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Independence and Accountability

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Abstract

Why have many central banks become more accountable and transparent in recent years? Part of the answer may be found in alternative solutions to the inflation bias problem endemic in discretionary policy-making. For example, accountability can reduce the "democratic deficit" of central banks which have been granted goal and/or instrument independence.

But this is not the whole story. The paper considers a set of distinct models of monetary policy institutions, each of which implies different mappings between accountability and independence. For example, we consider non-contingent rules; Rogoff's "conservative" central banker; and Walsh's optimal performance contract. Each of these models has real-world analogues.

The paper then considers how accountability and transparency can solve an inflation bias problem of its own in a world characterised by uncertainty regarding the authorities' inflation preferences. Such a model has parallels with the current monetary policy framework in the United Kingdom.

The paper also constructs a quantitative cross-country index of central bank accountability. This indicates that accountability and transparency may have served as a partial substitute for central bank independence among some countries, and as a partial substitute for poor monetary policy credibility among others.

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1.   Introduction

Commenting on an early draft of Fischer (1990), Milton Friedman observed:

"From revealed preference, I suspect that by far and away the two most important variables in their [central bankers'] loss function are avoiding accountability on the one hand and achieving public prestige on the other."

But over the last few years many central banks have made significant strides towards greater accountability and transparency. There has been a dilution of what Karl Brunner (1981) once called the "peculiar and protective political mystique" that has traditionally surrounded central banking. Examples are legion.

Central banks in all of the countries which have recently adopted inflation targets have become more open about the formulation and presentation of their monetary policies [Haldane (1995)]. Indeed, in New Zealand a formal contract - the Policy Targets Agreement - defines explicitly the objectives and intentions of policy, and the penalties imposed on the central bank in the event of these not being met. Similar such moves have been evident among central banks recently granted greater independence through legislative changes - for example, in France. And in the United States there is active debate on the replacement of the Humphrey-Hawkins Act - and its multiple objectives - with a single inflation objective, and on the publication of the full transcripts of Federal Open Market Committee meetings.

This paper asks how we might best explain this shift towards greater accountability and transparency. What benefits might it confer? Can we link it to the institutional setting for monetary policy across countries? Does it, for example, relate to moves towards greater central bank independence? The standard answer to these questions is that greater accountability has run hand-in-hand with moves towards greater central bank independence: greater accountability is the government's *quid pro quo* for granting greater central bank autonomy. Why? Independence delegates responsibility for monetary policy to an ultimately unelected authority - the central bank. So making this authority accountable for its actions insures against a "democratic deficit"; it fulfills a fundamental political or even ethical demand for democracy. Indeed, in the United Kingdom the Roll Committee Report (1993), which proposed statutory independence for the Bank of England, was entitled "Independent *and* Accountable", recognising just such a democratic demand.

But this politico-economic argument scarcely explains existing central bank practices. The Bundesbank is strongly independent yet has relatively few burdens imposed upon it in terms of accountability and transparency. And it is striking, too, that the statutes of the embryonic European Central Bank follow a similar blueprint. At the other end of the spectrum, the Bank of England has little formal central bank independence. But the UK's new monetary framework is characterised by considerable transparency. New Zealand offers a different model again. Independence was granted in the context of a formal contract between the government and the Reserve Bank, with accountability imposed through the threat of dismissal of the Governor.

It is clear from these examples that, in practice, the mappings between accountability and independence are far from straightforward. And, correspondingly, no one analytical model is able to account for all of them. But to begin to understand these mappings it is useful to consider a set of distinct models of monetary policy institutions - at the same time recognising that real-world institutions are not so easily pigeon-holed but rather reflect features of a variety of models.

There has been considerable recent interest in the design of monetary policy institutions [see, for example, Cukierman (1992), Persson and Tabellini (1993)]. The typical approach takes as its starting point the idea that there is an "inflation bias" problem endemic in discretionary policy-making. This time-consistency literature provides a suitable vehicle for setting out the monetary policy models we wish to consider here.

The time-consistency problem was first formalised in Kydland and Prescott (1977) and subsequently popularised in the monetary policy game of Barro and Gordon (1983a). As is well known, the inflation bias problem derives from the incentives of the policy-maker to spring inflation surprises on economic agents in order to secure a short-term boost to output and employment. But rational agents engage in pre-emptive nominal bargaining in anticipation of this. And the optimal response of the authorities is then to justify these price expectations - hence the inflation bias.

Several resolutions to this inflation bias have been put forward in the literature. These can be thought of as institutional frameworks which alter the policy-makers' incentives in such a way as to secure a Pareto-improving policy outcome. The four solutions which have attracted most attention in the literature are: *non-contingent rules*, such as Friedman's (1959) celebrated *k%* rule; Rogoff's (1985) *"conservative" central banker*; solutions based on

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reputation, such as Barro and Gordon (1983b), Backus and Driffill (1985) and Barro (1986); and the Walsh (1995)/Persson and Tabellini (1993) *optimal performance contract* for a central bank.[1] Each has - to a greater or lesser extent - some link with central bank independence. And each - implicitly at least - suggests greater or lesser degrees of accountability and transparency. It is this, ultimately, which explains the complexity of the independence/accountability relationship observed in practice, since countries combine features of all four models when designing monetary institutions.

It is relatively straightforward to rank these competing models in welfare terms [see, for example, King (1995)]. The conservative central banker dominates both the non-contingent rule and discretion, but is in turn dominated by the optimal contract which is typically able to secure a first-best.[2] But where might some of the new monetary frameworks, such as those in New Zealand and the United Kingdom, be placed within this spectrum? For example, in the United Kingdom both monetary policy instruments and targets are set by government, so the Bank of England has little real goal or instrument independence - at least as formally defined. Arguably, then, this might position the United Kingdom at a worst-best - discretionary - solution.

Fortunately, there are countervailing factors at work. Much of the conventional literature underplays the role of accountability, and in particular transparency, within the policy problem. If existing models were the full story, then the only information it would be useful to reveal - and hence be accountable for - would be the observed inflation rate. Yet, in practice, virtually all central banks choose to reveal much more than this. And, if there is uncertainty regarding inflation preferences, accountability and transparency can be shown to solve a time-consistency problem of their own. They can therefore generate welfare gains, even without formal goal or instrument independence. Such an outcome helps to rationalise the UK model. Indeed, because transparency is Pareto-improving within any institutional set-up characterised by preference uncertainty, it may have lessons for other central banks too, whether or not they are independent.

The next section seeks to define "accountability" and "independence", since these are elusive concepts. Sections 3-5 then consider how the various

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(1) Exentions of these basic frameworks have been provided by, among others, Lohmann (1992) and Flood and Isard (1988). We defer consideration of reputational models to Section 6.

(2) Subject to the central bank sharing the same inflation and output preferences as private sector agents, and the contract itself being feasible to implement in the first place.

monetary policy institutional set-ups outlined above might relate to the concepts of accountability and independence we define. In each case we begin by describing the basic model and then consider what real-world manifestations of such monetary policy institutions are evident in existing central bank practices. The models include the choice between rules and discretion (Section 3); the introduction of a "conservative" central banker (Section 4); and setting the central bank an optimal performance contract (Section 5). In addition, in Section 4 we review some of the empirical evidence which relates central bank independence to the level and variability of inflation and growth.

Section 6 extends the existing literature by presenting a model in which the inflation preferences of the authorities are uncertain and in which accountability or transparency then has a role. This is contrasted with the existing literature which suggests that there may be advantages to central banks in preserving a veil of secrecy. Our results imply that greater accountability and transparency can be beneficial by reducing preference uncertainty and hence inflation biases: by revealing information, central banks reduce the scope for - and therefore reduce the benefit from - creating surprise inflation.

In Section 7 we present a simple and preliminary index of central bank accountability for 14 industrialised countries (see the Annex for details). This is used to illustrate the importance of considering both accountability and independence as features of monetary policy institutions. Cross-country comparisons suggest that there is an inverse relationship between accountability and independence and that central banks in countries with a track-record of low inflation are less accountable than central banks in countries with less good inflation performances. Section 8 concludes.

2.   Some Definitions: Independence and Accountability

On *independence*, it is useful to follow Fischer's (1994) dichotomy between central bank *goal* independence - the central bank setting its own targets (or at least determining how precisely these targets are specified) - and *instrument* independence - the central bank's ability to choose its own instrument settings. The two are easily confused and in the literature have often been conflated. But the difference between them is crucial in explaining why various monetary models may imply differing degrees of accountability. The growing literature on quantitative indices of central bank independence is also important here in differentiating types of independence.

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Turning to *accountability*, the Oxford English Dictionary defines accountable as "obliged to give a reckoning or explanation for one's actions; responsible". And, in turn, it defines responsible as "legally or morally obliged to take care of something or to carry out a duty; liable to be blamed for loss or failure". So the natural context in which to consider accountability is within a principal-agent relationship. And, in a monetary policy context, these roles are typically taken by the government - as principal - and the central bank - as agent.

Within this principal-agent relationship, however, accountability might take a variety of forms. The simplest case to envisage is when there is a formal contract between the government and the central bank - a "legal" obligation to carry out a duty, or *de jure* accountability. This contract might specify what the central bank exercises discretion over - what is its "duty"; what it is to be held accountable for - for what it is "responsible"; what needs routinely to be monitored to ensure effective accountability - a "reckoning" or "explanation"; and what penalty will be imposed for non-compliance - apportioning the blame for "loss or failure".

