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THE LITERATURE ON THE INFLATION BIAS that can arise under discretionary monetary policy has emphasized the value of establishing a reputation for following credible policies designed to sustain low inflation. The ability to achieve such a reputation can depend on the institutional structure that governs the conduct of monetary policy. Because of this, a great deal of interest has been generated by the Reserve Bank of New Zealand Act of 1989. This Act was designed to give New Zealand's Reserve Bank greater independence from political influence, establish a single objective for monetary policy (price stability), and ensure accountability on the part of the Reserve Bank for the achievement of its policy objective. The basic structure of the Reserve Bank Act has been cited as a useful model for other countries (Willett 1994), but little formal analysis of the new law has yet appeared in the literature. Dawe (1993) provides a discussion of the Reserve Bank Act, while Fischer (1993) interprets New Zealand's monetary policy under the Act as an inflation-targeting policy and provides an excellent discussion of such policies. Buckle and Stemp (1991) formally analyze policy under the Act as equivalent to a price-level-targeting policy. These approaches capture some aspects of New Zealand's new policy process, but they neglect other aspects and thus may not provide a complete evaluation of the unique institutional changes contained in the Reserve Bank Act.

The Act specifies a complex set of relationships between the Reserve Bank and

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the government. These cover such issues as the appointment and reappointment procedures for the Governor of the Reserve Bank, the establishment of short-run inflation targets, and the conditions under which these targets may be modified. The Act essentially establishes a contract between the central bank and the government; the nature of this contract determines the incentives facing the Reserve Bank and, as a result, affects the conduct of monetary policy. Viewing central bank institutions as contracts leads one naturally to ask what sorts of incentives such contracts should establish for the central bank, and to ask whether the contract implicit in New Zealand's new Act is in some sense optimal. The purpose of this paper is to evaluate the Act using the principal-agent approach to central bank design developed in Walsh (1993, 1995) and Persson and Tabellini (1993).

An overview of the Reserve Bank Act is provided in section 1. The key aspects of the legislation likely to affect the conduct of monetary policy are discussed, and it is argued that the Act establishes a dismissal rule for the Reserve Bank Governor. Section 2 then derives an optimal dismissal rule which is used in section 3 to evaluate the Reserve Bank Act. Conclusions are summarized in section 4.

1. THE RESERVE BANK ACT

The Reserve Bank Act took effect on February 1, 1990, and was part of a broader governmental reform program designed to increase accountability in the public sector. The Act's purpose was to establish a clear and achievable policy objective for which the Reserve Bank could be held accountable. New Zealand's central banking reforms were motivated by its poor inflation performance (see Fischer 1993). As Table 1 shows, relative to the rest of the OECD, inflation was higher in New Zealand prior to the first oil price shock in 1973, New Zealand's inflation rate rose more during the 1970s, and it fell less after the general shift by OECD countries to disinflationary policies in the first half of the 1980s. Except for the temporary impact of wage and price controls in 1982–1984, inflation fluctuated around the 12–15 percent level from the mid-1970s until 1986.[1] While piecemeal reform in the mid-1980s gave the Reserve Bank the tools to achieve price stability as early as 1985 (Walsh 1988), previous unsuccessful attempts to reduce inflation meant the Reserve Bank lacked the credibility necessary to minimize the output costs of disinflation and to maintain low inflation.

The "Functions and Powers of the Reserve Bank" are set out in Part II of the Act. Sections 8–15 deal directly with monetary policy, setting out both a policy objective and a mechanism for the formulation and implementation of policy designed to achieve the mandated objective. The objective for monetary policy is specified in section 8: "The primary function of the Bank is to formulate and implement monetary policy directed to the economic objective of achieving and maintaining stability

1. In late 1986, the Government introduced a 10 percent general sales tax (GST) that temporarily pushed up the rate of inflation during 1987. In 1989, this tax was raised to 12.5 percent, adding about 2 percentage points to the inflation rate from mid-1989 through mid-1990.

