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Credibility Effects of Price Controls in Disinflation Programs

Prepared by Pierre-Richard Agénor*

Authorized for Distribution by Malcolm Knight

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Abstract

This paper examines whether price controls may enhance the credibility of a disinflation program, using a framework in which agents behave strategically. The analysis indicates that a partial price freeze is not fully credible, and may result in inflation inertia. The authorities may be able to determine optimally the intensity of price controls so as to minimize the policy loss associated with a discretionary monetary strategy. But the optimal intensity of controls is shown to be significantly different from zero only if the cost of enforcing price ceilings is not too high, or if the weight attached to price distortions in the policymaker's loss function is small.

JEL Classification Numbers:

C72, E31, E64

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I. Introduction

Price controls have been widely used in the context of stabilization programs in developing countries, despite well-known microeconomic costs (nonprice rationing, misallocation of resources, *etc.*). 1/ In the 1960s, controls played a major role in three important stabilization programs--those of Brazil in 1964, Argentina in 1967 and Uruguay in 1968. More recently, in the mid-eighties, Argentina, Brazil and Israel launched comprehensive anti-inflation plans with extensive wage and price ceilings. By contrast, Peru's Emergency Plan of 1985-86, as well as the Mexican Pact of Economic Solidarity of 1988-89, relied on a partial price freeze, while Bolivia, which introduced a disinflation program at about the same time as Argentina, succeeded in fighting inflation wih a purely "orthodox" package. 2/

Figure I shows the behavior of the inflation rate in Argentina, Brazil and Israel, before, during and after the imposition of price controls in the mid-eighties. The figure shows, first, that in all countries the rate of inflation accelerated in the months immediately preceding the introduction of controls--reflecting, in addition to a weakening of fiscal and credit policy, "anticipatory pricing" by firms. 3/ To the extent that controls may have been anticipated, the sharp fall in inflation following the introduction of controls may not be too surprising --even in cases where there was no adjustment in the fundamentals. Firms were willing to abide by the freeze since their prices had already been increased in anticipation of such policy measures. However, the Figure also shows that inflation remained positive (well above 1 percent per month in Argentina and Brazil) during the price freeze. Second, the Figure shows that while in all

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1/ Price controls were also used in several industrialized countries in the early 1970s, in an attempt to reduce inflation. A particularly interesting case in this regard is Sweden, whose experience is discussed by Jonung (1990). See also Wilton (1990) for the Canadian case.

2/ On these experiments, see Dornbusch *et al.* (1990), Cardoso (1991), Helpman and Leiderman (1988), Kiguel and Liviatan (1989, 1991), Végh (1991) and Paus (1991).

3/ This point has been emphasized by Kiguel and Liviatan (1991). Suppose that firms--or price setters--believe that the probability that the authorities will attempt to stop inflation through controls rises once inflation exceeds a critical level. Firms will then increase prices further in an attempt to anticipate the policy decision and enter the freeze in a favorable position. The rise in prices will balance the foregone profits they could incur by setting their prices "too high" against the potential losses resulting from setting their prices "too low."

cases price ceilings seem to have been associated with a sharp and immediate fall in the inflation rate, only in Israel were the effects long-lasting. In Argentina and Brazil, inflation--which remained positive during the freeze--accelerated sharply after controls were lifted, as a result of lax monetary and fiscal policies. 1/ The experience of Argentina and Brazil seems to suggest, therefore, that price controls alone simply repress inflation. To be effective, price controls must be accompanied by measures that create temporary conditions of general excess supply in the initial phase of the stabilization program (Malinvaud, 1990). If this is not the case, a price freeze cannot be maintained without creating serious imbalances. 2/ Wage and price controls cannot substitute for budget cuts and a tight monetary policy.

While there is general agreement on the above proposition, it has recently been argued that controls may help to slow down price increases by enabling the authorities to "signal" their commitment to stabilization and enhance the credibility of their disinflation plans. 3/ That lack of policy credibility can be a source of inflation persistence has been emphasized by Blejer and Liviatan (1987), Persson and van Wijnbergen (1988), and van Wijnbergen (1988). Blejer and Liviatan (1987) view the credibility issue as a severe

