Monetary Reform Credibility: Some Evidence for Brazil

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RESUMO

O objetivo desse artigo é discutir a credibilidade de duas reformas de combate à inflação adotadas no Brasil: os Planos Cruzado e Collor. Assume-se que a origem do problema de credibilidade vem da interação entre as autoridades monetária e fiscal estabelecida pela restrição orçamentária intertemporal. Credibilidade é definida como a probabilidade subjetiva de que o governo está seguindo as políticas por ele anunciadas. Os resultados obtidos indicam que ambas as reformas monetárias encorajaram uma política para a autoridade monetária, que seria apropriada para um regime ricardiano, mas estabeleceram planos de impostos e gastos que seriam factíveis somente num regime de dominância fiscal. Tais políticas monetária e fiscal são, contudo, incompatíveis. Não é factível levar adiante ambas ao mesmo tempo e isso explica a baixa credibilidade global e, em última instância, o fracasso, das duas reformas econômicas.

PALAVRAS-CHAVE

credibilidade, restrição orçamentária do governo, probabilidade subjetiva, Planos Cruzado e Collor

ABSTRACT

This paper discusses the credibility of two disinflationary reforms adopted in Brazil, the Cruzado and Collor Plans. The source of the credibility problem is assumed to lie in the interaction between the monetary and fiscal authorities established by the government budget constraint. Credibility is defined as the subjective probability that the government is following the announced policies. The results obtained indicate that both monetary reforms encouraged a policy for the monetary authority that would be appropriate for a Ricardian regime but advocated plans for taxes and expenditures that could only be feasible under a fiscal dominance regime. Such monetary and fiscal policies are, however, incompatible. It is not feasible to carry out both at the same time, and this explains the overall low credibility, and ultimate failure, of these two economic reforms.

KEY WORDS

credibility, government budget constraint, subjective probability, Cruzado and Collor Plans

INTRODUCTION

In contemporary discussions of deflationary policies it is an accepted argument that the greater the credibility of the anti-inflationary program, the lower the costs associated with it in terms of output and employment.

The recent literature on monetary credibility has concentrated almost exclusively on the strategic interdependence of private individuals and centralized policymakers.[1] In a one-shot monetary game, where the policymaker and private agents are fully informed about each other's objectives and the state of the economy, the credibility issue arises because there is an incentive for policymakers to seek short-run gains by generating inflationary surprises. The problem is that rational, private agents understand this incentive and adjust the nominal wage contract so as to achieve the real wage they aimed at in the first place. As a consequence, when the government inflates, employment remains at its natural level. Therefore, the only result of the government's discretionary policy is a positive inflation rate.

The inflationary bias of monetary policy was termed "dynamic inconsistency" by Kydland and Prescott (1977). Dynamic inconsistency occurs when a policy that seemed optimal at the planning date is no longer considered optimal later on, even though no new information has been obtained during the period.

In repeated monetary policy games with perfect information a credible equilibrium is sutained by a "reputational" or "deterrence" mechanism operating through strategies that prevent the policymaker from producing the discretionary inflation rate.

For example, Barro and Gordon (1983a), (1983b) proposed a simple trigger mechanism: if the policymaker fails to achieve the expected inflation rate in the previous period, the private sector anticipates the discretionary outcome. On the other hand, if the policymaker is able to make previous inflation meet expectations, the private sector believes it will follow the announced rule in the period.[2] This implies that the policymaker must compare the temptation to inflate at the discretionary rate (equal to the difference in the current value of its objectives when it chooses the discretionary instead of the announced rate of inflation) with the expected value of welfare loss associated with the increase in the private sector's inflationary expectations (the enforcement).

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1   Very good surveys of the literature can be found in BLACKBURN & CHRISTENSEN (1989) and FISCHER (1990).

2   The capacity of these incentive schemes to prevent the policymaker from engaging in opportunistic behavior depends on the absolute value of the punishment, the length of the punishment period and the policymaker's rate of time preference (as the punishment only occurs in future periods, if the monetary authority discounts the future more heavily, the penalty is less important to him).

Monetary games with asymmetric information, where a player with superior information can misrepresent during a period in order to build a reputation and take advantage of it in the future, make a deeper conceptualization and understanding of credibility possible.

The first type of uncertainty is called intrinsic uncertainty and it relates to the fact that one of the players does not know the preferences of the other players in the game. Backus and Drifill (1985a), (1985b) and Barro (1990), formulated a model in which the policymaker can be of two types. Type 1 (hard or strong) is known for his aversion to inflation and Type 2 (soft or weak) is known for his temptation to produce unanticipated inflation. Since the private agents are unaware of which type is in command, Type 2 has an incentive to appear strong, at least initially, to discourage inflationary expectations. This occurs because, if high inflation is immediately observed, Type 2 reveals himself as weak and the discretionary outcome is observed for the rest of the game. On the other hand, if a Type 2 policymaker pretends to be a Type 1 by playing low inflation he can keep inflationary expectations low until he considers it worthwhile to inflate. Credibility (or reputation) is, then, a state variable that measures the private sector's subjective probability that the policymaker is strong, and is updated according to Bayes' rule.

