation and output shared a similar weight.

However, this result changes dramatically after 1997. Inflation targets lose their importance (a negative value for  $\beta$  is counterintuitive, so we assume that  $\beta$  is zero). Instead, the importance given to the output gap grows disproportionately, ballooning to a  $\gamma$  above 5 points.

The result may seem counterintuitive. Serious disinflation took place only in the second part of the sample, a result that may seem inconsistent with loose monetary policy. Indeed, it is entirely possible that the Banco de la República shifted its focus away from inflation targeting in the past few years as a result of those same events. The contraction of the economy beginning in 1999 has been severe, and the country has not yet quite recovered from it. In light of these events, we can imagine that the excessively loose actions of the *Banco de la República* are a consequence of exceptional years of acute hardship and represent a clear attempt by the Bank to speed up the recovery, regardless of what the consequences for inflation may be.

If this interpretation is correct, then the estimated reaction function for the Central Bank since 1997 does not represent the “true” reaction function for Colombia; rather, it is representative of a particular period where extraordinary measures were taken in an effort to counteract extraordinary events. In order to truly gauge what the normal behavior of the *Banco* would be during normal times, we then should look at the reaction function estimated from the years 1991 to 1997. During this period, the Central Bank had a clear policy of inflation targeting, strictly enforced by the exchange rate band. It assumed that, once the situation returned to normalcy in Colombia and the country returned to the healthy growth rates of the past, it could then revert to its “usual” policies of strictly enforcing the inflation target. Obviously, the Bank is running a considerable risk by maintaining a very liquid market; inflationary expectations may rise before the recession ends, and Colombia may even return to a period of stagflation. This hypothetical scenario is strongly reminiscent of the American experience in the 1970s, when stop-go policies adopted by the Federal Reserve often fueled inflation to a point at which high interest rates had to be adopted and then subsequently lowered substantially in order to counteract the impending recession, to the point that neither low inflation nor high growth was achieved.

## Conclusion

Colombian monetary policy offers itself up to mixed reviews. Following the economic liberalization of the early 1990s, the Central Bank assumed a new leading role in the management of monetary policy. Free from direct interference from the government and other interest groups, policymakers at this institution were able to focus their attention on organizing a workable policy framework to address the task of disinflation. However, the Bank remained hampered both by indirect pressures from the government and by citizens' opposition to a costly disinflation. Furthermore, the *Banco de la República* maintained a set of policies and intermediate targets that ultimately conflicted, sometimes with each other and other times with the longer-term targets.

The reaction function then becomes a useful tool to analyze the net outcome of these different elements. In particular, it is helpful in addressing the issue of whether Colombia is, on average, targeting the inflation rate. The analysis of this function confirms that the Central Bank has enforced the inflation target as the nominal anchor for the economy. However, this conclusion is statistically weak, meaning that the Bank has been far from rigorous in its attempts. The first major objective of the *Banco de la República* has been to lower the inflation rate from the heights of the late eighties and early nineties to OECD levels of 3% per year; but the institution has proved to be in no hurry to reach such a result.

This analysis confirms that one of the Central Bank's strategies was to target the inflation rate by means of the exchange rate. Throughout the early nineties, the country maintained some sort of rigidity on the exchange market, first fixing the peso to a sliding peg, then allowing for ever-widening currency bands until the peso was allowed to free float in 1999. The reaction function shows that this exchange rate was also a nominal anchor for the economy, even though it proved to be quite weak and subject to changes when problems (such as speculative attacks) threatened its existence. Interestingly, as the Central Bank moved away from the exchange rate anchor, the inflation target lost importance and strength, even in a period during which these targets were finally being met. There are several possible explanations for such an occurrence. One is that the strong relationship between prices and the exchange rate caused the latter to behave like an implicit inflation target. Under this hypothesis, any effort put forward by the Central Bank to maintain the exchange rate within certain values was bound to have a secondary effect on the inflation rate, and therefore the toughness of the Bank's policies was a direct result of its obligations to meet daily objectives. Given the lack of attention in this analysis to this specific issue, this hypothesis will have to be tested in future research.

A second possible explanation for the weakening of the Central Bank's resolve to fight inflation comes from the weakness of the national economy and its fall into a grave recession in 1999. The recession was accompanied by a sudden increase in job losses, a negative turn of growth of GDP per capita, and a sudden slackness in aggregate demand. As demand fell, prices began to slow down significantly, and the process of disinflation gained a speed never before seen. Given this circumstance, it is possible to infer from the hardened conditions of the economy and the ease with which disinflation was achieved that policymakers shifted their worries from disinflation to the economy. This would explain why most interest rate movements focused more on aiding an ailing economy than on keeping inflation under check.

Regardless of the reasons that the current policies were adopted, it is clear that they are not sustainable. Inflationary pressures will build up, and expectations will rise once again—perhaps even before the effects of the recession have been worked out. If that comes to pass, it would be best for the *Banco de la República* to review its commitment to challenge inflationary forces before all the gains obtained at such a high cost disappear once again. The greatest task facing the Bank may be to find a way to keep inflation low now that it is so close to achieving its long-run target. . In order to do so, the Bank must realize that its current policies are not enough, and that it must seriously reconsider its objectives.

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## Notes

1. This problem may sound subtle until the case of Brazil is considered: during the period of high inflation in the eighties, Brazil cleared more than 7 billion checks per year, averaging 28 million every day—the same quantity that American Express would clear in its worldwide operations every month (Tullio and Ronci, 1996). The costs of such arrangements can thus be huge.
2. Note that the study was conducted in 1994, before the great recession of 1999; it may therefore overestimate the beneficial effects of lowering the inflation rate.
3. For purposes of brevity, the model presented here and its variations treat the exchange rate as exogenous. In the unabridged version of this paper, the exchange rate is shown to be significant and is included as part of the rule, even though its effect on policy is not large.
4. While the Fed does not have an institutional framework that forces it to adopt a target, the evidence put forth by Clarida, Galí and Gertler (1998) supports the view that it fiercely enforces an implicit target. The comparison is thus appropriate.
5. While GDP is observed quarterly in all OECD countries, this is not true for Colombia, where GDP is measured annually. The Banco de la República converts the annual measures into quarterly measures using statistical methods and other data observed in the economy throughout the year.
6. Apparently, some Colombian researchers have even employed output in the cement industry as a proxy for GDP.
7. I have slightly modified equation (3), including an extra lag to correct for autocorrelation. The Lagrange multiplier test rejects the hypothesis that the modified model is autocorrelated; the estimated coefficients are robust to zero, one or two lags.
8. The instrument set  $\mathbf{u}_t$  is defined as follows:  $\pi_{t-1}, \dots, \pi_{t-6}, \pi_{t-9}, \pi_{t-12}, Y_{t-1}, \dots, Y_{t-6}, Y_{t-9}, Y_{t-12}, \rho_{t-1}, \dots, \rho_{t-6}, \rho_{t-9}, \rho_{t-12}$ .
9. Finding a possible breakpoint is not too challenging in the case of Colombia. In particular, modifications of the exchange market are a direct consequence of changes in monetary policy. For example, the floating of the peso changed the policy of the Banco de la República, and therefore ought to be considered as a possible breaking point. Unfortunately, there are not enough observations to provide efficient estimates and valid hypothesis testing.
10. I thank Professor Oscar Jorda for suggesting the method followed here.

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