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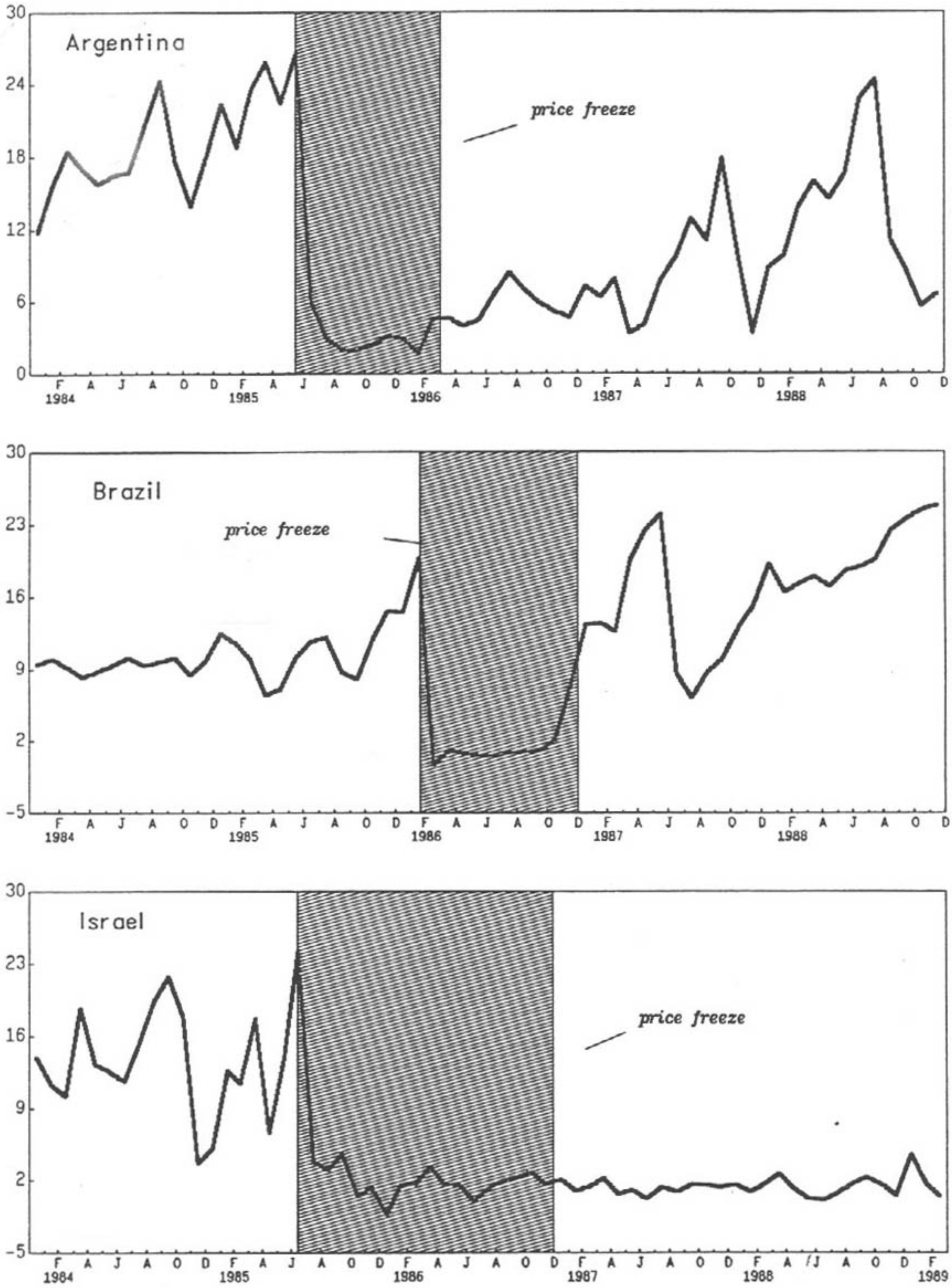
1/ Price controls were removed in December 1986 in Brazil, while in Argentina a phased removal began in April 1986. In Israel the lifting of controls started approximately 6 months after the beginning of the plan; that is, in January 1986. Controls were initially removed on a small number of goods and services. The number of products under controls was gradually reduced from 80 percent at the beginning of the program to about 25 percent in January 1987--a figure similar to that prevailing before the introduction of the program (Arstein and Sussman, 1990).

2/ In Israel and Argentina, restrictive financial policies and a temporary cut in real wages created a situation of excess supply that was maintained for some time because of downward rigidity of prices. In Brazil, by contrast, not only did monetary and fiscal policies fail to play a supportive role but excess demand was stimulated by an initial upward adjustment in real wages. As a result, potential pressure on prices developed rapidly and led to the abandonment of the freeze. See Kiguel and Liviatan (1989) for evidence on this point.