Another model of asymmetric information was developed by Cukierman (1986, 1992). In this case, the private sector does not know the current state of the policymaker's objectives but can draw inferences about it from the past monetary growth rates.[3] These inferences, however, are noisy due to the fact that monetary growth reflects not only shifts in the policymaker's preferences but also transitory control errors, and that its control is imperfect.[4] This formulation, then, takes into account intrinsic and extrinsic uncertainty, the latter being related to imperfect information about the stochastic shocks that hit the economy. Since the private sector does not immediately notice a change in the policymaker's objectives due to its incapacity to distinguish persistent changes in objectives from transitory control errors, credibility here appears as the speed with which the private sector recognizes that a sustained shift in the policymaker's preference has occurred. It is represented by a parameter in opposition to a state variable. The worse the control of the money stock, the longer the time necessary for the public to recognize a change in the central bank's objectives, and the lower the credibility.

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3   As it is assumed to be a unique relationship between monetary growth rates and inflation rates, those who want to maintain the discussion in terms of choice of inflation rate can do so, as BLACKBURN & CHRISTENSEN (1989) did. We prefer to proceed using monetary growth as it was used in the original work.

4   CUKIERMAN (1992) also formulates a model in which the policymaker's incapacity to precisely control inflation results from imperfect information about the state of the money demand. The conclusions are similar to those described here. Although the two sources of imperfect control are evaluated separately, he observes that they may operate simultaneously in real economies.

Although considering a single institution or individual to be responsible for the conduct of economic policy can represent a convenient abstraction, it is particularly misleading when credibility problems are taken into account. It is well known that the government lifetime solvency requirement imposes strong restrictions on the viability of anti-inflationary programs. Therefore, the source of the credibility problem lies, in fact, in the interaction between the monetary and fiscal authorities established by the government's budget constraint.

The purpose of this paper is to obtain empirical estimates for the credibility of the Cruzado and Collor Plans based on this view, that is, assuming that the credibility of monetary policy is related to the coherence of the macroeconomic policy as a whole, and not just to monetary policy. According to Baxter (1985), credibility is defined as the private agent's subjective probability that an economic reform actually occurred. The public updates its probability concerning the government's commitment to the policy reform using Bayes' rule.[5] Since her methodology was developed for a fixed exchange rate regime, it applies directly to the Cruzado Plan. In order to apply the procedure to the Collor Plan, however, the feasibility conditions for a credible monetary reform must be extended to capture the main characteristics of a floating exchange rate regime.[6]

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5 There are only a few empirical works that test for credibility. The most commonly used procedure is the forecast error method. When applied to the Phillips curve, support for the credibility hypothesis is provided if an estimated Phillips curve for one policy regime overestimates the rate of inflation for a new policy regime characterized by less inflation. In other words, negative forecast errors indicate the presence of credibility effect. BLANCHARD (1984) estimated a Phillips curve for the United States during 1979-1983 and also made estimations using the term structure of interest rates. CHRISTENSEN (1987a, 1987b) estimated a Phillips curve for Denmark and considered the nominal interest rate determination respectively. CROUSHORE & KOOT (1991) created two credibility variables and used them to verify how the Phillips curve estimates obtained by Blanchard change. The first measure of credibility compares the Fed forecasts of inflation and private sector's forecast, and the second one compares the Fed forecasts and actual inflation. These measures, then, capture respectively whether the public believes that the announced policy will in fact be implemented and if it will have the expected effect. AGENOR & TAYLOR (1992) argued that the parallel market premium is the adequate measure of credibility because it is sensitive to market expectations regarding economic policy. When private agents are suspicious about a disinflationary policy, they switch to foreign-denominated assets in order to avoid the inflation tax that is expected to occur given an anticipation of another inflationary surge. For a fixed supply of foreign assets, and other things kept equal, the parallel market exchange rate should depreciate, and the premium rise. Therefore the part of the parallel premium that cannot be explained by movements in the market fundamentals (domestic credit, past domestic inflation etc.) must result from changes in the credibility of economic policy. An application to the Brazilian Cruzado Plan was made.

6 Baxter's approach is chosen for two reasons in addition to the fact that she emphasizes that the credibility of a monetary reform depends on both monetary and fiscal policies. First, it follows closely the theoretical literature on credibility and reputation. Second, it is used to analyze countries characterized by hyperinflation, probably those that would benefit most from a credibility effect.

Section 1 describes how monetary and fiscal policy interact, and deduces the feasibility conditions of each that make the overall macroeconomic policy credible. Section 2 defines the measure of credibility. Section 3 reports the empirical results for two recent reforms adopted in Brazil, the Cruzado and Collor plans. Section 4 summarizes the main findings.

1. MONETARY POLICY, FISCAL POLICY, AND CREDIBILITY

Following Baxter (1985) we consider that the credibility of a monetary reform depends not only upon the monetary policy itself but lies in the interaction between the monetary and fiscal authorities established by the government's budget constraint.[7] In order to reduce the inflationary pressures associated with the monetization of fiscal deficits, interest-bearing government debt is issued. Any further reduction in monetization, and simultaneous solvency, can only be guaranteed by an appropriate stream of budget surpluses. If no such fiscal correction is adopted, the solvency condition can only be met by issuing additional base money. Rational agents then extract from the implausibility of a future reversal in fiscal policy signals of an eventual inflationary financing.[8]

More precisely, once monetary and fiscal authorities are considered separately there is the possibility that the two play a "game of chicken" over economic policy. Suppose the central bank promises to follow a tight monetary policy while the fiscal authority establishes taxes and expenditures that imply a stream of large future deficits. If both stick to their policies, the result is an overall macroeconomic program that is not credible because it is infeasible. The conflict is eventually solved when one of the two parties gives in. If the fiscal authority is stronger, the arithmetic of the government constraint makes the monetization of the deficit inevitable.[9] It is via these channels that fiscal policy influences the credibility of monetary reform. Given these coordination problems the private sector speculates over who will impose discipline, and when the game between the policymakers will be solved.