TABLE 1

ANNUAL INFLATION RATES (CPI)

	New Zealand	OECD	United States	United Kingdom
1962–1972	4.92	3.98	3.25	4.82
1973–1979	12.20	9.52	7.87	13.67
1980–1985	12.09	7.73	6.55	8.54
1986–1992	6.90	4.37	3.79	5.45
1990–1992	3.17	4.88	4.13	6.13
1992–1994	1.35	4.17	2.86	2.58

SOURCE: OECD Main Economic Indicators

in the general level of prices." This is the complete text of section 8; while price stability is made the "primary function" of monetary policy, no other objectives, such as employment or growth, that might serve as secondary objectives and possibly conflict with price stability are even mentioned. In contrast, the previous legislation (the Reserve Bank Zealand Act of 1964) ordered monetary policy to "be directed to the maintenance and promotion of economic growth and social welfare in New Zealand, having regard to the desirability of promoting the highest level of production and trade and full employment, and of maintaining a stable internal price level" (section 8, Reserve Bank of New Zealand Act of 1964, quoted in Buckle and Stemp 1991, p. 56).[2]

Monetary policy is to be formulated in terms of targets: the Finance Minister "shall, before appointing, or reappointing, any persons as Governor, fix, in agreement with that person, policy targets for the carrying out by the Bank of its primary function during that person's term of office, or next term of office, as Governor." These targets may be revised by agreement between the Governor and the Finance Minister as long as any new targets are recorded in writing and published in the *Gazette* of the House of Representatives. The first policy target agreement (PTA) was signed in March 1990. This was revised in December 1990 (after the defeat of Labour by the National Party in October 1990) and again in December 1992. While the 1990 PTAs directed the Bank to implement monetary policy toward "achieving" and "maintaining" a stable price level, the 1992 PTA (which is currently in effect) recognized the success New Zealand has experienced in reducing inflation by framing policy only in terms of "maintaining" price stability.

Each PTA has also included a definition of price stability, considered to be an inflation rate of 0 to 2 percent as measured by the Department of Statistics' Consumer Price Index (CPI). In practice, the Reserve Bank initially focused on a housing-adjusted measure of inflation and, more recently, on an estimate of "Underlying Inflation." Each PTA has also allowed for deviations from the target if the inflation rate as measured by the CPI diverges significantly from the rate measured by a price index that excludes the interest cost component of the CPI.

The PTA also sets out conditions under which the Reserve Bank might deviate

2. Section 10(a) of the new Act does state, however, that in implementing monetary policy, the Reserve Bank should take into account the "efficiency and soundness" of the financial system.

from the target. Significantly, the developments that would justify deviations from the 0–2 percent target range are all aggregate supply in nature: terms of trade price shocks from external sources, changes in indirect tax rates, a natural disaster or major fall in livestock numbers due to disease, and price level changes resulting from government levies.

The Act is explicit in assigning responsibility for achieving the targets set out in the PTA. According to section 41(1), "It is the duty of the Governor to ensure that the Bank carries out the functions imposed on it by this Act." And failure to achieve the policy targets can lead to the removal of the Governor; section 49 is titled "Removal of Governor from office" and it states "—(1) The Governor-General may, by order in Council, on the advice of the Minister, remove the Governor from office. (2) The Minister may tender advice under subsection (1) of this section if the Minister is satisfied—. . . (d) That the performance of the Governor in ensuring that the Bank achieves the policy targets fixed under section 9 or section 12 (7)(b) of this Act has been inadequate."[3]

While viewing New Zealand's Reserve Bank Act of 1989 as an inflation-targeting policy [as do Buckle and Stemp (1991) and Fischer (1993)] is clearly consistent with the broad outlines of the Act, it neglects much of the unique institutional structure set out in the Act and, in particular, the Act's attempt to make the Governor accountable for achieving price stability. As is well known, inflation targeting is not an optimal policy in the presence of supply shocks. Thus, if the Act is simply an inflation-targeting policy, it must be suboptimal. But the PTAs have explicitly recognized that targets may need to be changed in the face of supply shocks, so the Act has produced something more sophisticated than pure inflation targeting.