3/ In addition to the credibility issue discussed below, price controls have been advocated as a way to reduce inertia resulting from backward-looking expectations and wage indexation (Possen, 1978, Shupp, 1976) or forward-looking wage contracts (Cukierman, 1988), as a "transition" mechanism to a low-inflation equilibrium (Bruno and Fischer, 1990), as a coordination device (Dornbusch and Simonsen, 1988), as an instrument to reduce information costs for consumers (Zeira, 1989), and as a way to secure political gains (Jonung, 1990).

FIGURE 1. INFLATION AND PRICE CONTROLS IN HETERODOX PROGRAMS
(Month-to-month percentage changes in consumer prices)



Source: International Financial Statistics.

problem of asymmetric information, where the public needs time to verify the true stance of the new economic policy. A price freeze in this context gives the government a period of time during which it can prove that it is indeed attacking inflation at its roots--usually by cutting the budget deficit. But the use of price and wage controls can also be counter-productive, since these steps do not enable the public to learn whether the fiscal restraint is sufficient, and whether inflation has really stopped or is only temporarily repressed. Thus controls may also lengthen the adjustment period of expectations to a new equilibrium. Persson and van Wijnbergen (1988) have explicitly analyzed how controls can help in establishing credibility, by building upon the "signaling" model developed by Vickers (1986). In order to gain credibility, the policymaker must signal its willingness to accept a recession--without resorting to inflationary measures and without giving in to pressures to reverse its policy stance. Controls, in this context, minimize the cost of signaling the policymaker's commitment to low inflation.

This paper examines further the credibility effects that price controls may convey to stabilization programs in the context of high-inflation economies. In contrast to existing studies, it considers this issue by modeling directly the imposition of price ceilings. The analysis draws on recent developments in macroeconomics, which have emphasized the game-theoretic aspects of disinflation policies, and the strategic interactions between centralized policymakers and forward-looking private agents (Cukierman, 1991). The remainder of the paper is organized as follows. Section II discusses the time-inconsistency problem faced by a price-control policy, and its implications for inflation inertia. Section III examines the role that the intensity of controls--that is, the proportion of goods of which prices are subject to ceilings--can play in minimizing the policy loss associated with an imperfectly credible monetary policy. Finally, Section IV concludes and discusses some possible extensions of the analysis.

II. Controls, Time Inconsistency, and Inflation Inertia

In this section we set out a model with non-competitive markets and price-setting firms (as in Helpman, 1988, and van Wijnbergen, 1988) in which the policymaker faces an incentive to reduce inflation through the imposition of direct price controls. The policymaker has an informational advantage over the private sector--due, for instance, to a better monitoring capacity--and sets controlled prices after the realization of shocks to the economy.

Consider an economy that produces many goods, a proportion of which (such as goods produced by public enterprises, for instance) are subject to direct price controls by the policymaker. A reduction in the rate of inflation is assumed to increase political support while deadweight loss from excess demand--resulting from misallocation and resources devoted to nonprice rationing--reduces support, since aggregate real income is reduced. Price ceilings are chosen so as to maximize political support from holding prices down, against the opposition resulting from this deadweight loss. When prices are set below equilibrium, there are incentives for sellers to evade controls, so the policymaker must enforce the ceilings--at a non-prohibitive cost--to make them effective. Firms in the uncontrolled or "free" sector restrain price increases, beyond the expected increase in controlled prices, in order to avoid more stringent controls in the future.

Let $p_c(t)$ denote an index of the subset of prices set by the policymaker in period t and let $\tilde{p}_c(t)$ denote the market-clearing "equilibrium" price, that is, the price that would obtain in the absence of price controls. 1/ The deadweight loss due to price ceilings--the loss of (Marshallian) consumer and producer surpluses when excess demand and nonprice rationing result in a misallocation or waste of resources--can be approximated by

$$D(t) = \eta[p_c(t) - \tilde{p}_c(t)]^2, \qquad \eta = \eta(\overset{+}{\eta}_s, \overset{-}{\eta}_d), \tag{1}$$

where η_s and η_d denote the (absolute values of the) price elasticities of market demand and market supply, respectively, of goods subject to controls. Equation (1) assumes that the deadweight loss is greater the more elastic the supply of controlled goods is, the less elastic the demand is, and the larger the (squared) deviation between actual and equilibrium prices. 2/ The market-clearing equilibrium price is assumed to be determined by

$$\tilde{\pi}_c(t) = \tilde{\pi}_c + \epsilon(t), \tag{2}$$

1/ Both p_c and $\tilde{p}_c$ are measured in logarithms. In what follows, we assume that $p_c(t) \leq \tilde{p}_c(t)$.