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7 In fact this section closely follows BAXTER (1985). The only difference is that we also establish the feasibility conditions when a flexible exchange rate regime is chosen.

8 A formalized discussion of the coordination problems faced by the monetary and fiscal authorities is given in SARGENT & WALLACE (1981) and SARGENT (1993). For a game-theoretic approach see MASCIANDARO & TABELLINI (1988).

9 Of course, the monetary authority can also stick to its promise in which case the fiscal authority plays the role of the "chicken", and brings the budget into balance. This other possibility will be discussed later on.

We assume linear government policy rules. The constraints on the monetary authority depend on the exchange regime chosen. Under a fixed exchange rate regime the rule for monetary policy is given by:

$$DC_t = (1 + \overline{\theta} + \overline{\varepsilon}_t) DC_{t-1} \tag{1}$$

where DC_t is the level of domestic credit, $\overline{\theta}$ is the domestic credit growth rate, and $\overline{\varepsilon}$ is an i.i.d. error term with mean zero and variance $\sigma_{\overline{\varepsilon}}^2$.

If the exchange rate is fixed the money supply is determined by demand factors, and any excess demand or supply will lead to a stock adjustment through accumulation or decumulation of reserves. So, if domestic credit grows faster than inflation, the excess supply of money will be lost through the balance of payments and eventually a shortage of reserves will lead to a collapse of the fixed regime. As purchasing power parity must hold in the long run, implying an equality between the domestic inflation rate, π, and the foreign rate, π^*, a fixed rate regime requires that the monetary authority choose $\overline{\theta} \leq \pi^*$. This condition guarantees a sufficiently low growth of the domestic credit so that there are no reserve outflows to make the fixed exchange rate unsustainable.

On the other hand, if the exchange rate is allowed to fluctuate, it adjusts so that the balance of payments is always in equilibrium, and no movements in reserves are observed. In this case, the change in domestic credit is the change in the money supply, and thus in the rate of inflation. The rule for monetary policy is therefore given by:

$$MB_t = (1 + \theta + \varepsilon_t) MB_{t-1} \tag{1'}$$

where MB_t is the stock of base or high powered money at time t, and θ is the monetary base growth rate, and ε is an i.i.d. error term with mean zero and variance σ_ε^2. In this case, a restrictive monetary policy implies $\theta \leq 0$ in every period. Some could argue that the condition $\theta \leq 0$ is too restrictive and suggest that, given that purchasing power parity holds in the long run, a less restrictive but still credible monetary policy would be given by $\theta \leq \pi^* + \Delta s$, where Δs is the percentage rate of change of the exchange rate in the long run. The problem is that in a floating exchange rate regime the exchange rate adjusts instantaneously.

Then if the domestic inflation rate exceeds the foreign inflation rate, the domestic currency will depreciate at the rate of inflation differential in order to prevent the country's goods from becoming overpriced in world markets. The only way left to guarantee the public's faith in the central bank announcements is to make the bank announce a permanent control over money growth since this is the only variable it sets exogenously.

The rule for the government deficit is given by

$$D_t = \alpha_0 + \alpha_1 B_{t-1} + u_t \qquad (2)$$

where D_t is the real value of the government deficit at time t net of interest payments, B_{t-1} is the real value of government debt at time t-1, and u_t is an i.i.d. error term with mean zero and variance σ_u^2.

The government's budget constraint is represented by

$$D_t = B_t - (1+R)B_{t-1} + (DC_t - DC_{t-1}) / p_t \ (3), \text{ under a fixed rate regime, and}$$

$$D_t = B_t - (1+R)B_{t-1} + (MB_t - MB_{t-1}) / p_t \quad (3'), \text{ under a floating rate regime}$$

where R is the real rate of interest and p_t is the price level in period t.

Combining (2) and (3), and (2) and (3') we obtain the following two first-order difference equations in real debt, one for each type of exchange rate regime:

$$B_t = \alpha_0 + \gamma B_{t-1} - (DC_t - DC_{t-1}) / p_t + u_t \qquad (4)$$

$$B_t = \alpha_0 + \gamma B_{t-1} - (MB_t - MB_{t-1}) / p_t + u_t \qquad (4')$$

where $\gamma = 1 + R + \alpha_1$.

Substituting equation (1) in (4), and (1') in (4') we get:

$$B_t = \alpha_0 + \gamma B_{t-1} - \frac{\bar{\theta}}{1+\pi} \left(\frac{1+\bar{\theta}}{1+\pi} \right)^{t-1} \left(\frac{DC_0}{P_0} \right) + v_t \qquad (5)$$

$$B_t = \alpha_0 + \gamma B_{t-1} - \frac{\theta}{1+\pi}\left(\frac{1+\theta}{1+\pi}\right)^{t-1}\left(\frac{MB_0}{p_0}\right) + \xi_t \tag{5'}$$

where υ_t is an error term involving u_t and $\bar{\varepsilon}_t, \bar{\varepsilon}_{t-1}, ..., \bar{\varepsilon}_1$, and ξ_t is an error term involving u_t and $\varepsilon_t, \varepsilon_{t-1}, ..., \varepsilon_1$.

1. Stability conditions for (5) and (5') imply that $\gamma < 1$, and $\theta \le \pi$. The condition $\gamma < 1$ implies that $\alpha_1 < -R$, indicating that the government must promote some reduction of the principal of its debt.

