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*Credibility Effects of Price Controls in Disinflation Programs**

This paper examines whether price controls may enhance the credibility of a disinflation program. The analysis indicates that a partial price freeze may paradoxically lead to inflation inertia. The authorities may determine optimally the intensity of price controls so as to minimize the policy loss associated with a discretionary monetary strategy. However, the optimal intensity of controls is 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.

1. Introduction

Price controls have been widely used in the context of stabilization programs in developing countries, despite well-known microeconomic costs.[1] In the mid-1980s, Argentina, Brazil and Israel launched anti-inflation plans with varying intensities of wage and price ceilings.[2] Figure 1 shows the behavior of the inflation rate in Argentina, Brazil and Israel before, during and after the imposition of price controls. The figure shows, first, that inflation remained positive (well above 1% per month in Argentina and Brazil) during the price freeze. Second, it shows that while 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.

The conventional view is that the limited effect of price controls on inflation in Argentina and Brazil resulted from lax monetary and fiscal policies (Kiguel and Liviatan 1992). In this paper a different argument, based on the time inconsistency proposition advanced by Barro and Gordon (1983), is used

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[1]Various rationales have been offered for the imposition of price controls. 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 (Persson and van Wijnbergen 1993). A previous version of this paper discusses these views in more detail and is available upon request.

[2]On these experiments, see Kiguel and Liviatan (1992).

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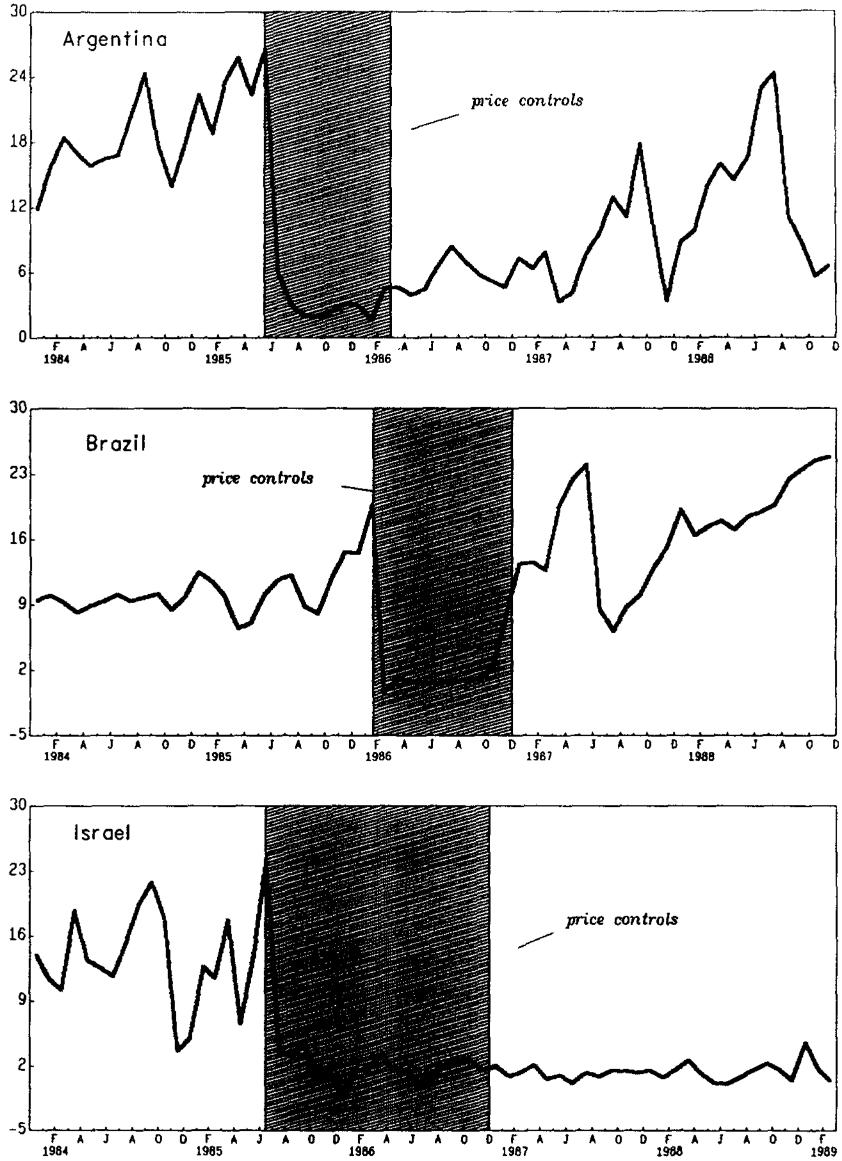

Figure 1.
Inflation and Price Controls in Heterodox Programs
(Month-to-month percentage changes in consumer prices)

to explain why inflation may remain positive during a price freeze. In addition, we also provide a rationale as to why countries may opt for varying the intensity of price controls—the proportion of goods whose prices are subject to ceilings—in the context of stabilization programs. In contrast to existing studies, we consider these issues by modeling directly the imposition of price ceilings. Section 2 discusses the time-inconsistency problem faced by a price-control policy and its implications for inflation inertia. Section 3 examines the role of the intensity of controls in minimizing the policy loss associated with an imperfectly credible monetary policy.