2/ A conceptually similar approximation has been used in Aizenman and Frenkel (1986), in which the welfare loss associated with contractually predetermined nominal wages is measured by the squared discrepancy between the actual wage and its equilibrium value. This type of measure, however, provides only a lower bound on the deadweight loss because it assumes that quantities produced at controlled prices are obtained by the consumers who value them most, and because it excludes the cost of resources devoted to nonprice rationing. For a further discussion, see Cox (1980).

where $\tilde{\pi}_c(t) = \tilde{p}_c(t) - \tilde{p}_c(t\text{-}1)$ and $\epsilon(t)$ denotes a stochastic shock, which is assumed serially uncorrelated with zero mean and constant variance. The probability distribution from which $\epsilon(t)$ is drawn is assumed to be common knowledge.

Price setters in the "free" sector set prices $p_n(t)$ so as to protect their relative position and without knowing the realized value of $\epsilon(t)$, so that

$$\pi_n(t) = p_n(t) - p_n(t\text{-}1) = E_{t-1}\pi_c(t), \tag{3}$$

where $E_{t-1}z(t)$ denotes the conditional expectation of $z(t)$ based on information available up to the end of time t-1. 1/

Setting $\pi(t) = p(t) - p(t\text{-}1)$, the rate of change of the domestic price level can be defined by

$$\pi(t) = \delta\pi_c(t) + (1 - \delta)\pi_n(t), \qquad 0 \le \delta \le 1 \tag{4}$$

where δ (assumed given for the moment) denotes the intensity of price controls--that is, the proportion of goods on which the authorities impose price controls.

While agents in the flexible-price sector set prices without knowing the realized value of the demand shock, the policymaker sets controlled prices after observing the shock. The policymaker is assumed to use controlled prices to offset some of the effect of $\epsilon(t)$ on the deadweight loss--for instance, by unexpectedly raising these prices when $\epsilon(t)$ turns out to be positive.

The policymaker's preferences entail a trade-off between inflation and the deadweight loss resulting from excess demand and price controls. Specifically, the policymaker aims at minimizing the expected loss function $L(t)$:

$$L(t) = E_t[D(t) + \theta\pi(t)^2], \qquad \theta > 0 \tag{5}$$

or, using (1) and (2),

$$L(t) = E_t[\eta(\pi_c(t) - \tilde{\pi}_c - \epsilon(t))^2 + \theta\pi(t)^2]. \tag{5'}$$

1/ The information set up to t-1 is common to the policymaker and the private sector and is assumed to include all relevant data on the policymaker's incentives and constraints.

Under discretion, the policymaker chooses a rate of increase of controlled prices that is such that the difference between political support resulting from a reduction in the inflation rate and political opposition resulting from the deadweight loss is maximized. Formally, he chooses $\pi_c(t)$ in each period so as to mimimize (5′) subject to (4), without regard to the announced policies, and taking private sector expectations as given. In the discretionary regime, the rate of change of controlled prices is therefore given by

$$\pi_c(t) = \frac{\eta}{\eta + \delta^2\Theta}\left[\tilde{\pi}_c + \epsilon(t) - \frac{\delta\Theta(1 - \delta)}{\eta}\pi_n(t)\right]. \tag{6}$$

Equation (6) indicates that under discretion, the reaction function of the policymaker calls for setting controlled prices at a level that is less than the equilibrium level--incurring therefore a deadweight loss. The reason for this is, of course, the inflationary cost of an increase in controlled prices. The degree of accomodation of demand shocks is inversely related to the relative inflation-aversion coefficient, Θ/η. Also, the higher the (predetermined) level of prices in the "free" sector, the lower the rate of change of controlled prices.

