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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 arising from the time-consistency problem. Accountability can reduce the "democratic deficit" of central banks with goal and instrument independence; and it plays a central role in solutions where the central bank is granted instrument independence to pursue a clear mandate set by government. This paper shows that accountability and transparency can also reduce inflation bias arising from uncertainty about the authorities' preferences (or about the models of the economy which they use). Accountability may serve as a partial substitute for independence, and likewise for reputation among central banks whose monetary frameworks have yet to establish themselves fully. Empirical results using a simple index of central bank accountability are consistent with this.

KEY WORDS: Inflation; Monetary policy; Rules and discretion; Central bank independence; Central bank accountability

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INDEPENDENCE AND ACCOUNTABILITY

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1. Introduction

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. 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)). 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 FOMC meetings.

How might we best explain this shift towards greater accountability and transparency? And what benefits might it confer? One 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 fulfils a fundamental political or even ethical demand for democracy.

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 United Kingdom'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 (the Policy Targets Agreement), 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.

There has been considerable recent interest in the design of monetary policy institutions (see, for example, Cukierman (1992) and Persson and Tabellini (1993)). The typical approach takes as its starting point the idea that there is an "inflation bias" problem endemic in discretionary policymaking - the time-consistency problem first formalised by Kydland and Prescott (1977) and subsequently popularised in the monetary policy game of Barro and Gordon (1983a). Several resolutions to this inflation bias have been put forward in the literature. These can be thought of as institutional frameworks which alter the policymakers' 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 *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. Each has - to a greater or lesser extent - some link with central bank independence. And each - implictly 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.

It is relatively straightforward to rank these competing models in welfare terms (see, eg, 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. 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. But much of the conventional literature underplays the role of accountability, and in particular transparency, within the policy problem - a key feature of the UK and other models. If there is uncertainty regarding inflation preferences, accountability and transparency can be shown to solve a time-consistency problem of their own, thereby generating welfare gains even without formal goal or instrument independence.

The next section seeks to define "accountability" and "independence", since these are elusive concepts. Sections 3-5 then consider how the various monetary policy institutional set-ups outlined above might relate to these concepts. In each case we begin by describing the basic model and then consider potential real world manifestations of such monetary policy institutions. Section 6 extends the existing literature by presenting a model in which accountability or transparency has a well-defined role. In Section 7 we present a simple and preliminary index of central bank accountability for 14 industrialised countries (see Annex for details). 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 transparent 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.

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 lowering 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 its reputation and credibility - by providing a means for it to be judged against the coherence and persuasiveness of its analysis. This results 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 qualitatively similar to a fully-specified legal contract between the government and the central bank.

3. The Time-Consistency Problem: Rules and Discretion

(a) Inflation Bias and Discretionary Policymaking

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

$$y = y^* + b(\pi - \pi^e) + \varepsilon \qquad (1)$$

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:

$$m = \pi + y \qquad (2)$$

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:[2]

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

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 policymaker with the ability to inflate the economy beyond its natural rate temporarily when given complete discretion over monetary policymaking.

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

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

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.[3] Discretion imparts the freedom to respond flexibly to shocks, thus stabilising output. So the discretionary solution secures optimal policy stabilisation - lower output variance - but at the expense of a higher inflation rate than is socially optimal - an inflation bias.

(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:

$$\pi_R = - (1/(1 + b)) \varepsilon \qquad (5)$$

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).[4] 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, inflation bias can be reduced only by forgoing stabilisation effort: lower inflation outcomes can be traded-off against greater output variance or vice-versa.

(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 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 tell us very little about independence-accountability mappings.

In practice, however, it is difficult 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.[5] 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. But both regimes were characterised by contingencies - whether revaluations or, on occasions, suspensions. And the lesser accountability of these regimes was probably due more to the unobtrusiveness of democracy upon government behaviour over much of the period.