2. 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) 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 a large number of homogeneous goods, a proportion of which (such as goods produced by public enterprises) are subject to direct price controls by the policymaker. A reduction in inflation is assumed to increase political support while deadweight loss from excess demand, resulting from misallocation of resources and nonprice rationing, reduces it, since real income is reduced.[3] Price ceilings are chosen so as to maximize political support from holding prices down (below equilibrium), against the opposition resulting from this deadweight loss. Firms in the uncontrolled or "free" sector restrain price increases beyond the expected rise in controlled prices in order to avoid more stringent controls in the future.

Let $p_c(t)$ denote the logarithm of an index of the subset of prices set by the policymaker in period t and let $\tilde{p}_c(t) \leq p_c(t)$ be the market-clearing equilibrium price, that is, the price that would obtain in the absence of price controls. 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

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

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. Equa-

[3]In general, as shown by Helpman (1988), price controls do not necessarily lead to a situation of excess demand. In practice, however, this has been the case in most heterodox stabilization programs, with shortages developing rapidly. See Kiguel and Liviatan (1992).

tion (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.[4] The market-clearing equilibrium price is assumed to be determined by

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

where $\tilde{\pi}_c(t) \equiv \tilde{p}_c(t) - \tilde{p}_c(t-1)$ and ϵ_t denotes a stochastic shock, which is assumed serially uncorrelated with zero mean and constant variance. The probability distribution from which ϵ_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 ϵ_t:

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

where $E_{t-1}z_t$ denotes the conditional expectation of z_t based on information available up to the end of time $t-1$.[5]

Setting $\pi_t \equiv p_t - p_{t-1}$, 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 uses controlled prices to offset some of the effect of ϵ_t on the deadweight loss, for instance, by unexpectedly raising these prices when ϵ_t turns out to be positive.

The policymaker's preferences entail a trade-off between inflation and the deadweight loss resulting from price controls. Specifically, the policymaker aims at minimizing the expected loss function:

$$L_t = E_t[D_t + \Theta\pi_t^2] \,, \qquad \Theta > 0 \,, \tag{5}$$

[4] 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).

[5] The information set up to $t-1$ is common to all agents and includes all relevant data on the policymaker's incentives and constraints.

or, using (1) and (2),

$$L_t = E_t[\eta(\pi_c(t) - \tilde{\pi}_c - \epsilon_t)^2 + \Theta\pi_t^2] \,. \tag{5'}$$

Under discretion, the policymaker chooses $\pi_c(t)$ in each period so as to minimize (5′) subject to (4), without regard to the announced policies, and taking private sector expectations as given. The rate of change of controlled prices is thus 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 below 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.

Consider now the "commitment" regime in which the policymaker adopts a price-setting rule that takes the form[6]

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

Equation (7) indicates that the policymaker partially accomodates systematic equilibrium price changes as well as demand shocks (to a degree Φ_1) through 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[7]

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

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. 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 inflation under commitment is

$$E_t\pi_t = \Phi_0\tilde{\pi}_c + \Phi_1\delta\epsilon_t \,, \tag{9}$$

[6]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).

[7]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 ϵ_t.

and the (unconditional) expected loss is given by

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

where σ_ϵ^2 denotes the variance of ϵ_t.

Under discretion, controlled prices are set by (6). Under rational expectations, the optimal solution is such that[8]

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

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

where $\lambda = \eta/(\eta + \delta^2\Theta) = \Phi_1$, $\kappa = \lambda/[1 + \Theta\lambda\delta(1 - \delta)/\eta] = \eta/(\eta + \delta\Theta)$. Under both discretion and commitment, a price freeze ($\pi_c(t) = 0$) is optimal when the weight on inflation in the policymaker's loss function is high, that is, $\Theta \to \infty$.

The (ex post) mean value of inflation under discretion is given by

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

with an (unconditional) expected loss given by

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

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. Inflation is therefore higher under imperfect credibility and entails an additional policy loss, as in the standard Barro-Gordon framework.