The Policy Target Agreement called for in the Reserve Bank Act represents an employment contract between a principal (the government) and an agent (the Governor of the Reserve Bank); it spells out the objectives for monetary policy and a measure, the rate of inflation, by which the Governor's performance will be judged. It also specifies the conditions under which the target inflation rate can be altered. Given this performance measure, the Governor is free to conduct policy with discretion and without direct interference.[4] Among the key aspects of the contract are (1) the specification of an explicit policy objective (price stability); (2) the use of realized inflation measured by a specific price index as a performance measure, with the Governor subject to dismissal if inflation exceeds a critical level; and (3) a procedure for renegotiating the inflation outcomes that would lead to dismissal in light of certain specific economic disturbances. In order to adequately evaluate the Act, therefore, it is necessary to have a framework that can capture the role a dismissal

3. The Bank must also make periodic policy statements as set out in section 15: "Policy statements—(1) Within 3 months after the commencement of this Act, and at intervals of not less than 6 months after publication of each preceding statement, and, if directed by the Minister, more frequently, the Bank shall deliver to the Minister and publish a policy statement for the next 6 months or for such other period as may be specified by the Minister in any direction to the Bank."

4. Unlike the situation in the United States, where a committee (the FOMC) is responsible for monetary policy decisions, the Governor of the Reserve Bank is solely responsible for the conduct of monetary policy in New Zealand.

rule can play in affecting the incentives faced by the central banker and the conduct of monetary policy.

2. OPTIMAL DISMISSAL RULES FOR CENTRAL BANKERS

Within the context of the standard Barro-Gordon framework, Walsh (1995) showed that a simple contract that makes the rewards to the central banker [the Governor's income, the central bank's budget, or perhaps, as suggested by Persson and Tabellini (1993), the central bank's prestige] a linear function of the rate of inflation eliminates the inflationary bias of discretionary policy while ensuring an optimal policy response to aggregate supply shocks. Persson and Tabellini (1993) extend this result and compare the contracting approach based on observable performance measures to the legislative establishment of central bank independence. State-contingent wage contracts, however, may be difficult to implement, and it is often argued that central bankers are not sufficiently motivated by personal gain to respond directly to financial incentives. When financial transfers are restricted, a general result from the principal-agent literature is that the threat to dismiss the agent can play a role in the optimal contract (see Singh 1982). If central bankers care about holding office, the Reserve Act, with its threat to fire the Governor, raises the cost to the Governor of engaging in excessive money growth and may serve to enforce a low-inflation policy.

Walsh (1993) showed that the socially optimal commitment policy could be sustained if the central banker was fired whenever inflation exceeded a critical level. In that paper, however, the central bank had an important information advantage relative to the public with respect to aggregate supply disturbances, and the possibility that the government might renegotiate with the central bank, as allowed for in the PTAs, was not considered. To analyze the implications of the Reserve Bank Act, it is necessary to extend this earlier work. The incentive for the government and the central banker to renegotiate the target inflation rate will depend on the degree to which nominal wages can respond to the same information used by the central banker in setting policy. Consequently, in order to study renegotiation, I follow Blinder and Mankiw (1984), Duca (1987), and Waller (1992) in assuming there are two sectors of the economy that differ in their price- and wage-setting behavior; while both sectors are characterized by one-period nominal wage contracts, wages in one sector are set prior to observing an economy wide supply shock, while the other sector is able to condition its nominal wage on the supply shock. The two-sector framework provides a means of studying how the optimal dismissal rule is affected when some agents are able to respond to the same news as the central banker about aggregate supply shocks.

It is assumed that, ex ante, the government has as its objective the minimization of the present discounted value of a social cost function that depends on output deviations around a target level and on inflation fluctuations. This cost function for period t is given by

$$S = \frac{1}{2}(y - y^c - k)^2 + \frac{1}{2}\beta\pi^2 \tag{1}$$

where y is the log of output, $k > 0$ is the difference between the policymaker's target (log) output level and the log of the equilibrium average output level, y^c; π is the rate of inflation.