But, equally, it is possible to envisage more subtle forms of accountability or transparency. These may be desirable even when relatively little formal - or legal - responsibility is delegated to the agent by the principal. For example, even a non-independent central bank could perceive advantages in explaining its actions, intentions and objectives as a means of influencing public expectations - and thus affecting the costs of delivering the central bank's goals; of influencing the public's social welfare function - by educating the public about the benefits of price stability; and of enhancing the reputation and credibility of the central bank - by providing a means for it to be judged against the coherence and persuasiveness of its analysis. Transparency and public accountability educate outside agents about the nature of the central bank's reaction function: how policy is, or should be, guided to ensure that the target is met. Such information could be communicated through public speeches, bulletins, press statements, inflation reports, and the publication of the minutes of monetary policy council meetings.

All of these examples might be held to result in greater central bank accountability - *de facto* if not *de jure*. Making the central bank's actions, intentions or analysis transparent subjects the central bank's reputation to a "reckoning", for which it will suffer "loss or failure" if it is found wanting. Such a set-up is thus similar to a fully-specified legal contract between the government and the central bank. They differ only in their opaqueness, their

legal enforceability and the penalties they ultimately impose for failure. A formal contract is more transparent - its terms are written down rather than implicit; it can be enforced by statute - rather than by fear of loss of credibility; and the penalties it imposes are pecuniary - rather than deriving from embarrassment. Here we take a broad definition of accountability that goes beyond a formal, legally binding performance contract, to encompass greater transparency and openness about monetary policy actions, intentions and objectives.

3.   The Time-Consistency Problem: Rules and Discretion

(a)   Inflation Bias and Discretionary Policy-making

We use the familiar Barro-Gordon framework. In a given period, output is described by a reduced-form Lucas surprise supply function:

$$y = y^* + b(\pi - \pi^e) + \varepsilon \tag{1}$$

where (the natual log of) output is denoted by y and its natural rate by y^*; π denotes the observed inflation rate; π^e is the mathematical expectation of this on the part of private sector agents, conditional on their information set at t-1; and ε is a white noise supply shock, with zero mean and variance σ_ε^2.

Assuming a constant velocity of circulation and normalising the previous period's price level to unity, we have:

$$m = \pi + y \tag{2}$$

where m denotes the money stock, which is assumed to be controlled deterministically by the central bank. Finally, we have the loss function of the authorities, which is quadratic in inflation and output. The target level of inflation is zero, but the target level of output, ky^*, exceeds the natural rate of output:[3]

$$L = a\,E\,\pi^2 + E(y - ky^*)^2 \qquad\qquad a > 0, k > 1 \tag{3}$$

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(3) There are a variety of factors that might generate $k > 1$. For example, Barro and Gordon (1983a) highlight distortionary income taxes and unemployment benefits as factors that might hold employment below its socially optimal level. See also Cukierman (1992, chapters 2-5).

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To follow the standard approach in the literature, we assume that each period the money supply is set by the central bank following the realisation of the supply shock. But the inflation expectations of private sector agents are formed, and wage contracts are agreed, prior to their observation of this shock. It is this asymmetry in reacting to the supply shock that provides the policy-maker with the ability to inflate the economy beyond its natural rate temporarily when given complete discretion over monetary policy-making.

We can solve for this *discretionary solution* by minimising L taking expected inflation as predetermined this period. But under rational expectations the private sector's expected inflation rate, in equilibrium, must equate with the policy-maker's optimal inflation rate under discretion. Equilibrium inflation in this setting is hence given by:

$$\pi_D = (b/a)\, z - (b/(a + b^2))\, \varepsilon \qquad\qquad (4)$$

where the D subscript denotes discretion, and $z \equiv (k-1)\, y^*$. The first term in (4) defines the familiar inflation bias. Note that this is positive and state-independent. And since the socially optimal inflation rate is assumed to be zero, this inflation bias is clearly sub-optimal from society's point of view.

The second term in (4) defines the authorities' stabilisation effort in the face of supply shocks. This can be shown to be equivalent to that under the optimal state-contingent rule [again, see King (1995)].[4] Discretion imparts the freedom to respond flexibly to shocks, thus stabilising output. So the discretionary solution secures optimal policy stabilisation - hence lower output variance - but at the expense of a higher inflation rate than is socially optimal - an inflation bias.

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(4) Formally, the loss function under discretion is:

$$L_D = (1+\theta)\, z^2 + (1/(1+\theta))\, \sigma_\varepsilon^2$$

where $\theta = b^2/a$. This compares with a loss function under the optimal state-contingent rule of:

$$L_O = z^2 + (1/(1+\theta))\, \sigma_\varepsilon^2$$

The second parts of these expressions are clearly the same; only the first terms differ, which derives from the inflation bias under discretion.

(b) A Non-Contingent Rule

This discretionary outcome is usefully contrasted with a *non-contingent rule* - a rule that fixes *m* independently of realisations of the supply shock, ε. This can be thought of as exactly analogous to Friedman's *k%* rule. Inflation under the rule (denoted *R*) can be shown to be:

$$\pi_R = -\left(1/(1 + b)\right) \varepsilon \tag{5}$$

Comparing **(4)** and **(5)**, it is clear that the rule succeeds in eliminating completely the inflation bias - the first part of **(4)**; it precommits policy to zero inflation. But it does so at the expense of a sub-optimal degree of stabilisation in response to supply shocks - compare **(5)** with the second part of **(4)**.[5] The non-contingent rule takes no heed of supply shocks when setting policy and so minimises stabilisation effort.

Herein lies the well-known credibility-flexibility trade-off, familiar from Canzoneri (1985), Rogoff (1985) and Lohmann (1992), among many others. In the absence of some means of precommiting to the optimal state-contingent rule,[6] the implication is that the inflation bias can be reduced only by forgoing stabilisation effort: lower inflation outcomes can be traded off against greater output variance or vice-versa. Inflation and stabilisation biases are offsetting. The non-contingent rule and discretionary solutions can be thought to mark the boundaries of this trade-off: hence the choices facing policy-makers are generally thought to involve a complicated "rules versus discretion" balancing act.

(c) Accountability, Rules and Discretion in Practice

The non-contingent rule, taken by itself, involves no delegation of power to any agency, such as a central bank. Consequently, it is characterised by no central bank independence - whether goal or instrument independence - and no accountability. Formally, there is no distinction between principal and agent

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(5)   Again, comparing the loss function under the rule:

$$L_R = z^2 + \left((1+a)/(1+b)^2\right) \sigma_\varepsilon^2$$

with the loss function under the optimal state-contingent rule clarifies this.

(6)   Which is typically ruled out as it is thought to be too difficult, in practice, to implement.

under the rule and so nothing for an agent to be held accountable for. So a non-contingent rule, if it were observed in the real world, would thus tell us very little about independence-accountability mappings.

Fortunately, it is difficult in practice to pinpoint any real-world examples of a strict non-contingent rule having been adhered to by developed countries, at least over the post-Bretton Woods period.[7] While many countries experimented with, for example, monetary targeting procedures in the 1970s and 1980s, in practice none of these frameworks worked in the rigidly inflexible fashion suggested by a non-contingent rule. Prior to the 1970s, the Gold Standard and Bretton Woods regimes did, in principle, come much closer to such a non-contingent rule. And during the first three-quarters of this century, accountability and transparency about monetary policy appear to have been much less of an issue. But these parallels are probably misleading. In practice, both the Bretton Woods and Gold Standard regimes were characterised by contingencies - whether revaluations or, on occasions, suspensions. And the reason for the lesser accountability of these regimes was probably due more to the unobtrusiveness of democracy upon government behaviour over much of the period,[8] rather than telling us very much about the economics of the monetary policy problem.

Coming right back up to date, a significant body of research has looked instead at simple *feedback rules* of various forms. The policy rules of McCallum (1988) and Taylor (1993) are prominent examples. These - unlike non-contingent rules - allow some degree of feedback from state variables, typically prices or money GDP, so as to secure a greater degree of policy stabilisation. They can perhaps be thought to offer a compromise between a strict non-contingent rule and the optimal state-contingent outcome. Empirical evidence suggests that even relatively simple feedback rules of this type can secure much better outcomes than typically arise from a non-contingent rule. It is probably unrealistic to think that any central bank would ever set policy according to the automatic pilot suggested by these policy rules. But it is not unrealistic to think that such rules could actively form part of a central banker's information set. Indeed, in this respect, it is striking how well John Taylor's policy rule does in tracking the path of US interest rates over the past few years.

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(7) Though it is easier to identify potential non-contingent rules among developing countries - for example, the currency boards which operate in Estonia and Argentina.

(8) Which, again, may help explain the non-contingent rules operating in some developing countries.

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4.   Central Bank Independence and the Rogoff Model

(a)   The Rogoff Model

In a highly influential paper, Rogoff (1985) showed that a Pareto-improving point on the credibility-flexibility frontier (better than either the non-contingent rule or discretionary outcomes) could be secured by delegating monetary policy-making to an authority with greater inflation aversion than society as a whole - a "conservative" central banker. Such a model probably comes closest to matching what many people would think of as central bank independence: delegation of monetary policy to an inflation-averse authority with instrument independence. As such, the Rogoff model provides a suitable vehicle for discussing the key results and findings of the burgeoning central bank independence literature.

To formalise matters, denote the *absolute* inflation aversion parameter of Rogoff's "conservative" central banker by α (where $\alpha > a$), and thus its *relative* degree of inflation aversion by $\rho = a/\alpha$ (where $\rho < 1$). Solving for inflation under this model:

$$\pi_I = (\rho\,b/a)\,z\, - ((\rho\,b/a)/(1 + \rho\theta))\,\varepsilon \tag{6}$$

where I denotes the independence outcome.