Consider now the case (referred to as the "commitment" regime in what follows) in which the policymaker adopts a price-setting rule which takes the form 1/

$$\pi_c(t) = \Phi_0\tilde{\pi}_c + \Phi_1\epsilon(t). \tag{7}$$

Equation (7) indicates that the policymaker partially accomodates systematic equilibrium price changes as well as demand shocks (to a degree Φ_1) through unexpected adjustment in controlled prices. The authorities select values of Φ_0 and Φ_1 that minimize the unconditional expectation (5′) subject to (7) and, from (3) and (7), $\pi_n(t) = E_{t-1}\pi_c(t) = \Phi_0\tilde{\pi}_c$. The optimal values can be shown to be 2/

$$\Phi_0 = \eta/(\eta + \Theta), \qquad \Phi_1 = \eta/(\eta + \delta^2\Theta), \tag{8}$$

1/ As is well known, in a linear-quadratic setting such as the one considered here, the optimal rule will also be linear as in (7).

2/ Note that the choice of the policy rule is assumed to be made before the realization of the demand shock, although the actual level of controlled prices is set after observing $\epsilon(t)$.

where $0 < \Phi_0, \Phi_1 < 1$. A comparison of equations (6) and (8) shows that under rule (7), the policymaker accommodates demand shocks to the same extent as under discretion, but systematic changes in the equilibrium price are accommodated to a lesser extent than in the discretionary regime. This is because, under commitment, the policymaker can infer the endogenous response of price setters in the free sector through price expectations.

The (ex post) mean value of the inflation rate in the commitment regime is given by

$$E_t\pi(t) = \Phi_0\tilde{\pi}_c + \Phi_1\delta\epsilon(t), \tag{9}$$

and the (unconditional) expected loss is,

$$L^C = [\eta(\Phi_1 - 1)^2 + \Theta(\delta\Phi_1)^2]\sigma_\epsilon^2 + [\eta(\Phi_0 - 1)^2 + \Theta\Phi_0^2]\tilde{\pi}_c^2, \tag{10}$$

where σ_ϵ^2 denotes the variance of $\epsilon(t)$.

Under discretion, controlled prices are set by (6). Under rational expectations, the optimal solution is such that 1/

$$\pi_n(t) = \kappa\tilde{\pi}_c, \qquad 0 < \kappa < 1 \tag{11a}$$

$$\pi_c(t) = \kappa\tilde{\pi}_c + \lambda\epsilon(t), \qquad 0 < \lambda < 1 \tag{11b}$$

where $\lambda = \eta/(\eta + \delta^2\Theta) = \Phi_1$, and $\kappa = \lambda/[1 + \Theta\lambda\delta(1 - \delta)/\eta] = \eta/(\eta + \delta\Theta)$.

The (ex post) mean value of the inflation rate is in this case given by

$$E_t\pi(t) = \kappa\tilde{\pi}_c + \lambda\delta\epsilon(t), \tag{12}$$

with an (unconditional) expected loss given by,

$$L^D = [\eta(\lambda - 1)^2 + \Theta(\lambda\delta)^2]\sigma_\epsilon^2 + [\eta(\kappa - 1)^2 + \Theta\kappa^2]\tilde{\pi}_c^2 \tag{13}$$

1/ Note that $\pi_n(t)$ in (11*a*) differs from $\pi_c(t)$ in (11*b*) only by the last term, since demand shocks cannot be anticipated by price setters in the flexible price sector. They fully take into account the systematic component of the price controls policy, which implies that the policymaker's objective of reducing the deadweight loss creates only inflation and no real gains.

A comparison of equations (10) and (13) shows that, since $\kappa > \Phi_0$, $L^D > L^C$. The nature of this result can be explained as follows. Unless there is a binding arrangement forcing the policymaker to adjust prices so as to maintain equality between supply and demand, there exists a temptation to lower controlled prices below their equilibrium level in order to dampen inflationary expectations and reduce overall inflation. However, once the demand shock is realized, expectations are formed, and prices are set in the rest of the economy, the policymaker has an incentive to raise controlled prices and reduce the deadweight loss--or political cost--associated with the ceilings. Private agents understand this incentive, and will expect the authorities to follow the discretionary regime, no matter what regime is announced. As a result, in equilibrium prices in the uncontrolled sector are set at a higher level than they would otherwise be if the commitment regime was fully credible--at $\kappa\tilde{\pi}_c$ instead of $\Phi_0\tilde{\pi}_c$, see equations (7) and (11*a*). Inflation is therefore higher under imperfect credibility and entails an additional policy loss which depends on the size of the difference $(\kappa - \Phi_0)$. 1/