In sector one, nominal wages are set before any information on the current period's disturbances is available; sector two sets nominal wages after observing the aggregate supply shock. Output in each sector is produced according to a Cobb-Douglas production function of the form $y_i = Y + \alpha n_i + e$ where y_i is the natural log of output in sector i, n_i is the natural log of employment in sector i, and e is an economy wide aggregate supply shock. The supply shock is taken to be a serially uncorrelated process drawn from a distribution with mean zero. If the nominal wage is set equal to the value expected to clear the labor market, and each sector faces an inelastic supply of labor, the natural log of real aggregate output is given by

$$y = y^c + \frac{\alpha}{1 - \alpha}(\pi - \pi^e) + \frac{1 + \alpha(1 - s)}{1 - \alpha}e \tag{2}$$

where s is the fraction of the economy in sector one, and π^e is a weighted average of the inflation rate expected by each sector: $\pi^e = s\pi_1^e + (1 - s)\pi_2^e$ (see Waller 1992). If all wages are set before e is observed (that is, $s = 1$), the model is essentially that of Rogoff (1985).

The link between money growth and inflation is given by

$$\pi = m + v \tag{3}$$

where m is the rate of money growth and v is a velocity shock, assumed to be a mean zero, white noise process, distributed independently from e. The central bank's policy instrument is the money growth rate m.

Since the PTAs have emphasized the measurement issues involved in picking a specific price index to use in defining the Reserve Bank's policy objectives, assume that π is not directly observed but that, instead, the central bank and the government observe a measured rate of inflation that is related to π according to equation (4):

$$\pi^m = \pi + b + \xi \tag{4}$$

where b is any average bias and ξ is a mean zero, serially uncorrelated stochastic measurement error. Fischer (1993) cites an estimate due to Rae, Lloyd, and Fung (1992) suggesting inflation as measured by New Zealand's CPI has an upward bias of about .5 percentage points relative to a theoretical cost-of-living index, implying a value of .5 for b.

The presence of both hidden information and hidden actions needs to be recog-

nized in designing mechanisms to affect central bank behavior. To do so, it is assumed the central bank has a private, unverifiable forecast v^f of the velocity shock and that only a monetary aggregate, $M = m + \omega$, is publicly observable, where ω is a mean zero money multiplier disturbance. The central bank is able to condition its policy response on v^f (and e), but because the government (and the public ex post) is able to observe only M and π^m, the central bank's setting for m and its forecast of v are unverifiable. This means the government cannot simply specify a complete state-contingent policy rule (that is, a value of m for every possible realization of e and v^f) and fire the central banker if deviation from this rule occurs.[5]

Ex post, the government and the public have the same information as the central bank with respect to supply disturbances.

From (3) and (4), we can write $\pi^m = m + v^f + (v - v^f) + b + \xi = m + v^f + b + \phi$ where $\phi = (v - v^f) + \xi$. Denote the marginal and cumulative density functions of ϕ by $f(\,)$ and $F(\,)$. The function $f(\,)$ is assumed to be continuous and symmetric around $\phi = 0$.

The optimal commitment policy can be shown to equal

$$m^c(e, v^f) = -\delta^c e - v^f \tag{5}$$

where $\delta^c = sa[1 + \alpha(1 - s)]/(1 - \alpha)[(sa)^2 + \beta]$ and $a = \alpha/(1 - \alpha)$.[6] Under this policy, the response to the supply shock reflects the fact that e is publicly observed after contracts in sector one are signed. Consequently, the central bank has a partial informational advantage, so any systematic monetary policy response to e will affect output. If $e < 0$ is observed, for example, output will be low relative to its mean. It is optimal to not fully insulate inflation but to allow inflation to rise to partially offset the decline in output. The optimal effect on inflation is $-\delta^c e$. If all contracts are signed after e is observed ($s = 0$), $\delta^c = 0$ and the optimal commitment policy reduces to $m^c = -v^f$. Even when $s \neq 0$, however, the optimal policy always involves using m to fully offset v^f.

As is well known, this policy is not time consistent. The government cannot commit to deliver a zero rate of inflation on average. If there exists a large supply of identical potential central bankers, however, the government can credibly commit to fire the central banker whenever inflation gets too high. The commitment is credible because carrying it out is costless for the government.