Equation **(6)** neatly encapsulates the benefits - and costs - which central bank independence is deemed to confer. On the benefits side, the inflation bias implied by **(6)** is clearly lower than in the discretionary case, by an amount related to the relative inflation aversion of the conservative central bank. Against this, the conservative central banker now falls short of offering optimal stabilisation policy - the second parts of **(4)** and **(6)** also differ. So the lower inflation bias is bought at the expense of potentially greater output variability.

The credibility-flexibility trade-off is thus preserved. The interesting point, however, is that when ρ is chosen optimally, Rogoff's conservative central banker secures a welfare outcome which is preferable to either the rules or the discretion solutions: it achieves a Pareto-preferred point on the

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credibility-flexibility frontier.[9] *Prima facie*, this lends strong support to
independent central banking solutions to the time-consistency problem.

(b)   Empirical Evidence on Central Bank Independence

There have been a plethora of empirical studies which have attempted to shed
light on the validity of the reduced-form implications of the Rogoff central
bank independence model. From equation **(6)**, the two most important of these
implications are that an independent central bank should: (i) attenuate
inflation biases (lower average inflation); and (ii) accentuate stabilisation
biases (raise output variability).

To assess these implications, a number of quantitative indices of central bank
independence have been constructed over the last few years, beginning with
Bade and Parkin (1987), and now including Alesina and Summers (1993),
Grilli, Masciandaro and Tabellini (GMT, 1991), Cukierman (1992), and
Eijffinger and Schaling (1993, 1995). These indices have become increasingly
elaborate and all embracing: the GMT index, for example, is made up of 15
legal characteristics grouped under five headings. And the empirical evidence
on them has recently been extended to developing as well as developed
countries [Cukierman (1992)]. A reasonably consistent picture emerges from
these studies.

In their original study of twelve developed countries over the period 1972-86,
Bade and Parkin found a significant negative relationship between political
aspects of central bank independence - for example, instrument independence -
and the average level of inflation; but no such significant relationship for
financial measures of independence - for example, the budgetary autonomy of
the central bank. At least for developed countries, these results seem to be very
robust to different central bank independence indices and different sample

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(9) Rogoff shows that the optimal degree of conservativeness lies in the interval $0 < \rho < 1$. Welfare
under the conservative central banker is given by:

$$L_I = (1 + \theta\rho^2)\, z^2 + ((1 + \theta\rho^2)/(1 + \theta\rho)^2)\, \sigma_\varepsilon^2$$

where $L_I < L_D$ if ρ is chosen optimally.

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periods [see, *inter alia*, GMT (1991), Cukierman (1992), Eijffinger and Schaling (1995)].[10] Of the various proxies for independence, it appears to be those linked most closely to instrument independence (and, to lesser extent, goal independence) that match with inflation performance [Debelle and Fischer (1994), Fischer (1994)]. For example, appointment procedures for central bank governors and board members appear to tell us little about inflation performance in the cross-section. Empirical links between independence and inflation *variability* have proved rather harder to establish. But they also generally point towards a negative correlation [Alesina and Summers (1993), De Haan and Sturm (1992)].

So existing empirical evidence appears to lend strong support to the first of the Rogoff model's predictions: in the cross-section greater (goal and instrument) independence does tend to be associated with lower inflation, both in mean and variance. Whether we can tell a causal story from these correlations is, of course, another matter. There are those who have suggested that the observed correlations are instead the result of some third common driving factor: for example, the inflation preferences of agents in an economy; or the influence of pressure groups, such as those within the financial community [Posen (1993)]; or the nature of the wage-bargaining process [Hall (1994)]. But that said, the negative correlation between independence and inflation seems about as close to a "stylised fact" as central banking scholars are ever likely to get.

The second of the Rogoff model's predictions - that independence should result in greater output variability - raises deeper-seated questions. Most empirical studies have failed to find any significant link between independence and the mean or variability of output growth or employment [see De Long and Summers (1992), Alesina and Summers (1993)]. Taken by itself, this evidence would imply that independence delivers a "free lunch": an inflation gain, without any of the countervailing output costs. Why might this be?

There are many potential explanations. Fischer (1994) offers differences in the susceptibility of different economies to shocks, and differences in their capacity to deal with these shocks, as perhaps the two most important explanations. On the second of these, it could be that independence serves to limit

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(10) Extending the analysis to a further 47 developing countries, Cukierman (1992) finds no significant evidence of a link between independence and inflation - a result he attributes to these countries having "less regard for the law". But a significant relationship is found between inflation and the actual - as opposed to statutory - rate of turnover of central bank governors, a result which could illustrate the same thing.

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policy-induced, discretionary monetary policy disturbances, which more than counterbalances any loss from sub-optimal supply shock stabilisation [Alesina and Gatti (1995)]. Or it could be that independent central banks are simply more efficient in the way they set their monetary policies; their policy "engineering" is more precise and effective. But, equally, non-monetary institutional factors might explain the output puzzle. For example, fiscal policy, indexation or exchange rate policy could account for different countries' abilities to cope with the constellation of real and nominal shocks affecting them [see, for example, Aizenman and Frenkel (1985)]. An alternative explanation, pursued in the next section, is that countries already have something akin to an optimal performance contract in place, which resolves the credibility-flexibility trade-off and makes redundant the second of the Rogoff model's predictions.

(c) Accountability and Central Bank Independence in Practice

Because the Rogoff solution involves delegation of monetary policy responsibility to a non-government agency, it clearly raises questions of accountability. Formally, there is now a clear principal-agent relationship at work, in a way not true of the non-contingent rule or discretionary outcomes. At least within the narrow confines of the Barro-Gordon paradigm, however, there is no real accountability constraint implied by the Rogoff solution. Specifically, the model suggests there is no need for monitoring of the central bank or the imposition of *ex-post* penalities upon it for failure. Why?

The conservative central banking solution - unlike the contract approach - is not designed to make a zero-inflation bias *incentive-compatible* for the central bank. Instead, the intention is that a central bank be chosen with the right set of incentives - in particular, inflation preferences - in the first place. That way, there is no need to try to alter the incentives of anyone. Simply leaving an inflation-averse institution to its own devices is enough to ensure a preferred inflation outcome.[11] If the central bank has goal as well as instrument independence, then accountability makes no sense: the institution is judged against targets it sets itself, so an accountability constraint on behaviour never binds. The conservative central banker just goes about his or her business in a largely unconstrained fashion. So the Rogoff case can perhaps be characterised

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(11) McCallum (1995) discusses a variant of this argument: a situation where a government just "does the right thing" in its monetary policy operations.

by (almost) complete goal and instrument independence and relatively little accountability.

Real-world examples of the Rogoff model could, in principle, be held to include any independent central bank. In practice, however, very few real-world institutions combine both high instrument and goal independence with little accountability in the strict way implied by the Rogoff model. The Bundesbank offers one possible exception. It has complete instrument independence; its objectives are not very precisely specified, so it has a high degree of goal independence; and at the same time, the Bundesbank has relatively little formal accountability to anyone.[12] Likewise, independent central banks which have recently adopted inflation targets could also be thought to have inherited some - if not all - of the features of the Rogoff model. Inflation targets implicitly raise the weight attaching to inflation stabilisation in the authorities' loss function. So they too may help offset inflation biases, independently of the accountability issue.

By contrast, and despite having instrument independence, the US Federal Reserve system does not fit neatly within the Rogoff model. It is required to aim for the multiple objectives embodied in the Humphrey-Hawkins Act, which can be thought to dilute its "conservatism" and goal independence; it is formally accountable to the US government through the Chairman's twice-yearly appearances at Humphrey-Hawkins hearings and through frequent other testimonies to Congressional Committees; and the Chairman is formally appointed by the President.

This raises a second question about the Rogoff model as a blueprint for an independent central bank. While the economics of this model are crystal clear, the *politics* are much muddier. Delegation of power to an unelected authority might be interpreted as a dilution of democracy: an empowered, but unaccountable, central bank gives rise to a "democatic deficit". One parallel is perhaps with the judicial system. There is a time-consistency problem here too: the government may be tempted to interfere in the execution - as well as the enactment - of the law, in pursuit of its own short-term objectives. In most countries it is therefore deemed important for the *judiciary* to be both free from political interference in its day-to-day implementation of the law *and* accountable so that justice is seen to be done and public confidence

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(12)   Though the Bundesbank President is appointed by the government.

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maintained.[13] To have the first without the second runs the risk of the independent institution becoming undemocratic - in the sense of its activities being unconstrained by the elected representatives of the people. The same reasoning could be applied to central bank independence as embodied in the Rogoff model: independence without accountability. Indeed, it was largely this democratic motive that lay behind the Roll Committee's (1993) recommendation that independence for the Bank of England should be accompanied by greater parliamentary accountability for its actions.

Democracy is a compelling - if ultimately intangible - argument for accountability. Indeed, Fischer (1994) uses precisely this argument to pinpoint a potential danger facing the Bundesbank - the desire to target inflation below its socially optimal level.[14] And, of course, such a danger then applies equally to the European Central Bank, should it come into play. Yet in practice it seems that the Bundesbank has been careful to reflect - perhaps even to cultivate - a public acceptance of the need for price stability. The hyperinflationary experiences of the 1920s are said to have given rise to an inbuilt social distaste for inflation among German citizens.[15] It seems likely that the Bundesbank has, at least in part, exploited this social acceptance of price stability in securing low inflation over the post-war period. Without the social acceptance of sound money policies, it seems unlikely that the Bundesbank could have combined as much independence with as little accountability for quite as long.