This time-inconsistency result helps explain why, as shown in Figure I, inflation may remain positive under a partial freeze. 2/ Price setters in the "free" sector understand the incentive that the policymaker has to raise controlled prices after private sector pricing decisions are taken--the reduction of the deadweight loss that ceilings entail. Therefore, they raise prices by more than they would

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1/ Note that the above result assumes that the rule followed in the commitment regime is the outcome of an optimization process. If the authorities adopt an *ad hoc* rule--of the type $\pi_c(t) = 0$, for instance--there will be no reason, in general, for the private sector to suspect that the authorities will depart from it, since the optimization process which indicates the incentive to renege has been eschewed. However, since the policymaker has chosen a policy arbitrarily, private agents will eventually realize that there is nothing that prevents him from choosing a different policy in an equally arbitrary way in the future. The outcome of this is nevertheless unclear, and may not yield any definite ranking between "commitment" and "discretionary" regimes.

2/ Existing explanations of this phenemonon follow along the lines of Paus (1991), who considers Peru's experience during the Emergency Plan implemented in 1985-86. The attempt to slow down inflation by holding back adjustments in government-determined prices led to a growing deficit of the nonfinancial public sector. The increase in the deficit had an expansionary effect on money supply which maintained inflationary pressures. The rationale proposed below, however, does not rely in any sense on lax monetary policy.

have if they had been convinced that the policymaker would keep his commitment to the pre-announced price rule. Consequently, the extent of "inflation inertia" results from the lack of credibility of price ceilings, and will in general be inversely related to the proportion of prices subject to control, δ. 1/ 2/

If the policymaker could make a binding commitment to a price-setting rule in the controlled sector, inflation would be lower under a partial freeze. 3/ However, unilateral commitments will usually lack credibility. In a dynamic context, a formal mechanism which entails reputational forces (and "punishment" strategies) may provide a commitment mechanism which could alleviate the time-inconsistency problem discussed above and provide a substitute for a binding agreement. Such reputational mechanisms have been discussed by Barro (1986) and Rogoff (1989), in a different context. But rather than focusing on these issues here, we turn to the question of whether price controls can be used to alleviate the time-inconsistency problem confronted by monetary policy.

III. The Optimal Intensity of Price Controls

We now generalize the model presented above so as to introduce monetary policy explicitly. The purpose of the analysis is to show that if the policymaker bears the macroeconomic--or political--cost resulting from price ceilings, then the intensity of price controls (the coefficient δ defined above) can be chosen so as to minimize the loss associated with a discretionary monetary policy.

As a first step in proving this result, let us assume that the equilibrium rate of change of prices in the controlled sector depends on (expected) changes in real money holdings, in addition to a stochastic shock and a deterministic component: 4/

1/ As a result, $\partial(L^D - L^C)/\partial\delta < 0$. Note that, from equations (8) and (11), under a complete freeze $\delta = 1$ and $\Phi_0 = \kappa$, so that the discretionary and commitment regimes yield the same outcome. This follows trivially from the fact that with comprehensive ceilings the inflationary bias of a discretionary regime disappears.

2/ A similar result would obtain in a framework where only prices in the free sector were subject to stochastic shocks.

3/ For instance, the commitment mechanism could take the form of a penalty imposed on the monetary authority so as to remove the incentive to exploit the temporary predeterminedness of price expectations.

4/ The introduction of money holdings captures the impact of a real balance effect on the "notional" demand for controlled goods.

$$\tilde{\pi}_c(t) = \bar{\pi}_c + \alpha[\mu(t) - E_{t-1}\pi(t)] + \epsilon(t), \qquad \alpha > 0 \tag{14}$$

where $\mu(t)$ denotes the rate of change of the nominal money stock.

Although the authorities know how the equilibrium price in the controlled sector is formed, they announce--prior to price setters' decisions--a deterministic policy rule of the type

$$\bar{\pi}_c(t) = 0. \tag{14'}$$

In the absence of a credible and well-defined commitment mechanism there is no reason, however, for price setters in the free sector to believe that the authorities will adhere to the announced rule--even if, once private price decisions are taken, they actually stick to it. This lack of credibility results essentially from the same type of time-inconsistency problem discussed above. In general, agents will attach a probability ($1 - \rho$, say) that the rule (14′) will be followed, and a probability ρ that controlled prices will be set according to (14). 1/ Prices in the flexible sector will therefore be set according to

$$\pi_n(t) = \rho E_{t-1}\tilde{\pi}_c(t) + (1 - \rho)E_{t-1}\bar{\pi}_c(t), \qquad 0 < \rho < 1 \tag{15}$$

or, using (14) and (14′):

$$\pi_n(t) \equiv E_{t-1}\pi_c(t) = \rho\bar{\pi}_c + \alpha\rho[E_{t-1}\mu(t) - E_{t-1}\pi(t)]. \tag{3'}$$