Based on this, a monetary policy reform can be considered credible if it satisfies two feasibility conditions for each type of exchange rate regime. For a fixed rate regime these conditions are :

(i) $\bar{\theta} \le \pi^*$, which guarantees a sufficiently low domestic credit growth rate, such that there is no continued reserve losses, and the inflation rate is reduced

(ii) $\gamma < 1$, and $\bar{\theta} \le 0$, that ensure that the path for real government debt is non-explosive.

For a floating rate regime the conditions are:

(i) $\theta \le 0$, which ensures that the long-run inflation rate can be reduced

(ii) $\gamma < 1$, and $\theta \le \pi$, that again impose limits on the government debt.

2. MEASURING THE CREDIBILITY OF A MONETARY REFORM

Let us assume that government policies take the form of a linear multiple regression model:

$$y = X\beta + e$$

where y is the policy's variable, X is a $1xK$ vector of state variables, β is a $Kx1$ vector of regression coefficients, and e is an independently and identically normally distributed error term with mean zero and variance σ^2.

When the government announces a reform, private agents have some prior beliefs about the future value of β. More precisely, we assume they have a prior with inequality restrictions for β given by $g(\beta, \sigma) = \sigma^{-1}$ over the feasible parameter region, and 0 outside this region.[10] As time passes, information contained in the realizations of the policy variables is incorporated into the private sector's forecast of the future path of policy.

Credibility is defined as the posterior probability assigned by the agents to the event that the government is really following the announced policy. If the government is really committed to its promises, so that the current course of economic policy is consistent with the program originally announced, the probability that the constraints implied by the announced measures are true is high and remains so as new information on the policy variables is obtained.

When a prior with inequality restrictions is employed, Bayes' rules leads to a posterior density function for β which is a truncated multivariate t distribution.[11] Version 7 of SHAZAM includes sampling from a multivariate t distribution, and the associated computations for Monte Carlo Integration. This makes it possible to straightforwardly obtain estimates of posterior means and standard deviations, and, of particular interest here, posterior probability estimates for any specified region of the parameter space.[12]

3. CREDIBILITY OF MONETARY REFORMS IN BRAZIL : CRUZADO PLAN, MARCH 1986 TO MAY 1987, AND COLLOR PLAN, MARCH 1990 TO JANUARY 1991

The Brazilian economy's record after the mid-1980s shows that all attempts to end inflation were abandoned shortly after they were announced. The Bresser Plan lasted only six months, from July to December 1987, while the Cruzado, Summer

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10 BAXTER (1985) assumes a natural conjugate prior for β. It is given by a multivariate normal distribution, conditional on σ, and its specification requires values for a prior mean vector and a prior covariance matrix. Given the difficulty involved in specifying a complete prior covariance matrix, we prefer to adopt a prior with inequality restrictions.

11 A good introduction to Bayesian analysis with inequality restrictions is given by JUDGE *et alii* (1988) and GRIFFITHS (1988). Indispensable, however, is GEWEKE (1986).

12 Suppose $Pr(0 < \beta < 1)$. This probability is given by the area under the posterior function $g(\beta | y)$. What Monte Carlo numerical integration does is to artificially draw a random sample from the density $g(\beta | y)$. The proportion of these observations which lie between 0 and 1 is an estimate of $Pr(0 < \beta < 1)$. The degree of accuracy of the estimate depends on the choice of the size of the artificial sample.

and Collor plans lasted around twelve months. In addition to the short duration, two other points call attention. First, once an adjustment program failed it was immediately followed by another one, generating a sequence of stabilization attempts. Second, it seems that with each new attempt the government tried to pursue more drastic measures in an effort to convince the public of its commitment. After all, only a government determined to stop inflation would be willing to accept the consequent recession.

All these facts "per se" can be considered an indication of the Brazilian economic authorities' lack of credibility or incapacity for commitment. However, if it is certain that at the final period of each of the stabilization plans the credibility was low, it is not known for sure that that had been the case from the announcement date. Moreover, the behavior of credibility may have shown a completely different pattern during the different programs.

The discussion of credibility of disinflationary policies is important given the now general acceptance that the greater the belief in the government's commitment to the measures announced the lower the costs of reducing inflation. Also, it is accepted that credibility brings with it the added bonus of reducing inflation itself since the actual inflationary process depends on expectations about the future behavior of prices. What seems more appealing, however, is that once a credibility problem is identified, as well as its source, potential solutions can be presented to guarantee precommitment.

Credibility, as defined in the previous section, will be calculated here for the Cruzado and Collor plans. This choice is supported by the fact that only these two programs could be characterized, at least at the time of their announcements, as an abrupt change in the government strategy for formulating economic policy.

Based on the idea that the Brazilian inflation had as its main source an inertial component, the Cruzado Plan ingredients were formed primarily by the remotion of indexation, a general freeze of prices, including the exchange rate, and the adoption of a new currency. With respect to fiscal policy, the government believed that the measures adopted at the end of 1985 were sufficient to reduce the inflationary pressures derived from deficit financing. Neither were any targets established for the monetary policy.[13] At least during the first months, the monetary policy would be used to accommodate the increase in the demand for money resulting from a decrease in the inflationary expectations.

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13 Although there was no announcement that a tight monetary policy would be followed, as observed before, the decision to fix the exchange rate constrains the choice of monetary policy.