Lohmann (1992) presents a hybrid of the Rogoff model. Responsibility for monetary policy is delegated to an independent central bank, *à la* Rogoff. But there is an override clause, whereby government can intervene in monetary policy in the face of "large" supply shocks to secure more effective output stabilisation. The central bank's behaviour adapts accordingly to this clause, to minimise the chances of its ever being invoked (the central bank being overridden). And the outcome of this game is then a Pareto-improvement over

(13) In the sense that the legal process is conducted in an open and transparent manner, including full public disclosure of the reasoning behind judgements taken by the highest courts of appeal, such as the US Supreme Court and the European Court of Justice.

(14) Fischer observes: "The Bundesbank is not formally accountable to any other body, whereas the Fed is. The Bundesbank arrangement, where the policy goal is not precise, and there is no formal accountability, poses a potential danger: there is very little to prevent it from pursuing a socially excessive anti-inflationary policy".

(15) But not, seemingly, among the citizens of all the other countries with hyperinflations then or at other times, such as the South American countries of Argentina, Brazil, Chile and Uruguay.

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Rogoff, since it secures more effective output stabilisation. See also Flood and
Isard (1988).

Unlike the pure Rogoff model, the Lohmann model does involve accountability
of a fashion: the central bank is held to account - overridden - in the event of
significant shocks. This, in turn, alters its behaviour, making a
welfare-improving outcome incentive compatible. Moreover, the Lohmann
model has some clear real-world analogues. For example, the New Zealand
Policy Targets Agreement has explicit exemptions in the event of "significant"
shocks to, for example, the terms of trade; and in the Netherlands, the
Minister of Finance has the right to issue an "instruction" to the central bank
on monetary policy. A similar power also exists in Canada. In the United
Kingdom, the Roll Committee report on central bank independence also
explicitly advocated an override mechanism.

5.   Optimal Contracts for Central Bankers

(a) The Walsh Model

In recent papers, Walsh (1995) and Persson and Tabellini (1993) have
demonstrated that, in principle at least, resolution of the credibility-flexibility
trade-off is remarkably straightforward. The Walsh solution is typically
thought to take the form of a contract between the government (the principal)
and the central bank (the agent). The contract levies a linear tax on the central
bank for any inflation outturn in excess of the inflation target, and pays a linear
subsidy if the outturn is below the target. In all other respects, the central bank
is given complete discretion when setting policy. So this is a game in which
the central bank has complete instrument independence but little goal
independence, since inflation objectives are written into the terms of the
contract drawn up by government.

A suitably specified contract can be shown to offset fully the inflation bias,
while at the same time leaving stabilisation policy unaffected: that is, a linear
tax can make a first-best attainable.[16] There is then no longer any trade-off
between credibility and flexibility, since the contract secures the benefits of the
former without interfering with the latter. Intuitively, this is straightforward to

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(16) Provided society and the monetary authority share the same preferences over output and inflation.
In the event that they do not, an optimal contract is still feasible, but it is rather more complex than the
simple linear tax.

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see. In the discretionary solution [equation (**4**)], the inflation bias part of the solution (the first term) and the stabilisation part (the second term) are entirely separable. It is in this sense that credibility and flexibility need not trade off. Moreover, the inflation bias in (**4**) is constant; it is invariant to the shocks that lie at the heart of the stabilisation problem. The trick under the optimal contract approach is thus to raise the marginal cost of inflation by a *fixed* amount - equal to the inflation bias. And a linear tax does this job perfectly, without interfering in any way with stabilisation effort.

To see this formally, augment the central bank's loss function with a linear tax levied at a rate ω on the observed inflation rate:

$$L = a E \pi^2 + E (y - ky^*)^2 + \omega\pi \quad a > 0, k > 1, \omega > 0 \qquad (7)$$

If we then design the tax in such a way that the marginal cost of inflation is raised by an amount equal to the inflation bias:

$$\omega = (b/a) z \qquad (8)$$

then the tax will offset fully the (constant) incentive to generate an inflation bias. This can be seen by solving (**7**) for the inflation rate subject to (**8**). This gives:

$$\pi_C = (- b / (a + b^2)) \, \varepsilon \qquad (9)$$

where the C subscript denotes the contract solution. Comparing (**4**) and (**9**) it is clear that the inflation bias is fully offset, while the stabilisation effort remains the same as that under the optimal state-contingent rule - hence the first-best.[17]

(b) Svensson's Inflation Target Interpretation

In Walsh (1995) this first-best solution is derived as a contract between the government and central bank. Recently, however, Svensson (1995) has shown that the same optimal outcome can result from a suitably specified inflation target. To see this, imagine that the central bank is charged with hitting an

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(17) Correspondingly, the value of the loss function under the Walsh contract is exactly equal to L_0.

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inflation target π^*, which is below the socially optimal inflation rate. The central bank's objective function thus takes the modified form:[18]

$$L = a E (\pi - \pi^*)^2 + E (y - ky^*)^2 \qquad a > 0, k > 1 \qquad \text{(10)}$$

But this can be rewritten trivially as:

$$L = a E \pi^2 + E (y - ky^*)^2 + (2a\pi^*) \pi + \varphi \qquad \text{(11)}$$

where $\varphi \equiv a\pi^{*2}$. We can see that this is formally identical to the Walsh linear tax, up to a constant φ. Equating **(11)** and **(7)**, it is easily seen that the Walsh first-best can be replicated by setting an inflation target satisfying:

$$\pi^* = -(b/a) z \qquad \text{(12)}$$

That is, the inflation target is set equal to the negative of the inflation bias.[19] So the Svensson model implies that setting a sub-optimally low inflation target can completely resolve the credibility-flexibility trade-off - even if an inflation target congruent with the socially optimal inflation rate cannot.

(c)   Accountability and Optimal Central Bank Contracts in Practice

Under the Walsh contract, there is a clear principal-agent relationship at work. But unlike in the Rogoff model the central bank is assigned instrument but *not* goal independence. This means that the central bank clearly has something to be accountable for; it does not decide itself what it is to be judged against.

The contract, in turn, uses this accountability to impose a constraint upon the central bank, penalising (or sometimes rewarding) it for target misses. The role of such penalties, again unlike in Rogoff, is explicitly to alter the central bank's inflationary incentives - in particular, to make a non inflationary biased equilibrium incentive compatible for the central bank. In both these respects, the optimal contract solution differs substantively from the Rogoff model.

(18)   We are again simplifying by assuming that the socially optimal inflation rate is zero.
(19)   In the more general case where the socially optimal rate of inflation is non-zero, the inflation target should be set equal to the socially optimal inflation rate minus the inflation bias in order to secure a first-best.

The accountability constraint imposed under the Walsh contract - a linear tax - is clearly minimalist: it requires only that actual inflation outcomes are monitored, so that the tax can be levied on them. With a clearly specified target and an appropriate set of penalties, the agent is provided with exactly the right incentives to "do the right thing". And with the contract designed to ensure incentive compatability with the first-best, there is then no need for exhaustive monitoring of anything other than inflation itself, on which the tax is being levied. This is precisely the beauty of the optimal-contract literature.

But to what extent is Walsh's optimal contract, or Svensson's inflation target, replicated in the real world? Are such solutions feasible in practice, despite their neatness in theory? The optimal-contract approach can be questioned on at least four counts.

First, it is clear that the contracting first-best can only be supported if the contract itself is fully credible. But if the government is to negotiate, monitor and enforce the contract then the literature has perhaps doubled-back on itself. The original argument for an independent central bank was that the government could not credibly pre-commit to a rule. But, equally, it may be unable credibly to pre-commit to enforcing a contract. An inflation bias may then re-emerge because the public believes that the government might spring an inflation surprise by not enforcing the contract. Because of this, some authors have observed that the Walsh solution is really a way of *relocating* the time-consistency problem rather than actually *resolving* it [Canzoneri, Nolan and Yates (1995), McCallum (1995)]. Alternatively, if the electorate rather than the government is the principal, the problem shifts to how the contract can be enforced - from whom does the electorate seek recourse if the contract is breached?

Second, the non state contingency of the inflation bias in the Barro-Gordon game is crucial for the simple form of the contract to work. Canzoneri *et al* (1995), for example, show how this result can break down - and thus how the credibility-flexibility trade-off can be re-established - if a real interest rate bias is introduced into the authorities' loss function. The inflation bias then becomes dependent on the shock that necessitates the stabilisation effort. The contract will thus achieve the first-best only if the tax on observed inflation becomes state dependent, which in turn would require the construction of a much more complicated contract. Transparency could then have a role to play, since it would help the public to verify states of the world and thus to assess the response of the central bank to them.

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Third, how far are the features of a contract (or Svensson-style inflation target) mirrored in reality? Many countries have announced clearly specified targets which might reasonably be interpreted as a performance contract of sorts. This would encompass countries with monetary and exchange rate, as well as inflation, targets. But few of these frameworks impose *explicit* penalties for target misses. The optimal-contract literature usually envisages the penalty taking a pecuniary form: for example, linking the Governor's salary, or the central bank's budget, to inflation performance. Very few countries have such a pecuniary penalty mechanism in place. Of course there is no reason, in principle, why the penalty under the Walsh contract could not be non-pecuniary: for example, embarrassment costs could serve as the disincentive mechanism. But in practice, it is difficult to think how such costs could be accurately calibrated, so that the principal was sure that the right amount of the medicine was being administered to the agent.