The threat of dismissal will only affect the conduct of monetary policy if the central banker receives utility from being in office. Following Fratianni, von Hagen, and Waller (1995), assume that the central banker cares about expected social costs as given in (1) *and* about being in office. Let V denote the direct per period utility to the central banker from holding office. Assuming that there is no limit on the num-

5. This type of dismissal rule and its interaction with the optimal term length is analyzed by O'Flaherty (1990).

6. This result is derived in an Appendix available from the author.

ber of periods the central banker potentially can serve, the central banker's problem is equivalent to a sequence of single-period decision problems that involve choosing the money growth rate in period t to maximize

$$W = V - E(S) + \rho\theta\bar{U} \tag{6}$$

where ρ is the central banker's subjective discount factor, θ is the probability of reappointment, and $\bar{U}$, which is independent of the central bank's current decisions, is the expected utility from holding office at $t + 1$.[7]

Suppose the government offers a potential central banker an employment contract in which the central banker will be free to conduct policy under discretion but will be fired if measured inflation exceeds a critical rate $\pi^*(e)$ which may depend on the realization of the aggregate supply shock. Assume the fixed wage payment is such that the candidate accepts this contract. Nominal wages in sector one are then set, after which e is observed. Wages in sector two are then set, the central banker obtains a forecast of v and sets its instrument m, acting with discretion, and taking as given the public's expectations of inflation. Finally, measured inflation is observed, and the central banker is reappointed if and only if $\pi^m \leq \pi^*(e)$.

The probability of reappointment, θ, equals the probability that measured inflation is less than or equal to π^*, conditioned on the central bank's information set:

$$\theta = \text{Prob}(m + v + b + \xi \leq \pi^*/e,\ v^f) = F(\pi^* - m - v^f - b). \tag{7}$$

Faster money growth, ceteris paribus, increases the probability that measured inflation will exceed π^* and thereby reduces the probability that the central banker will be reappointed.

Using equations (1)–(3), and (7), the first-order condition for the central bank's choice of m to maximize the objective function given by (6) can be written as

$$ak - [a^2 + \beta]\mu + a^2\pi^e - \frac{a[1 + \alpha(1 - s)]}{1 - \alpha}\, e - \rho\bar{U}f(\pi^* - \mu - b) = 0 \tag{8}$$

where $\mu = m + v^f$.[8] In forming their expectations, the public is aware that m is set to satisfy (8). Under rational expectations, the time-consistent rate of money growth that maximizes central bank utility, given that the public's expectations are consistent with the central bank's decision problem, is the solution to

$$m^{rd} = \frac{ak}{\beta} - \frac{\rho\bar{U}}{\beta}\, E(f) - \frac{\rho\bar{U}(f - E(f))}{sa^2 + \beta} - \delta^{rd}e - v^f \tag{9}$$

7. If $\bar{U} \equiv U_{t+1}$ is defined as the value of holding office at $t + 1$, then $U_{t+1} = V + \rho\theta_{t+1}U_{t+2}$. Since ρ_{t+1}, θ_{t+1}, and U_{t+2} do not depend on decisions taken during period t, the central banker's problem reduces to a single-period decision problem with the objective function given in (6).

8. The second-order condition for the central banker's maximization problem is satisfied as long as $f' \leq (a^2 + \beta)/\rho\bar{U}$ where f' is the partial derivative of f.

where E denotes expectations formed prior to observing e, $\delta^{rd} = a[1 + \alpha(1 - s)]/(1 - \alpha)[sa^2 + \beta] \geq \delta^c$ and $f(\,)$ is evaluated at $\pi^* - m^{rd} - v^f - b$.

Since m^c minimizes S under commitment, it will be optimal for the government to choose π^* so that $m^{rd} = m^c$ if it can do so. Using (5), equation (9) can be written as

$$m^{rd} = m^c + \frac{ak - \rho\bar{U}E(f)}{\beta} - \rho\bar{U}\frac{f - E(f)}{sa^2 + \beta} + [\delta^c - \delta^{rd}]e \,. \tag{10}$$

In order to implement the socially optimal commitment policy, the government must pick π^* in such a way that the last three terms on the right side of (10) sum to zero. This requires

$$f(\pi^* - \pi^c - b) = \frac{ak}{\rho\bar{U}} + Ae \tag{11}$$

where $\pi^c = -\delta^c e$ is the rate of inflation under the commitment policy and $A = [sa^2 + \beta][\delta^c - \delta^{rd}]/\rho\bar{U}$.[9] Using the definitions of δ^c and δ^{rd}, it can be shown that for $s < 1$, $A < 0$. If $s = 1$ (all contracts signed before e is observed), $A = 0$.