This result helps explain why, as shown in Figure 1, inflation may remain positive under a partial freeze, without assuming that monetary policy is expansionary. Price setters in the "free" sector understand the policymak-

[8]Note that $\pi_n(t)$ in (11a) differs from $\pi_c(t)$ in (11b) 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.

er's incentive to raise controlled prices after private pricing decisions are taken. Thus, they raise prices by more than they would have if they had been convinced that the policymaker would keep his commitment to the preannounced price rule. Consequently, the extent of "inflation inertia" results from the lack of credibility of price ceilings, and is inversely related to the proportion of prices subject to control, δ.[9]

If the policymaker could make a binding commitment to a price-setting rule, inflation would be lower under a partial freeze. However, unilateral commitments will usually lack credibility. In a dynamic context, a formal mechanism that entails reputational forces may provide a commitment mechanism that could alleviate the time-inconsistency problem discussed above and provide a substitute for a binding agreement (see Rogoff 1989). But rather than focusing on these issues here, we turn to the determination of the optimal intensity of price controls when monetary policy also faces a time-inconsistency problem.

3. 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. This would thus provide a rationale for explaining different intensities of price controls across countries.

We begin by assuming that the equilibrium rate of change of prices in the controlled sector depends on unexpected changes in real balances, in addition to a stochastic shock and a deterministic component:[10]

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

where μ_t denotes the rate of change of the nominal money stock.

Although the authorities understand the mechanism through which the equilibrium price in the controlled sector is formed, they announce, prior to price setters' decisions, a deterministic policy rule of the type

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

[9]Note that, from (8) and (11), $\delta = 1$ and $\Phi_0 = \kappa$ under a complete freeze, so that the discretionary and commitment regimes yield the same outcome. This follows trivially from the fact that with comprehensive controls the inflationary bias of a discretionary regime disappears.

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

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).[11] Prices in the flexible sector will therefore be set according to

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

or, using (14) and (14′),

$$\pi_n(t) = E_{t-1}\pi_c(t) = \rho\tilde{\pi}_c + \alpha\rho[E_{t-1}\mu_t - E_{t-1}\pi_t]\,. \tag{3′}$$

Using (4) yields $E_{t-1}\pi(t) = \pi_n(t)$. Equation (3′) can thus be written as, with $0 < \lambda < 1$,

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

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 $\pi(t) = (1 - \delta)\pi_n(t)$.

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,

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

where c, $\psi > 0$. $\Delta > 0$ is a distortion term that accounts for the difference between the natural level of output and the policymaker's "real" target.[12]

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

$$\mu(t) = \Omega\left[\left(\lambda + \frac{\psi}{\alpha^2\eta}\right)E_{t-1}\mu_t + \frac{(\lambda - 1)}{\alpha}\,\tilde{\pi}_c + \frac{\psi}{\alpha^2\eta}\,\Delta - \epsilon_t/\alpha\right], \tag{19}$$

where $\Omega = \alpha^2\eta/(\psi + \alpha^2\eta)$, so that $0 < \Omega < 1$. Equation (19) indicates that the policymaker partially accommodates private agents' money growth expectations, since $\Omega(\lambda + \psi/\alpha^2\eta) < 1$.

[11]In a fully dynamic framework, ρ would be endogenous.

[12]Monetary surprises are introduced, as in Cukierman (1992), to capture the "real" effects of monetary policy.

Under rational expectations, the equilibrium solution is

$$\mu_t = \frac{\psi\Delta}{\alpha^2\eta(1-\lambda)} - \tilde{\pi}_c/\alpha - \Omega\epsilon_t/\alpha\,, \tag{20}$$

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

$$\mu_t = \Phi_0\tilde{\pi}_c + \Phi_1\epsilon_t + \Phi_2\Delta\,. \tag{21}$$

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

$$\Phi_0 = -1/\alpha\,,$$

$$\Phi_1 = -\frac{\alpha\eta}{\psi+\alpha^2\eta} = -\Omega/\alpha < 0\,,$$

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

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

$$E_t\pi_t = \frac{\lambda\Psi(1-\delta)\Delta}{\alpha^2\eta(1-\lambda)} = (1-\delta)\frac{\rho\Psi}{\alpha\eta}\Delta\,, \qquad E_t\pi_t = 0\,, \tag{23}$$

while the (unconditional) expected loss functions are

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

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

Equations (24) indicate that in general $L^D > L^C$. As before, the discretionary policy leads to a worse outcome than what is obtained under commitment. Since the policymaker cannot convince the public that the monetary policy rule (21) will be followed, the time-inconsistency problem leads to an "inflationary bias," as in Barro and Gordon (1983).

Since only the discretionary policy is time-consistent, the intensity of price controls, as measured by δ, can be chosen so as to minimize the policy loss that monetary activism entails.[13] To do so requires minimizing expected loss (24a) with respect to δ, which yields

[13]A conceptually similar procedure is adopted by Rasmussen (1993), who determines the

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

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 ($c \to \infty$), the optimal intensity is zero. The same result obtains if the policymaker attaches a very high weight on price distortions ($\eta \to \infty$). Finally, when the weight on inflation in the policymaker's loss function is very high ($\Theta \to \infty$), the optimal policy calls for a complete price freeze ($\delta^* = 1$). These results help explain why the intensity of price controls may vary across countries, by relating the choice of δ to underlying policy preferences.

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