This brings us to the fourth point: imposing a linear tax. Almost all targeting arrangements are quadratic in nature. For example, there is no presumption that any central bank at present reaps benefits - pecuniary or otherwise - from *under*shooting its targets. Yet this would be a logical implication of the Walsh contract. And without it, the first-best collapses. Another way of delivering the first-best, following Svensson, is if there are real-world examples of central banks with inflation targets set below the socially optimal inflation rate.[20] But most countries appear in practice to be targeting rates of inflation above, rather than below, the socially optimal rate. Moreover, it is questionable whether, under Svensson's inflation target, the central bank would want to be set an objective which it would rarely be seen to hit. This would surely be credibility depleting over the longer run. It is difficult, then, to argue that the Svensson first-best has any counterparts in the real world, at least at the moment.[21]

Taking these points together, the only country that perhaps comes close at present to the Walsh contract (or some variant of it) is New Zealand. There,

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(20) It is difficult to make objective judgments about where the socially optimal rate of inflation might lie. But if we make the assumption that the public at large have read and fully digested Michael Woodford's chapter on the "Optimum Quantity of Money" in the *Handbook of Monetary Economics*, then it is quite difficult to mount a wholly convincing case for an optimal rate of inflation much different than zero.

(21) Of course, it is not just discretionary policy-makers that generate inflation bias. Statisticians do it too. So inflation targets must typically make some allowance for measurement bias - arising from the fixed weights in existing price indices, or their failure to capture properly changes in quality - when they are set. But netting-off plausible estimates of measurement bias would still fail to give negative targeted inflation rates in the vast majority of inflation-target countries (see Haldane (1995)).

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the Policy Targets Agreement is an explicit, and precisely specified, contract between the government and the Reserve Bank. Explicit penalties are written into this contract, in that the Governor can be dismissed for failures to meet the target; he or she is held directly accountable for inflation target misses. Walsh (1995) has shown that this punishment mechanism can mimic perfectly an optimal contract, since the *expected* probability of dismissal is linear in inflation. Moreover, because the Reserve Bank's budget is fixed in nominal terms, this is also analogous to a linear inflation tax - even though, in practice, this constraint was devised with budgetary rather than monetary incentives in mind. This combination of targets, penalties and accountability thus seems to come reasonably close to matching the Walsh set-up.[22]

Other countries fare well on some features of Walsh's optimal contract, but fail to satisfy fully all the criteria that might deliver a first-best. For example, the United Kingdom has a clearly specified inflation target, which allows simple monitoring. This target, in turn, is intended to impose embarrassment costs on the authorities in the event of the target being breached - so it is a performance contract of sorts. The extent to which these costs are linear in inflation is then the key to determining how close the United Kingdom's current institutional set-up is to an optimal contract. The truthful answer is: probably some distance. But even if all of the Walsh criteria are not satisfied exactly, existing mechanisms are still a clear improvement over earlier institutional infrastructures in the United Kingdom. Similarly, moves elsewhere towards clear and quantitative price stability objectives - for example the inflation targets recently put in place in Australia, Canada, Finland, Israel, New Zealand, Sweden and Spain - are a step in the right direction, if not the final word. And the fact that these targets are not set as low as the negative of inflation bias does not of course preclude them from securing *some* welfare benefit, by pushing inflation in the direction of its socially optimal rate.

Moreover, the introduction of an inflation target is not the full extent of the recent changes in the United Kingdom's monetary framework. As important has been the move towards a more transparent system of monetary policy implementation. Such a move has been emulated in other countries. These developments go well beyond the accountability and transparency implied even by the optimal contract. It is reasonable to ask, then, what role accountability

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(22) Although because of the escape clauses in the Policy Targets Agreement, Walsh (1995) ultimately concludes that the New Zealand model falls short of an optimal contract.

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and transparency about monetary policy-making - defined in the more general sense of Section 2 - may play in a world of second-best or worse.

6.   Accountability with Uncertain Central Bank Preferences

(a)   Private Information and Monetary Policy-making

The Barro-Gordon model is often rationalised as a game in which the central bank has private information on realisations of one of the state variables - information assumed to be unavailable to private-sector agents [see, for example, Canzoneri (1985)]. This informational asymmetry in turn gives the authorities either a first-mover advantage (when setting policy) over private sector agents (when forming their inflation expectations), or an incentive not to divulge all their private information. This information advantage provides the central bank with the means to expand output temporarily. So requiring the central bank to disclose this information may offer a way of resolving the inflation bias problem. Transparency could potentially afford welfare benefits.

Such a model would be straightforward to devise. But two factors suggest that it would be less than satisfactory as a way of rationalising the benefits which policy accountability and transparency might confer. First, the time-consistency problem derives not just from the central bank's ability to observe the supply shock prior to private-sector agents, but from its ability to act in response to this shock faster than private-sector agents. So in the conventional game, private sector wage contracts are signed in period zero; the supply shock occurs - and is observed by the central bank - in period one; and the central bank sets its instrument in period two, on the basis of the supply shock. But if the timing of this game is preserved, then disclosure of the supply-shock information by the central bank does nothing to resolve the time-consistency problem, because private sector agents are already locked into a nominal wage bargain at period zero. If such wage-bargaining structures exist independently of the monetary policy framework, then greater transparency may confer no benefits whatsoever - at least within the simple Barro-Gordon model. And, in practice, this seems to be the most likely outcome. In the real world, wages are typically negotiated annually, whereas monetary policy is set monthly (or even more frequently). If these decision-making lags are fixed, or at least sticky, then disclosure of the central bank's private information on supply shocks would do little to offset inflation biases.

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Second, and much more fundamentally, it is questionable just how realistic the assumption of private information on the part of the central bank is - at least as far as supply shocks are concerned.[23] Certainly, having worked in a central bank, we find it difficult to think of many practical examples! To illustrate, if the supply shock is induced by the *government* - for example, by a change in distortionary taxes - then it is as transparent to private sector agents as to the authorities themselves. If the supply shock is *external* in origin - for example, a shock to the oil price - it is unclear where the authorities' informational advantage would lie. And if the supply shock is rooted in *private sector* behaviour - greater competitiveness among retailers is a topical example in the United Kingdom - then it is just possible the authorities could be at an informational *dis*advantage to the agents actually experiencing the supply shock. None of these examples offer compelling reasons for believing that the authorities have an absolute informational advantage over other agents in the economy.

So what informational advantage might the authorities have? The one thing the authorities do clearly possess more information on than outside agents are their own preferences. If the authorities know anything, it is their own minds. But in the standard Barro-Gordon game, the authorities' preferences are common knowledge and certain. In practice, at least in countries with less than perfect monetary policy credibility, this is rarely the case. For example, inflation preferences may be subject to short-run political pressures. And these pressures may vary in their severity according to the state of the political and economic business cycle at the time. Even when monetary policy is delegated to an independent monetary authority, it is unlikely such an institution will have preferences that are known with certainty - at least when reputation and credibility are initially low.

Private sector agents then face a tricky signal-extraction problem. They are subject to uncertainties both from additive supply shocks and from multiplicative preference shocks. Such a setting can be shown to afford a distinct role for accountability and transparency.

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(23) In Canzoneri (1985), the private information of the authorities was assumed to be on money demand shocks; but the general point carries across to most types of shocks we can think of.

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(b)   A Model of Inflation Preference Uncertainty

To formalise these thoughts, consider generalising the loss function, **(3)**:

$$L = a_t E \pi^2 + E (y - ky^*)^2 \qquad\qquad k > 1 \tag{13}$$

where a_t - the authorities' inflation preferences - are now assumed to be a random variable satisfying $a_t = a^* - x_t$, where x_t is a mean-zero normal variate with *conditional* variance σ_x^2.[24] So from the viewpoint of the public, the authorities' preferences are subject to periodic white-noise shocks, distributed around a^*. x is unobservable for private sector agents, but is of course known to the authorities themselves. Agents face uncertainty about the authorities' true inflation preferences each period at the time they enter into the nominal wage bargain.

Moreover, agents care about both the mean and variance of inflation outturns.[25] So when forming their inflation expectations each period, they internalise the information on the distribution of x as well as its mean. Indeed, because they are inflation risk averse, agents require compensation for the conditional variation in x - a risk premium of sorts - to guard against an adverse preference shock eroding real wages. This insurance premium is factored into agents' nominal wage expectations and thus, in turn, is reflected in actual inflation under rational expectations. This can be seen formally by solving the model **(1)**, **(2)** and **(13)** for agents' inflation expectations under discretionary policy (now denoted DU):[26]

$$\pi^e_{DU} = \Phi (.) (b/a^*) z \tag{14}$$

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(24)   Technically, we require a_t to be strictly positive. But, clearly, when working with a normal distribution there exists a finite probability of a negative outcome for a_t. We are assuming that this probability is sufficiently small that it can be ignored here.

(25)   When forming inflation expectations, they minimise their squared inflation forecast errors. So, implicitly, agents are risk-averse and have a linear-quadratic utility function.

(26)   We have used a second-order Taylor series approximation to solve for the expectation of the ratio of two random variables when deriving **(14)**. This is consistent with agents being mean-variance optimisers. Further details of this model are given in Nolan and Schaling (1995).

where:

$$\Phi(.) = \frac{[a^*((a^*+b^2)^2 + \sigma_x^2)]}{[a^*(a^*+b^2)^2 - b^2\sigma_x^2]} \qquad (15)$$

which compares with inflation expectations under discretion of:

$$\pi^e_D = (b/a^*)\,z \qquad (16)$$

It is easily seen from (14) that $\Phi(.) > 1 \;\forall\; \sigma_x^2 > 0$. In the special case where $\sigma_x^2 = 0$, $\Phi(.) = 1$, and the model collapses to the certainty equivalent preferences case given by (16). Consequently, any uncertainty regarding inflation preferences - a non-zero σ_x^2 - will generate an upward bias to inflation expectations and hence to the inflation rate itself. It is also clear from (14), however, that preference uncertainty only worsens the existing inflation bias problem; it cannot generate an inflationary bias of its own. For example, setting $k = 1$ in (14) removes the inflation bias independently of σ_x^2.