For a solution $\pi^*(e)$ to (11) to exist, it is necessary that $ak/\rho\bar{U} + Ae \leq \max f(\phi) = f(0)$. The central banker must earn sufficient utility from holding office ($\rho\bar{U}$) to make the chance of being dismissed offset the incentive to inflate. And the aggregate supply shock cannot be too bad (since $A < 0$). As long as $ak/\rho\bar{U} + Ae \leq f(0)$, however, the optimal commitment policy can be sustained under discretion if the central banker is fired whenever measured inflation exceed the critical rate π^*.[10] Since the right side of (11) is independent of the characteristics of any measurement bias in π^m, π^* is increased to reflect fully any average measurement bias: $\partial\pi^*/\partial b = 1$. Neither π^c nor π^* are functions of v^f. Under discretion, the central bank will optimally offset expected velocity shocks; the government, therefore, need not observe, or verify, the central bank's forecast of v^f. Thus, the central bank can have private information on v, as in Canzoneri (1985), without affecting the optimal reappointment policy or the achievability of the socially optimal commitment policy.

3. IS THE RESERVE BANK ACT OPTIMAL?

According to the analysis presented in the previous section, the optimal commitment policy can be sustained by a dismissal policy based on the measured rate of

9. π^* must also satisfy the second-order conditions for the central banker's problem.

10. Since $f(\,)$ is symmetric, both $\pi^* - \pi^c - b = z > 0$ and $\pi^* - \pi^c - b = -z < 0$ will be solutions to (11) where $f(z) = f(-z) = ak/\rho\bar{U} + Ae$. The second-order condition for the central banker's decision problem is definitely satisfied for $f' \leq 0$, which occurs when $\pi^* - \pi^c - b > 0$; this is the solution discussed in the text. If $\pi^* - b < \pi^c$, $f' > 0$ and faster money growth reduces the marginal reappointment cost of additional money growth. If this effect is sufficiently large, the second-order condition could be violated. Setting $\pi^* - b < \pi^c$ implies the central banker is dismissed even if π^c is delivered. The relevant solution would seem to be $\pi^* - b > \pi^c$.

inflation. The government must establish a critical inflation rate π^* and fire the central banker whenever actual inflation exceeds this value. The critical rate should be a function of aggregate supply disturbances and measurement error in the observed inflation rate, but it should be independent of aggregate demand shocks. This is exactly what the Policy Target Agreements required by the Reserve Bank Act do. The government and the Reserve Bank Governor set a target rate of inflation. This target is state contingent. It can be adjusted on the basis of aggregate supply considerations; it cannot be adjusted in light of aggregate demand disturbances. Thus, the government and the Reserve Bank set target rates that correspond to $\pi^*(e)$. If inflation exceeds the target, the Governor can be dismissed. In addition, the target rates established in the PTAs appear to have reflected concerns about measurement error in the CPI, as the previous analysis suggested should be the case.

The Reserve Bank Act of 1989 seems to mimic quite well the firing rule designed to sustain the socially optimal commitment policy. However, two important qualifications are in order. First, a dismissal policy based on the measured rate of inflation will sustain the socially optimal policy if and only if the central banker cares about holding office *and* shares society's preferences with respect to output and inflation fluctuations. Second, the optimal dismissal policy must be renegotiation-proof.

The central bank preferences given in equation (6) depend on the utility from holding office *and* the social loss suffered from output fluctuations and from inflation. If the central banker cares only about reappointment, the banker will set m to maximize reappointment probability. This means that m will be set equal to $m^c(e, v^f)$ if and only if the probability of reappointment is maximized at $\pi = -\delta^c e = \pi^c$. This could be achieved if reappointment is a function of $(\pi^m - \pi^c - b)^2$, for example. This represents a two-sided firing rule under which the central banker would be fired if actual inflation falls sufficiently below π^c as well as if it exceeds π^c. When the central banker cares about V, the dismissal threat is one sided (that is, only fire if inflation exceeds some critical value), since the role of the threat is to offset the positive inflation bias that arises when the central banker is granted discretion. A one-sided threat is more consistent with the focus on the positive inflation bias that arises under discretion. According to the current Governor of the Reserve Bank, in the face of aggregate supply shocks, "monetary policy should in principle accommodate at least part of the adjustment" (Brash 1993, p. 282). This suggests that the Bank implicitly incorporates the real costs of output fluctuations into its objective function.