The Collor Plan, on the other hand, made indisposable 80% of the money stock (M4=M1+all other financial assets) which corresponded roughly to 30% of the GDP. The other 20% were converted into the new currency, and could be freely used.[14] The purpose was to reduce the money stock in order to gain control over its flow, the money supply. On the fiscal side, an adjustment was announced of around 10% of the GDP that would be more than sufficient to balance the public accounts, thus avoiding the future use of debt or money financing. Especially emphasized as a means to achieve the proposed goal were the implementation of an administrative reform and the privatization of some public enterprises. And lastly, a floating exchange rate regime was adopted.

It was previously argued that a feasible reform should satisfy two conditions for each exchange rate regime. The two conditions, in the case of a fixed or flexible rate regime, are independent in the sense that the choice of θ does not constrain the choice of γ. Given a choice of the domestic credit or monetary base growth, the government is free to choose the deficit path it likes.

Although there is not necessarily any covariance between the rules for fiscal and monetary policy, it may exist when actual data is considered. Therefore, seemingly unrelated regression estimates were obtained to test for such covariance.

For the Cruzado Plan (characterized by a fixed rate regime) $\overline{\theta}$ is estimated using equation (1), and γ is obtained by equation (4), both reproduced below :

$$DC_t = (1 + \overline{\theta} + \overline{\varepsilon}_t)DC_{t-1} \tag{1}$$

$$B_t = \alpha_0 + \gamma B_{t-1} - \frac{DC_t - DC_{t-1}}{p_t} + u_t \tag{4}$$

For the Collor Plan (characterized by a flexible rate regime), the parameters for the monetary and fiscal policies were estimated using equations (1') and (4') respectively. Both equations are also reproduced below:

$$MB_t = (1 + \theta + \varepsilon_t)MB_{t-1} \tag{1'}$$

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14 The resources blocked were subject to monetary correction of 6% per year, and would be made available again in twelve months.

$$B_t = \alpha_0 + \gamma B_{t-1} - \frac{MB_t - MB_{t-1}}{P_t} + u_t \tag{4'}$$

In fact, since the coefficient of $\dfrac{(DC_t - DC_{t-1})}{P_t}\left[\dfrac{(MB_t - MB_{t-1})}{P_t}\right]$ must be 1, the

following regression can be run:

$$B_t^* = B_t + \gamma B_{t-1} + u_t \tag{6}$$

where $\quad B_t^* = B_t + \dfrac{(DC_t - DC_{t-1})}{P_t}\quad$ under a fixed rate regime, and

$B_t^* = B_t + \dfrac{(MB_t - MB_{t-1})}{P_t}\quad$ under a flexible rate regime.

The value of the Breusch-Pagan LM test for diagonal variance-covariance matrix for the Cruzado Plan equals 1.7845 while for the Collor Plan it is 1.1634, with one degree of freedom. Since both statistics are lower than the critical value of 3.841 it is not possible to reject the null hypothesis at the 5% level of significance. Therefore, there is no evidence of covariance between the economic rules.

Since monetary and fiscal policies can be considered independent events, the joint probability that both conditions are satisfied, that is, the credibility of the overall economic reform is given by $pr(\bar{\theta} \leq \pi^*)pr(\gamma < 1)$, and $pr(\theta \leq 0)pr(\gamma < 1)$ respectively.

The results for feasibility of the monetary and fiscal policies, as well as for the credibility of the overall macroeconomic programs, are presented below. Computation was made for 200,000 replications, including 100,000 antithetic ones.[15] It is important to observe that as agents' prior beliefs about the parameters of the government rules are diffused, expectations can be rapidly affected by close adherence to the announced program. If the government returns to its initial plan, even after departing from it, the posterior means converge rapidly to the announced value. This explains in part some abrupt changes in expectations.

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15 The antithetic replication simply changes the sign of the vector of random numbers, and according to GEWEKE (1986), improves convergence substantially.

For the Cruzado Plan, as is shown in Figure 1, the probability that the first condition for a feasible monetary reform is satisfied reaches 73% by July.[16] After that good start credibility declines almost monotonically. In October, when the value of exports falls from US$2.1 billion to US$1.3 billion, credibility is less than 30%. The parallel market premium reached 100% in October and November due to the increasing speculation of an eventual maxidevaluation of the currency. In fact, in October the government promoted a small devaluation (1.8%), revealing its incapacity to sustain a fixed exchange rate. In November the credibility of monetary policy is smaller than 10%, and remains quite low until the official end of the reform period.

FIGURE 1 - CRUZADO: PROBABILITY OF FEASIBLE MONETARY POLICY
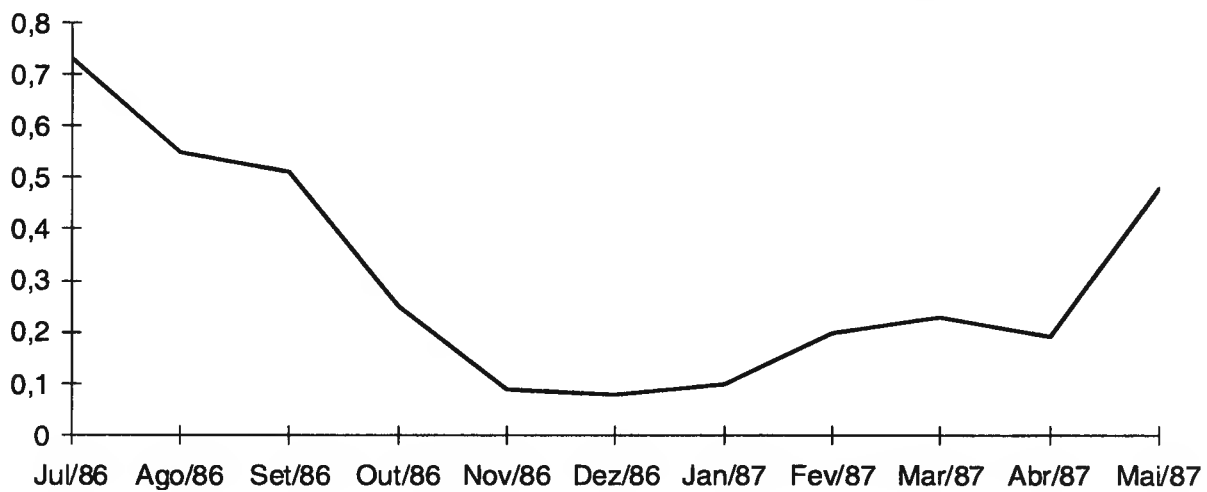
The probability that fiscal policy was "feasible" falls over the course of the reform (Figure 2) until November. Despite this fact, the probability that $\gamma < 1$ is higher than 50% is observed in almost all the periods, except October and November.