For completeness, actual inflation in this set-up is given by:

$$\pi_{DU} = [b^2/(a_t+b^2)]\,[(\Phi\,(b/a^*) + 1]\,z - [b^2/(a_t+b^2)]\,\varepsilon \qquad (17)$$

where the upward bias to actual inflation - in excess of the conventional inflation bias - is evident from the first part of (17).[27] But note that the preference shock also affects stabilisation effort at the margin - the second part of (17). This is now dictated by *realised* outcomes for a_t, rather than its mean a^*. And so each period - if not on average - there is the potential for the authorities' stabilisation effort to differ from that which is optimal for private sector agents, even when policy is being set in a discretionary fashion.

All of this clearly implies that a reduction in preference uncertainty is a "free lunch": it will both lower inflation biases - by a potentially significant amount - and improve stabilisation effort. It is unambiguously welfare improving. And, importantly, the additional inflation bias arises in this game despite the fact that preferences themselves have no systematic bias either side of a^*. This is of course not the case with the conventional time-consistency problem, where

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(27) Compared with the first part of (4).

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it is the authorities' asymmetric output preferences around the natural rate that generate inflation bias.

The extent of this additional inflation bias is clearly conditional on σ_x^2. Moreover, the risk premium rises at an increasing rate with σ_x^2.[28] So significant increases in preference uncertainty can generate sizable increases in inflation bias. Further, these increases in bias are larger, the lower the inflation-aversion of the authorities (the lower a^*); or, put differently, the less the degree of central bank independence. So reductions in preference uncertainty are significantly welfare enhancing for low independence/low credibility central banks; and conversely for highly independent central banks. These points are best illustrated with some numerical examples.

(c) Some Simple Numerical Examples

Let $k = 1.1$ - that is, the authorities target a rate of output 10% above its natural rate.[29] A larger k would obviously generate bigger inflation biases, as it would signify a greater incentive to inflate. Further, we normalise the natural rate of output, y^*, to unity, and set b - the coefficient in the surprise supply function - equal to 4.[30]

Take initially the case where $a^* = 0.4$ - a relatively low degree of inflation aversion or independence. If we consider first the certainty-equivalent case - there is zero variance around a^* - then expected inflation will equal 1 percentage point. Now consider letting the variance of a^* take on a non-zero value. At $\sigma_x^2 = 3.35$, expected inflation doubles to more than 2 percentage points. And while the variance in this example is extreme, this at least illustrates the potential for preference uncertainties to increase signficantly inflation biases.

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(28) Assuming technology to be Cobb-Douglas and the supply of other (than labour) factors of production to be fixed in the short run, it can be shown that $b = \beta/(1-\beta)$, where β is labour's income share. In the United Kingdom, β is around 0.8, which gives $b = 4$. Obviously, different assumptions could generate different values for b.

(29) This is probably a conservative estimate. For example, economists' *unbiased* estimates of the NAIRU in the United Kingdom can often differ by as much as 50%.

(30) Assuming technology to be Cobb-Douglas and the supply of other (than labour) factors of production to be fixed in the short run, it can be shown that $b = \beta/(1-\beta)$, where β is labour's income share. In the United Kingdom, β is around 0.8, which gives $b = 4$. Obviously, different assumptions could generate different values for b.

Consider now the case of a more inflation-averse or independent central bank - one with $a^* = 2$. As we would expect, expected inflation in the certainty-equivalent case falls, to 0.2 percentage points. And, perhaps most interestingly, if we now set $\sigma_x^2 = 3.35$ then this raises expected inflation only marginally, to 0.22 percentage points. What this seems to suggest is that for countries with relatively little independence, or perhaps a poor inflationary track-record, significant reductions in inflation bias can be achieved by lowering preference uncertainty. These reductions are much smaller for inflation-averse central banks, when preference uncertainty is reduced by the same absolute amount. This result has some relevance when we come to look at the empirical link between central bank accountability, independence and credibility in the cross-section in Section 7.

(d) Reputation

So how does all of this relate to accountability and transparency? We observed earlier how the one piece of private information central banks might legitimately possess was on their own inflation preferences: that is, information on the conditional distribution of a_t. At the same time, the model above illustrates how important such information potentially is in combating inflation bias - even in the absence of any formal goal or instrument independence. So it follows that disclosure of private information on inflation preferences by the central bank can secure clear welfare benefits.

But there is more than one way such disclosure could be achieved. Reputation - or monetary policy credibility more generally - is one way. Typically in the literature, reputation is modelled in a dynamic repeated game [see, for example, Barro and Gordon (1983b), Backus and Driffill (1985), Barro (1986)]. Analytically this can prove cumbersome, as an infinity of solutions is often liable to obtain. But reputation could equally be thought of as something which constrains the conditional variation in inflation preferences: a good track-record shrinks the conditional distribution of inflation outcomes, by revealing information on the distribution of the authorities' "true" inflation preferences over time. Intuitively, this way of capturing reputation sounds quite appealing. After all, "price stability" is as much, or more, to do with the *variation* in inflation as with its mean value - despite the preoccupation with the latter in the literature to date. So if the desire for a good reputation results in an effort to constrain preference uncertainty over time, then its effects - from the above model - will clearly be net beneficial: reduced inflation bias.

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This story has a potential read-across to a number of countries - perhaps Germany and Japan especially. In the German case, the Bundesbank has sought to reveal its preferences by its actions and inflation performance since 1957. The Japanese case is more apposite still. The Bank of Japan has no formal independence - it is at the discretionary outcome (14) - and so reputation is potentially all. So revealing information on inflation preferences through stability-oriented policy actions has arguably been central in helping to maintain low inflation in Japan, in the absence of formal central bank independence.

(e)   Accountability, Transparency and Central Bank Secrecy

Reputation amounts to revealing preference information by "deeds". Transparency, or *de facto* accountability, can be thought to do it by "words". There are a variety of forms these words might take: speeches, press statements, appearances before Parliament, bulletins and inflation reports, and publication of the minutes of monetary policy council meetings are among the more common. All of these reveal information on the authorities' reaction function - its actions, objectives and intentions - and thus on the distribution of the authorities' inflation preferences. Hence the conditional variance, σ_x^2, falls and the signal extraction problem facing agents when forming inflation expectations and entering the wage bargain is simplified. Correspondingly, agents will demand less compensation for inflation uncertainty - and a lower inflation bias will obtain.

The United Kingdom provides a good case study of how this might work in practice. The Bank of England has no formal goal or instrument independence; it too is perhaps at (14). But recently its advice has been made transparent, thereby forcing into the open whether - in the event of any disagreement - the government has different inflation preferences to the Bank, or whether instead it simply disagrees with the Bank's technical judgement. The three most important vehicles for this greater transparency have been the inflation target itself, which makes clear the authorities' medium-term price stability objectives; the published minutes of the Chancellor/Governor meetings, at which monetary policy decisions are made and discussed on the record each month; and the *Inflation Report*, which offers the Bank's own independent analysis of inflationary trends. The model would explain this shift toward greater openness - and that in other countries - as an attempt to reveal private information on implied inflation preferences, and hence to lower uncertainty-induced inflation biases. And the effects of this are clearly welfare improving.

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None of this is to say that the UK model is necessarily the best. From equation (**14**), it is clear that still further welfare improvements could be secured: either by granting central bank independence - shifting the mean of $a*$ upwards; or by writing a Walsh-type contract - provided this is feasible.[31],[32] But at the same time, the model carries the implication that a little bit of transparency - a small reduction in preference uncertainty - may go a long way.

It is interesting, too, that the countries which have become noticeably more transparent in recent years are precisely those with low initial endowments of credibility. For example, it is striking how many inflation target countries - whose monetary regimes have no real track-record because of their newness - have also recently sought greater transparency. Central banks in the United Kingdom, Sweden, Spain, Canada and New Zealand, for example, have all recently decided to publish inflation or monetary policy reports explaining their actions and intentions relative to their inflation target.

Such a development would fit neatly within our model. These low-credibility countries with new monetary frameworks cannot rely on reputation - "actions" - to reveal information on the distribution of their inflation preferences. So instead they rely on "words" to give them a credibility fillip. Recent shifts towards greater transparency may be serving as a surrogate for reputation or credibility in countries whose monetary regimes have yet to establish cast-iron inflationary credentials.

Transparency may also be useful in helping reveal information on the authorities' preferred "model" of how the world works, in addition to revealing information on their inflation preferences. This model uncertainty might also generate inflation biases through a risk premium effect. Making 'b' - the inflation surprise coefficient - stochastic within our analytical model would have similar consequences to making 'a' stochastic, which illustrates this point.

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(31) From (**14**), admitting preference uncertainty would complicate the optimal-contract solution, by requiring that the linear tax depend upon the moments of the distribution of preference shocks. But provided these moments are stable, this would not be an insurmountable task. A trickier problem is to ask who this tax should be levied on and by whom, now that the government and private sector agents' utility functions differ.

(32) Or, alternatively, countries could attempt to build up over time a reputation for monetary rectitude. There is no implication here that a "words" approach is preferable to a "deeds" approach; most likely the reverse is true.