Using (4) yields $E_{t-1}\pi(t) = \pi_n(t)$. Equation (3′) can therefore be written as

$$\pi_n(t) = \frac{\alpha\rho}{1 + \alpha\rho}[E_{t-1}\mu(t) + (\bar{\pi}_c/\alpha\rho)] = \lambda E_{t-1}\mu(t) + \lambda\bar{\pi}_c/\alpha, \tag{16}$$

where $0 < \lambda < 1$.

It follows from (4) and (16) that, since the policymaker always implements the price rule (14′), the overall inflation rate is predetermined and given by $\pi(t) = (1 - \delta)\pi_n(t)$.

1/ In a dynamic framework, the probability of adhering to the price rule (14′) would be endogenous and would converge to unity if the policymaker sticks to the rule over time.

We now expand the loss function (5′), to account for a positive --and rising--cost associated with the degree of price controls, δ, as well as the effect of monetary surprises:

$$L_t = E_t[\eta(\pi_c(t)-\tilde{\pi}_c(t))^2 + \theta\pi(t)^2] + \Psi[\mu(t)-E_{t-1}\mu(t) - \Delta]^2 + c\delta^2, \qquad (18)$$

where c, $\Psi > 0$. $\Delta > 0$ is a distortion term which accounts for the difference between the natural level of output and the policymaker's "real" target. 1/

Following the procedure described above, the reaction function of the policymaker under discretion can be shown to be

$$\mu(t) = \Omega\left[(\lambda + \frac{\Psi}{\alpha^2\eta})E_{t-1}\mu(t) + \frac{(\lambda-1)}{\alpha}\tilde{\pi}_c + \frac{\Psi}{\alpha^2\eta}\Delta - \epsilon(t)/\alpha\right], \qquad (9)$$

where $\Omega = \alpha^2\eta/(\Psi + \alpha^2\eta)$, so that $0 < \Omega < 1$. Equation (19) indicates that the reaction function of the policymaker calls for partial accommodation of private agents' money growth expectations, since $\Omega(\lambda + \Psi/\alpha^2\eta) < 1$.

Under rational expectations, the equilibrium solution is

$$\mu(t) = \frac{\Psi\Delta}{\alpha^2\eta(1 - \lambda)} - \tilde{\pi}_c/\alpha - \Omega\epsilon(t)/\alpha, \qquad (20)$$

which indicates that the policymaker reacts to systematic price changes and demand shocks in the controlled sector by lowering the rate of expansion of the money stock.

Again, as before, we consider in the commitment case a monetary policy rule given by

$$\mu(t) = \Phi_0\tilde{\pi}_c + \Phi_1\epsilon(t) + \Phi_2\Delta. \qquad (21)$$

The optimal values of the parameters in (21) can be shown to be

$$\Phi_0 = - 1/\alpha, \qquad (22a)$$

1/ Monetary surprises are introduced, as in Cukierman and Meltzer (1986), to capture the "real" effects of monetary policy; see also Flood and Isard (1989). Note that implicit in our formulation is the assumption that the money market clears through changes in, say, interest rates.

$$\Phi_1 = -\frac{\alpha\eta}{\Psi + \alpha^2\eta} = -\Omega/\alpha < 0, \tag{22b}$$

$$\Phi_2 = 0. \tag{22c}$$

Equations (22) yield a rule that has the same form as (20)--except that there is no response to the distortion term Δ. Using (16) and (20)-(22), the (ex post) mean values of the inflation rate under discretion and commitment, respectively, are given by:

$$E_t\pi(t) = \frac{\lambda\Psi(1 - \delta)\Delta}{\alpha^2\eta(1 - \lambda)} = (1 - \delta)\frac{\rho\Psi}{\alpha\eta}\Delta, \tag{23a}$$

$$E_t\pi(t) = 0, \tag{23b}$$

while the (unconditional) expected loss functions are,

$$L^D = [\eta\Omega^2 + \Psi(\Omega/\alpha)^2]\sigma_\epsilon^2 + [\Theta(1 - \delta)^2(\frac{\rho\Psi}{\alpha\eta})^2 + \Psi]\Delta^2 + c\delta^2, \tag{24a}$$

$$L^C = [\eta\Omega^2 + \Psi(\Omega/\alpha)^2]\sigma_\epsilon^2 + \Psi\Delta^2 + c\delta^2. \tag{24b}$$