FIGURE 2   CRUZADO: PROBABILITY OF FEASIBLE FISCAL POLICY
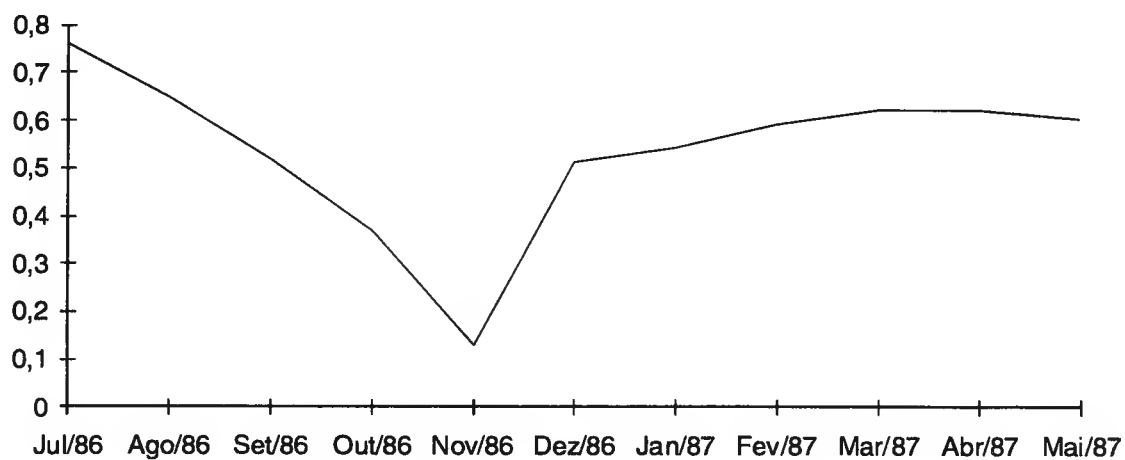
16 Our estimations start when n=5, even for the fiscal policy rule that includes a constant.

The credibility of the reform was defined as the probability that feasibility conditions for the monetary and fiscal policies are satisfied. The credibility of the Cruzado Plan is shown in Figure 3. In the fifth month after the announcement date it is as high as 55%, falling systematically after that. Although information for the months that immediately followed the announcement is not available, the results obtained here can account also for the pattern suggested by survey evidence (NOVAES, 1990) and Agenor and Taylor (1992). Just four or five months after the plan was adopted, the initial gain in credibility was continuously lost. This happened despite the adoption of an external commitment. In fact, as observed by Cukierman, Kiguel and Liviatan (1992) the announcement of a fixed exchange rate represented a very weak commitment. *"Policymakers did not tie their hands in any way, and it was clear from the outset that their main objective was to halt an inflationary acceleration rather than to bring about permanent price stability."*(p. 16)[17]

FIGURE 3 - CRUZADO: PROBABILITY OF CREDIBLE REFORM
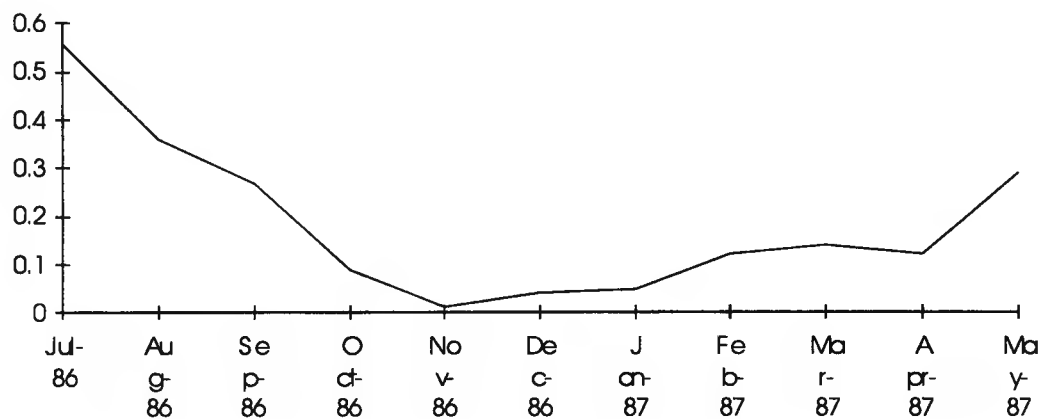
The credibility of monetary policy during the Collor Plan remains below 50% over the whole reform period (Figure 4). The probability of a feasible monetary policy is 36% in the fifth month after the announcement date, and decreases almost montonically after that, reaching only 6% in December 1990, one month before the reform is abandoned.