So far this analysis stands in some contrast to the central bank "secrecy" literature, some of which has attempted to explain secrecy in monetary policy-making as a rational Pareto-improving outcome. This literature has a long history.[33] But several of the more recent contributions are usefully compared and contrasted with the results here.

In Dotsey (1987), central bank secrecy is shown to reduce the *unconditional* variance of interest rates, but to increase agents' *conditional* forecast errors when predicting them. The story here is familiar enough. The revelation of more information - more "news" - will increase the variability of forward-looking asset prices, if they are priced rationally and efficiently. So, for example, in the United Kingdom the publication of the *Inflation Report* and of the Chancellor/Governor minutes has increased market activity and *unconditional* asset price variability around the time these important pieces of "news" are released. This is precisely what economic theory would predict.

But because this news should help to improve the private sector's understanding of the likely stance of current and future monetary policy, it ought to reduce the *conditional* variance of interest rates. Agents now condition expectations on an improved information set, so uncertainty - but not variability - falls. And because it is conditional variation - uncertainty rather than variability - which affects real behaviour via the risk premium, then welfare improves as more information is revealed. Secrecy is always a bad. This is precisely the message from our model, where the revelation of preference information serves to reduce the conditional variation in inflation - and hence the risk premium which attaches to it - thereby securing a welfare improvement.

Stein (1989) establishes a positive role for noisy announcements on the part of the monetary authorities. For example, suppose a wide range for an inflation target is announced. There are then two conflicting forces acting upon credibility. The wider band offers greater scope for "small" inflation surprises. But it also curtails the authorities' ability to generate "large" inflation surprises - ones beyond the limits of the wide range - without a large loss of credibility. And because the credibility costs from a "large" inflation surprise more than

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(33) Goodfriend (1986) provides a good summary and critique of the arguments used by the Fed to rationalise secrecy.

offset the output gains from engineering such a surprise, a noisy announcement thus helps to boost credibility. But precise talk is "cheap" - that is, non-credible. There is always an incentive for the authorities to renege on precise announcements, because they have only a small potential credibility cost.[34]

Cukierman and Meltzer (1986) and Tabellini (1987) both present models similar in spirit to the one above, where there is some degree of uncertainty regarding the authorities' preferences. In an important paper, Cukierman and Meltzer develop a role for secrecy or "ambiguity" in monetary policy. This arises because adding noise to the economy can help the authorities to disguise an inflation surprise.[35] On the face of it, this story sounds plausible enough.

But the rationale behind recent moves towards greater transparency stands in sharp contrast to these models. Central banks have sought greater transparency precisely to help prevent private sector agents thinking the worst of them and factoring inflation biases into their price expectations. Openness can then serve as a demonstration effect of a central bank's unwillingness to countenance inflation surprises for short-term output gain: central banks are voluntarily forgoing one means of camouflaging inflation surprises. For example, revealing greater information lessens the scope for - and hence reduces the benefit from - a surprise inflation. It also increases the severity of the penalties private sector agents impose for cheating: losses of monetary policy credibility will be large and more immediate. And this, in turn, reduces the incentives to create an inflationary surprise in the first place.

Karl Brunner (1981) wrote of central bank secrecy:

"The mystique thrives on a pervasive impression that Central Banking is an esoteric art. Access to this art and its proper execution is confined to the initiated elite. The esoteric nature of the art is moreover revealed by an inherent impossibility to articulate its insights in explicit and intelligible words and sentences."

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(34) Garfinkel and Oh (1995) present an extended version of Stein's model, which encompasses a continuum of central bank types, some of which may choose never to talk.
(35) Mathematically, the differences between the model here and Cukierman and Meltzer (1986) are that they allow preferences to follow an AR(1) process (whereas in our model they follow a random walk) and set their model in an explicitly intertemporal context (rather than the one-shot game used here). Also, "secrecy" in their model derives from noisiness in control of the money stock.

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Part of the motivation behind the Bank's *Inflation Report* was precisely to overcome this problem. As any self-respecting academic will tell you, "one learns a subject by teaching it". The self-same principle applies to the setting of monetary policy. And we hope the *Inflation Report*, and developments like it, might continue to serve as an educational tool - not just for private sector agents, but for the "initiated elite" too.

7. Accountability, Credibility and Independence in the Cross-Section

So far we have attempted to link our models to existing central bank practices through "words". Now we see what evidence there is from some "numbers". To do this, we need to create an index of accountability, in a similar spirit to the central bank independence indices. To our knowledge, only one author has so far attempted this [Havrilesky (1995)]. But because his estimates overlap in some respects with existing central bank independence indices, they are not best placed to help assess accountability-independence mappings. So instead we have constructed our own accountability index.[36] This is based on four criteria: (a) whether the central bank is subject to external monitoring by parliament (as, for example, in France, the United States and the United Kingdom); (b) whether the minutes of meetings to decide monetary policy are published (as in the United States and United Kingdom); (c) whether the central bank publishes an inflation or monetary policy report of some kind, in addition to standard central bank bulletins; and (d) whether there is a clause that allows the central bank to be overridden in the event of certain shocks [as in Lohmann (1992)]. These are obviously simple proxies.[37] We recognise that some of them could, in certain circumstances, be used to diminish the

(36) See the Annex for details of this index.
(37) Two additional proxies were suggested at the Bank of Japan conference. First, Don Kohn commented that if the Governor of a central bank can be re-appointed at the end of his or her term of office this might make the central bank more accountable. But this would not make much difference to our index, since central bank Governors can be reappointed in twelve of the fourteen countries we consider. Second, Professor Franco Bruni noted that it might be more difficult to make a central bank accountable if it has multiple objectives, for example being responsible for both monetary policy and banking supervision. But it is not clear that this would necessarily have an impact on accountability, since there need not be a conflict between the various functions of the central bank. And since there appears to be, for whatever reason, a weak but positive correlation across countries between the rate of inflation over the last decade and whether a central bank is responsible for banking supervision [see Goodhart and Schoenmaker (1995)], the inclusion of such a proxy would tend to have the effect of making central banks from low (high) inflation countries appear to be more (less) accountable.

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independence of a central bank through political interference; and that they might not capture the extent to which some central banks have influenced and cultivated public opinion through other means. But they cover most of the main features of accountability, as defined in Section 2. The accountability index is created as a simple sum of these criteria.

We distinguish goal and instrument indices of independence, since this distinction was important in differentiating features of the various models we looked at. For goal independence we begin with the criteria suggested by Eijffinger and Schaling (1993), namely (a) whether the statutes of the central bank make it independent of the government; (b) whether more than half the appointments to the central bank board are made independently of the government; and (c) whether there are government officials on the board. To these we add a measure of *de facto* goal independence, namely (d) whether the central bank does in practice set its own goals (for example monetary or inflation targets). Chart 1 plots this measure of goal independence against inflation performance over the past ten years. It illustrates the inverse relationship discussed in Section 4.[38] An index of instrument independence would add little value to our exercise here since of the fourteen industrialised countries we consider (Australia, Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, New Zealand, Spain, Sweden, Switzerland, the United Kingdom and the United States), all but one (the United Kingdom) have significant instrument independence.

Chart 1: Central bank goal independence and cumulative CPI rates

Per cent (a)

New Zealand

Spain

Italy

Sweden

Australia

United Kingdom

United States

Canada

Switzerland

France   Belgium

Germany

Netherlands

Japan

(a) Cumulative CPI rates, 1985-95.

Index of central bank goal independence

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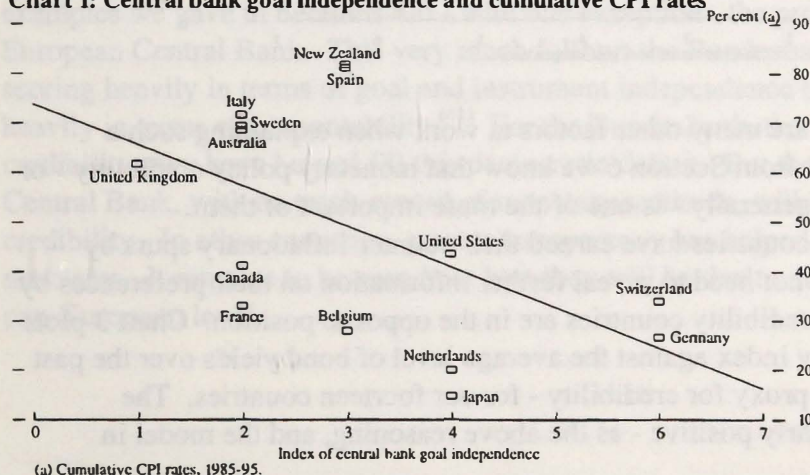
(38)   This relationship is statistically significant at 95%; the *t*-ratio is 2.16.

39

Chart 2 plots central bank goal independence against our accountability index. The correlation is clearly negative.[39] Interestingly, this is precisely the relationship the Rogoff and optimal-contract models, when taken together, would predict. The greater is a central bank's goal independence, the less it is accountable for: setting your own objectives makes it difficult for you to be held accountable for them. But as goal independence lessens - government sets down the terms and conditions, for example via a Walsh contract - then accountability rises. The negative correlation in Chart 2 is, however, inconsistent with a purely democratic or political explanation of accountability, which would assert that independence and accountability should run in parallel - or else a widening democratic deficit would force change on the existing institutional set-up.