Equations (24) indicate that in general $L^D > L^C$. As before, the discretionary policy leads to a worse outcome than that which obtains under commitment. Since there is, in general, no way to convince the public that the monetary policy rule (21) will be followed, the policymaker also faces a time-inconsistency problem (Barro and Gordon, 1983). The policymaker has an informational advantage over the private sector, so policy interventions play some stabilizing role. However, leaving the policymaker free to stabilize entails a cost, by imparting an "inflationary bias" to the economy.

Since only the discretionary policy is time-consistent, the intensity of price controls--as measured by the coefficient δ--can be chosen so as to minimize the policy loss that monetary activism entails. 1/ To do so requires minimizing the expected loss function (24a) with respect to δ, which yields

$$\delta^* = \kappa/(\kappa + c), \qquad \kappa = \Theta(\rho\Psi\Delta/\alpha\eta)^2. \tag{25}$$

1/ A conceptually similar procedure is adopted by Rasmussen (1991), who determines the optimal degree of wage indexation in a model where the government faces a time-inconsistency problem with respect to its exchange rate policy.

Equation (25) indicates that the optimal intensity of price controls depends on the relative weights on inflation, price distortions in the controlled sector, and the "real" policy target in the policymaker's loss function, as well as the cost of enforcing controls, c. In the general case, $0 \leq \delta \leq 1$. For instance, the higher the weight attached to inflation in the loss function, the higher the intensity of controls ($\partial\delta^*/\partial\theta > 0$); the higher the cost associated with enforcing price ceilings, the lower the intensity of controls ($\partial\delta^*/\partial c < 0$). If the cost of enforcing controls is prohibitive ($c \rightarrow \infty$), the optimal intensity is zero. The same result obtains if the policymaker attaches a very high weight on price distortions ($\eta \rightarrow \infty$).

IV. Concluding Comments

Developing-country macroeconomists have often argued that once "fundamental factors" causing inflation--excessive monetary growth and the underlying budgetary deficit--have been put under control, there is no need to intervene directly in the formation of prices. Such actions have been viewed as not only unnecessary but also harmful, because they prevent the price system from performing its allocational function efficiently. Recent research has argued, however, that price controls may reduce inflation persistence in cases where price expectations are being formed under the belief that the stabilization effort is not sustainable, even though the government is determined to implement and sustain its effort. In this context, traditional policy measures may have relatively limited impact because inflationary expectations are rigid downwards. This may exacerbate the credibility problem and may lead to a collapse of the program. Price controls could be effective in signaling the authorities' policy stance and in "buying time" to take deeper adjustment measures and demonstrate the commitment to stabilize.

The purpose of this paper has been to re-examine the credibility argument for the implementation of price controls in stabilization programs. The analysis showed first that, by itself, a partial price freeze is time-inconsistent and may lead, paradoxically, to inflation persistence. This problem arises whenever a policymaker announces a policy rule that aims at maintaining controlled prices below their equilibrium level, so as to reduce the rate of price increase in the uncontrolled sector and therefore overall inflation. Once flexible prices are set and the demand shock occurs, however, the optimal policy is to raise controlled prices so as to reduce the deadweight loss associated with controls. Agents in the flexible price sector, understanding the temptation to follow the discretionary regime, will expect the authorities to act in a discretionary fashion, no matter what policy rule is announced. They therefore increase prices at a faster rate than they would otherwise. In the absence of an institutional mechanism that precommits the policymaker to adhere to a price adjustment rule, the "inflationary bias" of price controls will persist.

The analysis was then extended to show that the authorities may be able to determine optimally the intensity of price controls--that is, the proportion of prices subject to ceilings--so as to minimize the loss implied by a discretionary (or time-consistent) monetary policy. But this results in the effective imposition of price ceilings only if the cost of enforcing them is not too high, or if the weight attached to price distortions in the policymaker's loss function is small. Although the particular formula obtained for the optimal intensity of price controls depends on the specific setup used in the paper, the general implication of the result is likely to remain valid in a variety of settings.

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