The second issue that needs to be addressed is the renegotiation-proofness of the optimal dismissal contract. The contract considered in section 2 assumed that the government specified a function $\pi^*(e)$ of critical inflation rates *prior* to observing the actual aggregate supply shock. This prior commitment ensures that the optimal policy response to e takes into account the expectations of agents in sector two, the sector whose wages and prices are contingent on the observed value of e.

The Policy Target Agreements in New Zealand, however, only specify that the target inflation rate *can* be adjusted in light of aggregate supply disturbances, but

they do not fully specify the exact nature of the changes in π^*. That is, the PTAs do not specify an explicit function $\pi^*(e)$ prior to the realization of any aggregate supply disturbances. If the government and the central bank renegotiate π^* after observing e, the government will have an incentive to set the reappointment probability to achieve the rate of inflation that minimizes social costs taking π_1^e as given. The socially optimal policy formed before π_1^e is set is not equal to the optimal policy once π_1^e is set, and the time-inconsistency problem reappears. As a result, if π^* can be renegotiated after sector-one wages and e are observed, the optimal dismissal rule can be shown to lead to a rate of inflation given by

$$\pi^N = \pi^c + s\frac{ak}{\beta} \tag{12}$$

where the superscript N denotes under renegotiation. Inflation exceeds that obtained under the socially optimal commitment policy, and the inflationary bias is equal to sak/β. Since $0 \leq s \leq 1$, this is positive but smaller than the bias that results under pure discretion (ak/β). If all wages and prices are set after observing e (that is, $s = 0$), the bias is zero.

Allowing the critical rate that determines reappointment to be renegotiated after e is observed results in an average inflation bias that is between the optimal level of zero and the value under full discretion of ak/β. The average bias is smaller, the greater is the fraction of private sector contracts signed after the aggregate supply signal is revealed. In other words, the greater the flexibility of wages and prices, the smaller will be any bias that arises from renegotiating the target rates.

4. CONCLUSIONS

The similarity between an optimal dismissal rule and the Reserve Bank Act of 1989 suggests that New Zealand may, in fact, have achieved an optimal central banking structure. And New Zealand's inflation experience since the passage of the Act in 1989 has been consistent with the objective of achieving price stability; inflation has been kept below 2 percent for over three years.

Two aspects of the Act do not fully mimic the optimal dismissal rule, however. First, the socially optimal commitment policy can be achieved through the use of a dismissal rule based solely on measured inflation only if the central banker shares society's preferences between output stabilization and inflation. The optimal policy calls for partial monetary accommodation in the face of aggregate supply disturbances, and the degree of accommodation depends on the weight given to inflation relative to output fluctuations in the social loss function. If the central banker uses a different weight in setting policy, suboptimal policy will result. With its emphasis on price stability as the only goal of monetary policy, the Act does not ensure that the central bank will share society's preferences.

Second, the procedures in the Act for adjusting the target rate of inflation are time

inconsistent if wages exhibit nominal rigidity. The optimal rule requires that the critical inflation rate triggering the central banker's dismissal be a function of the supply shock. However, the government must be able to commit to the *function* relating aggregate supply shocks to critical inflation rates. If the critical inflation rate can be changed after the shock is observed, as is the case in the Policy Target Agreements, the government will have an incentive to set the critical rate too high, since some wages and prices are already set. The possibility of renegotiating the critical inflation rate implies that the positive average inflation bias of discretionary policy is not completely eliminated.

Despite these reservations, the match between the Reserve Bank Act and an optimal central bank contract is surprisingly good. The Act should be seriously studied by other countries considering revisions in their central banking legislation.

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