Chart 2: Central bank goal independence and accountability
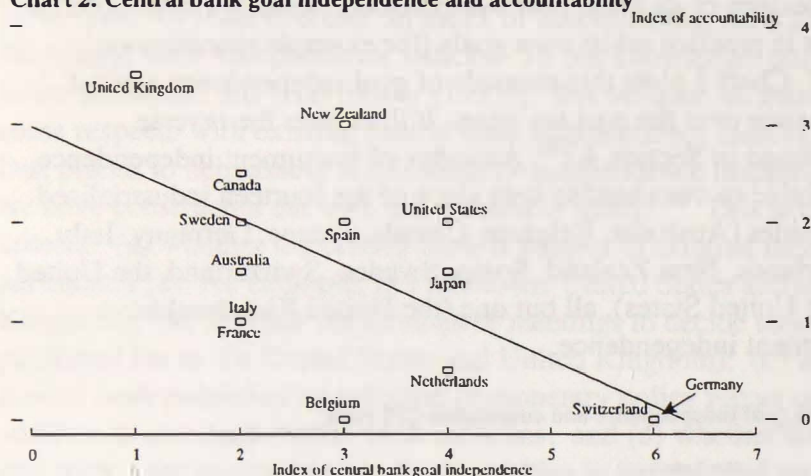
Of course, there are many other factors at work when explaining such a correlation. And from Section 6 we know that monetary policy credibility - or reputation more generally - is one of the more important of them. High-credibility countries have earned their counter-inflationary spurs by deeds, and so do not need to reveal further information on their preferences by "words". Low-credibility countries are in the opposite position. Chart 3 plots the accountability index against the average level of bond yields over the past decade - a crude proxy for credibility - for our fourteen countries. The correlation is clearly positive - as the above reasoning, and the model in

(39) This relationship is also statistically significant at 95%; the *t*-ratio is 2.84.

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Section 6, would imply.[40] Indeed, Chart 3 could perhaps be characterised as two main clumps: the good reputation/low accountability clump in the bottom left-hand corner; and the poor reputation/high accountability clump in the top right. It is particularly striking to note how many inflation target countries lie in the second clump. They have seemingly used transparency as a surrogate for credibility - indeed, in the UK case, perhaps as a partial substitute for independence.

Chart 3: Accountability and average bond yields

(a) Average annual bond yields, 1985-94.
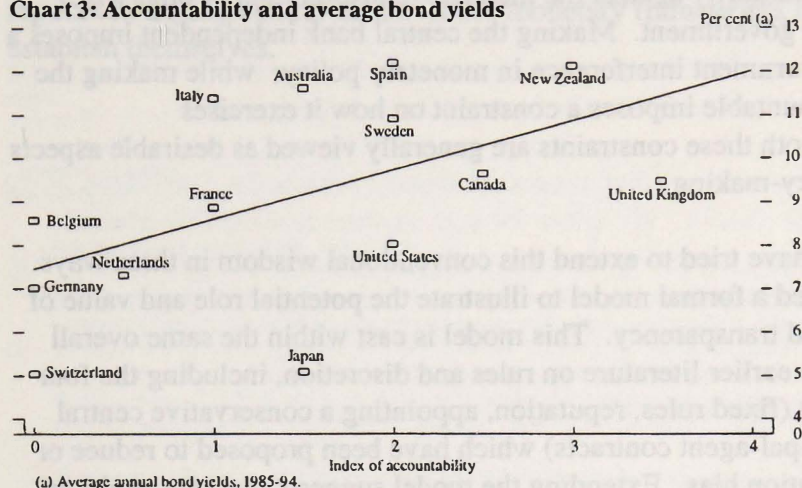
All in all, and despite their obvious simplicity, many of these cross-sectional correlations seem to match rather well with the models and real-world examples we gave in Sections 4-6 - with one exception: the prospective European Central Bank. This very much follows the Bundesbank model, scoring heavily in terms of goal and instrument independence but much less heavily in terms of accountability.[41] For the Bundesbank, the evidence is that credibility may have helped fill this democratic deficit. But the European Central Bank, with no track-record of monetary rectitude, will begin with less credibility. In other countries, greater transparency has helped cope with these problems. It remains to be seen how best they will be dealt with at a pan-European level.

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(40) This relationship is also statistically significant at 95%; the *t*-ratio is 2.16.

(41) It would perhaps lie above the line to the left on Chart 3.

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8.   Conclusions

Many commentators have stressed the importance of accountability. Central banks are not made independent so that they can do whatever they like, but to enable them to pursue an objective free from political interference. Accountability can then be viewed as an adjunct to independence which enables the government - and society as a whole - to monitor the performance of the delegated authority against the mandate (constitutional or otherwise) given to it by the government. Making the central bank independent imposes a constraint on government interference in monetary policy; while making the central bank accountable imposes a constraint on how it exercises independence. Both these constraints are generally viewed as desirable aspects of monetary policy-making.

In this paper we have tried to extend this conventional wisdom in three ways. First, we have used a formal model to illustrate the potential role and value of accountability and transparency. This model is cast within the same overall framework as the earlier literature on rules and discretion, including the four existing solutions (fixed rules, reputation, appointing a conservative central banker and principal-agent contracts) which have been proposed to reduce or eliminate an inflation bias. Extending the model suggests that in a world in which there is uncertainty about the preferences of the authorities, transparency or accountability may also help to reduce - but not eliminate entirely - inflation bias. Moreover, these gains may be largest for countries with little existing independence or a low degree of inflation aversion. This does not imply that accountability by itself is necessarily preferable to any of the four solutions; merely that it could reduce inflation bias, either by itself or in conjunction with one or more of the other solutions.

Second, we have considered the forms which accountability might take, either as a complement to or component of one of the solutions, or as a substitute for them. And we have illustrated this by attempting to match each of the solutions to existing real-world central banking institutions. No single model can account for all of the features of such institutions. But several models come close to matching specific institutions: Rogoff's conservative central banker and the Bundesbank; Walsh's optimal contract and New Zealand's Policy Targets Agreement; and our preference-uncertainty model and the United Kingdom's new monetary framework.

Third, we have constructed a very preliminary and simple index of central bank accountability which can be compared with measures of central bank

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independence and with economic performance. Two features are striking here. First, that cross-section correlations point towards an inverse relationship between accountability and independence - consistent with accountability and transparency having served as a partial substitute for independence, rather than as a complement. And second, that countries with a good reputation for low inflation seem to be characterised by relatively low degrees of accountability, and conversely for countries with less respectable inflation track-records. This is consistent with accountability having also served as a partial substitute for reputation among central banks whose monetary frameworks have yet fully to establish themselves.

Annex: Index of Central Bank Accountability

Our constructed index of central bank accountability is based on four criteria:

- whether the central bank is subject to external monitoring by Parliament;

- whether the minutes of meetings to decide monetary policy are published;

- whether the central bank publishes an inflation or monetary policy report of some kind, in addition to standard central bank bulletins; and

- whether there is a clause that allows the central bank to be overridden in the event of certain shocks. We allow for both *explicit* and *implicit* override procedures. If the central bank law mentions an explicit escape clause - for example New Zealand - a country receives a score of unity. If overriding the central bank is not *a priori* excluded it receives a score of one-half.

The accountability index is a simple sum of these criteria.

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Central Bank Accountability Index

	Parliamentary monitoring	Minutes published	Inflation/ monetary policy report published	Override clause
Australia[a]	*	-	-	1/2
Belgium	-	-	-	-
Canada[b]	*	-	*	1/2
France[c]	*	-	-	-
Germany[d]	-	-	-	-
Italy	*	-	-	-
Japan[e]	*	-	-	1/2
Netherlands[f]	-	-	-	1/2
New Zealand	*	-	*	*
Spain	*	-	*	-
Sweden[g]	*	-	*	-
Switzerland[h]	-	-	-	-
United Kingdom[i]	*	*	*	1/2
United States[j]	*	*	-	-

* Denotes a value of unity and - a value zero.

(a) The Reserve Bank reports to Parliament on an annual basis. In the event of a disagreement between the government and the Board, the Treasurer may submit a recommendation to the Governor-General and the Governor-General may, by order, determine the policy to be adopted by the Bank (Reserve Bank Act 1959).

(b) The Governor is called to give evidence to Parliament. Although no formal minutes are published, the central bank governor's comments to the Board of Directors on monetary policy are published following the subsequent Board meeting. The Bank of Canada Act 1967, provided that the Finance Minister may, with government approval, issue a specific countermanding directive that must be published. To date, no such directive has been issued.

(c) The Governor should account for his actions before Parliament at least twice a year.

(d) German Parliament can invite, but not compel, the Bundesbank President to attend parliamentary committee hearings. Although the government does not have the vires to override the central bank, decisions can be suspended for two weeks at the request of the Government.

(e) The Bank of Japan Law of 1942, amended in 1949, provided the Bank of Japan with the sole responsibility for the operational aspects of interest rate policy. The Minister of Finance, however, has general powers of order over operations and suerpvision, along with the right to appoint and dismiss directors. These powers of order have never in fact been used. The Bank of Japan reports annually to Parliament.

(f) Although the Minister of Finance legally has the right to issue formal directives to the central bank, the application of this right is always considered by both authorities as an ultimate remedy.

(g) The Governor of the Riksbank participates in a public hearing before the finance committee of the Parliament. The Economics Department of the Riksbank publishes *Inflation and Inflation Expectations in Sweden* three times a year.

(h) The Swiss National Bank and the Swiss Government are obliged to consult each other before implementing policies, but there is no formal monitoring by Government.

(i) The Treasury has the power, so far unused, to issue formal but unpublished directives to the Bank of England.

(j) Tne Federal Reserve Chairman must report to Congress twice a year, relating the Fed's policy to the economic goals of Administration and Congress. The Chairman may be called to give testimony at any time.

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