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17 Among the stabilization policies evaluated by these authors the Cruzado Plan appears as the one with the weakest commitment. The degrees of commitment to the stabilization program in Israel and in Argentina (Austral Plan) were stronger because the fixed exchange rate was supported by a promise of no monetization of the budget deficit. The programs adopted in Europe in the 1920s and the 1991 Convertibility Plan in Argentina represented an even a stronger commitment given that the fixed exchange rate was supported by a legal obligation to back the issuance of money with foreign assets.

## FIGURE 4 - COLLOR: PROBABILITY OF FEASIBLE MONETARY POLICY
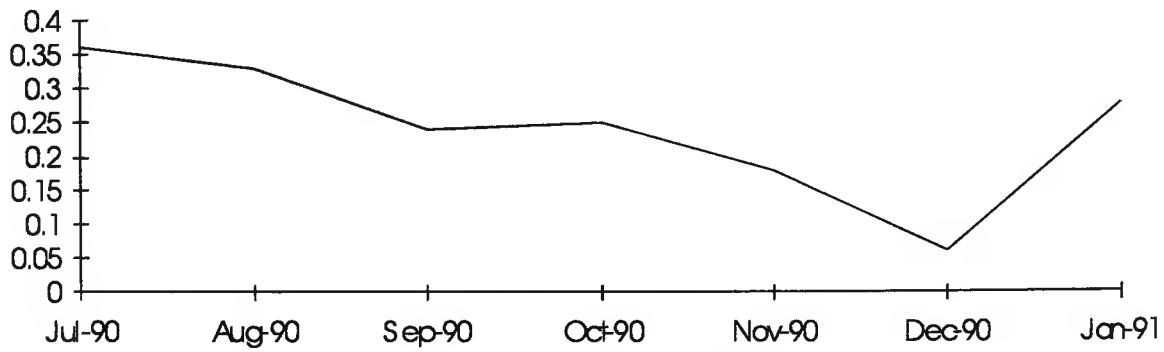
The results obtained for the probability of a feasible fiscal policy are much better (Figure 5). It starts quite high (84%), and its lowest value is as high as 60% observed in November.

FIGURE 5 - COLLOR: PROBABILITY OF FEASIBLE FISCAL POLICY
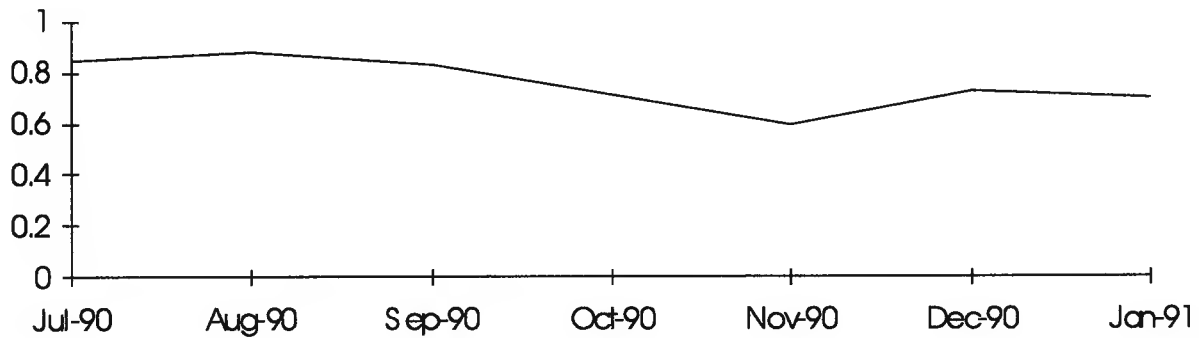
Finally, the credibility of the overall stabilization plan is quite low as can be seen in Figure 6. In July it reaches only 30%, and after that falls almost continually.

FIGURE 6 - COLLOR: PROBABILITY OF CREDIBLE REFORM
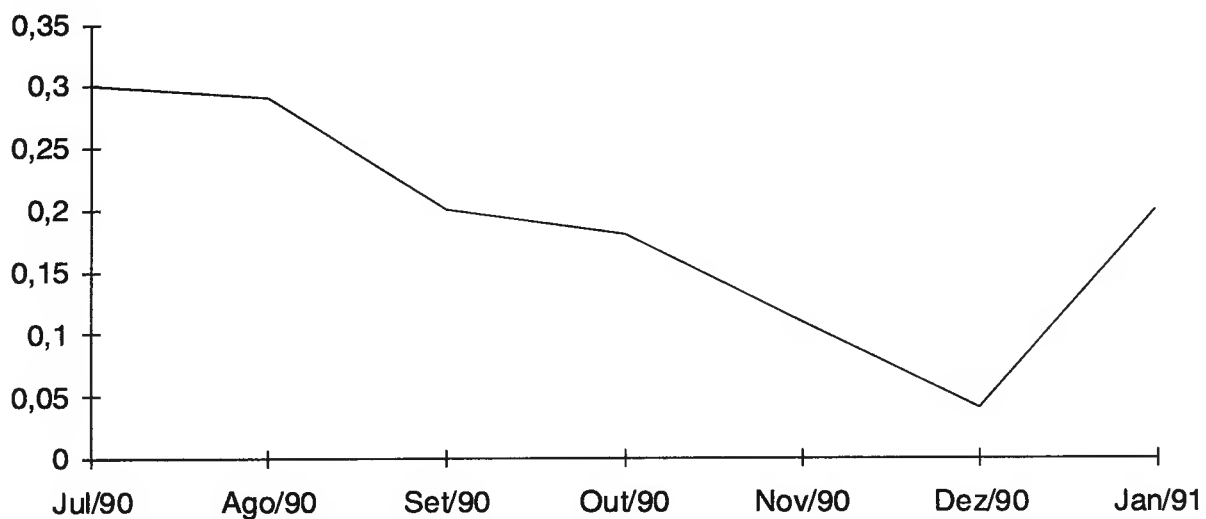
When comparing the Cruzado and Collor Plans two common features call immediate attention. First, both plans presented a low credibility of monetary policy. Although the Cruzado Plan had a much better start, the fact is that in general credibility is almost always below 50%. Second, credibility of fiscal policy is surprisingly high during both stabilization programs.

As observed in section 1, the sustainability condition of fiscal policy is derived from the government's budget constraint. One explanation for the high credibility of fiscal policy could then be that the government follows a debt-financing regime in which the deficits are temporary, and are expected to be followed by offsetting prospective surpluses (Ricardian regime). However, if this is the case, the path of base money should be unaffected by the deficits, and so the credibility of monetary policy should also be high. As this is not the case, this kind of regime seems an inadequate description of the Brazilian's government recent behavior.

Another explanation is that the government is following a regime similar to the one described by Sargent and Wallace (1981), and Sargent (1993). The government is running such a persistent stream of large deficits that increases in the monetary base have to be used to finance the budget. The "Inflation tax", as an additional source of revenue, then guarantees that the budget is balanced, assuring the credibility of fiscal policy. On the other hand, as the agents are aware of the debt-financing regime followed, they know that any announcement of a more conservative monetary policy cannot be trusted.

This argument is valid only in the case of "fiscal dominance", that is, when fiscal policy is given exogenously, independent of monetary policy. Formal evidence that this is the regime followed by the Brazilian government can be found in Pastore (1995) and Rocha (1995). Some informal evidence, as observed by Masciandaro and Tabellini (1988), comes from the fact that the "degree of fiscal dominance" can be interpreted as a measure of central bank independence from the fiscal authority. Three measures of central bank independence obtained from Cukierman, Webb, and Neyapti (1992) give some idea of the high subordination of the Brazilian central bank to the needs of the government.[18] Although these indices represent

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18 The first measure is a legal measure of independence, and is based on the written information expressed in the charters of the central banks of the different countries. In a range from zero (minimum independence) to one (maximum independence) the Brazilian index is 0.21 during the eighties. This corresponds to the 62nd place from the top when the whole sample of 72 countries is considered, and the 44th place when considering only the 51 developing countries. As the practical application of the law can be more important than what the law itself establishes, especially with respect to developing countries, the actual frequency of turnover of central bank officers is used as another measure. It corresponds to the average number of central bank officer's changes per annum in a country/subperiod, and is based on the presumption that, at least above some threshold, a larger turnover of central bank officers indicate a lower level of autonomy. For 1950-89 Brazil presented the second highest average turnover rate among all the countries in the sample. Brazil's index is 0.68 (an average turnover of about 18 months), a little bit better than the 0.93 value (an average turnover of about 13 months) achieved by the Argentine central bank. Finally, when the legal independence and turnover indices are combined to form an overall measure of central bank independence the Brazilian central bank is again classified near the bottom. It only has a better index than those presented by Argentina and Chile.

quite indirect evidence, especially if the great subjectivity involved in their construction is taken into account, they give additional support to the hypothesis that the recent debt-financing regime followed implies an exogenous fiscal policy.

We have, therefore, that both the Cruzado and Collor Plans encourage a policy for the monetary authority that would be appropriate for a Ricardian regime but advocating plans for taxes and expenditures that could be feasible only under a fiscal dominance regime. Such monetary and fiscal policies are, however, incompatible. It is not feasible to carry out both at the same time, and this explains the overall low credibility, and ultimate failure, of these two economic reforms.[19]

4. CONCLUSIONS

The credibility of monetary reform was considered to depend on both monetary and fiscal policies. If the private sector believes that the real value of government debt is following an explosive path, they will assign a high probability to the event that the monetary reform will be abandoned. This results from the fact that a fiscal deficit, in the long run, is incompatible with low monetary expansion.

The results obtained for the Brazilian Cruzado and Collor plans are quite interesting. The credibility of fiscal policy is high even though no fiscal correction was implemented, indicating that seigniorage is responsible for the non-explosive path of the government debt. This, on the other hand, explains the low credibility of monetary policy. Therefore, there is an indication of a monetary regime of fiscal dominance. In this case, encouragement of a more restrictive monetary policy is simply incompatible with tax and expenditure plans that imply large deficits. The overall credibility is low because such monetary and fiscal policies are incompatible.

The major opportunities for further research seem to be empirical. The technical and conceptual problems are considerable, particularly when the adopted programs are of short duration as in the Brazilian case. Some suggestions are:

1) Measure credibility continuously over time, that is, also in periods where there is no strong change in policy.

2) Generically speaking, credibility is the private sector's degree of belief in the consistency between the current economic policy and the program originally announced by policymakers. It is related, therefore, to the of the economic authorities' capacity for commitment. When calculating credibility, one is concerned about how serious the problem of noncommitment is as perceived by the agents. So, it would be interesting to distinguish empirically between

periods in which policy precommitment was effective and those in which it was not. Once this is done, the next step would be to measure how important the lack of credibility was.

3) Test the time inconsistency hypothesis that is considered to be the heart of the recent credibility literature.

4) Verify how important credibility is for practical policymaking.

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