A significant body of research has looked instead at simple *feedback, or contingent, 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 fully optimal state-contingent outcome. 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 bankers' 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 recent years.

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 policymaking 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.

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:

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

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 credibility-flexibility frontier.[6] 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).

Existing empirical evidence (beginning with Bade and Parkin (1987), and including Alesina and Summers (1993), Grilli, Masciandaro and Tabellini (1991), Cukierman (1992), and Eijffinger and Schaling (1993, 1995)) 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.[7] Whether we can tell a causal story from these correlations is, of course, another matter. Some 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) and 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? 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 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.

(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. But the model also suggests there is no need for monitoring of the central bank or the imposition of ex-post penalties upon it for failure. 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. Simply leaving an inflation-averse institution to its own devices is enough to ensure a preferred inflation outcome.[8] Put differently, 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. So the Rogoff case can perhaps be characterised 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.[9] 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 United States 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 "democratic deficit".[10] Indeed, it was largely this democratic motive that lay beyond the Roll Committee's (1993) recommendation that independence for the Bank of England should be accompanied by greater parliamentary accountability for its action. Lohmann (1992) presents a hybrid of the Rogoff model which goes some way towards addressing this "democratic deficit". Responsibility for monetary policy is still delegated to an independent central bank. But there is an override clause whereby government can intervene in the face of "large" supply shocks to secure more effective output stabilisation. So the Lohmann model does involve accountability of a fashion: the central bank is held to account - overridden - in the event of significant shocks. And the outcome of this game is then a Pareto-improvement over Rogoff. 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 and Canada, the Minister of Finance has the right to issue an "instruction" to the central bank on monetary policy.

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. 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.[11] Intuitively, this is straightforward to see. The inflation bias in (4) is constant; it is invariant to the shocks that lie at the heart of the stabilisation problem. Raising the marginal cost of inflation by a fixed amount - equal to the inflation bias - thus offsets fully this bias, without in any way interfering with stabilisation effort. The credibility-flexibility trade-off is resolved.

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:

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

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 fully offset 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.[12]

(b) Svensson's Inflation Target Interpretation

Recently, 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 inflation target π^*, which is below the socially optimal inflation rate. The central bank's objective function thus takes the modified form:[13]

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

But this can be rewritten trivially as:

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

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:

$$\pi^* = - (b/a)\, z \qquad (12)$$

That is, the inflation target is set equal to the negative of the inflation bias.[14] 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 <u>not</u> goal independence, since inflation objectives are written into the terms of the contract drawn up by government. 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. 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. But 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". 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? The optimal contract approach can be questioned on at least four counts. First, 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. 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 *et al* (1995)). 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. The contract would then achieve the first-best only if the tax on observed inflation became state-dependent - a contract that would probably be impossible to write, let alone enforce.

Third, how far are the features of a Walsh 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. For example, 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. In principle, the penalty under the Walsh contract could 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 undershooting its targets. Yet this would be a logical

implication of the Walsh contract. 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. But most countries appear in practice to be targeting rates of inflation above, rather than below, the socially optimal rate.[15] 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. That would surely be credibility-depleting over the longer run.

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, 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 Govenor 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.[16] 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. 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 and elsewhere. As important has been the move towards a more more transparent system of monetary policy implementation. These developments go well beyond the accountability and transparency implied even by the optimal contract. It is reasonable to ask,

then, what role accountability and transparency about monetary policymaking - defined in the 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 Policymaking

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. So requiring the central bank to disclose this information may offer a way of resolving the inflation bias problem.

Yet 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.[17] 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, 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 possible the authorities could be at an informational disadvantage 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. 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.

(b) A Model of Inflation Preference Uncertainty

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

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

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.[18] 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.[19] 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 becomes 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):[20]

$$\pi^{e}_{DU} = \Phi\,(.)\,(b/a^{*})\,z \qquad (14)$$

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). But note also that stabilisation effort 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. All of this clearly implies that a reduction in preference uncertainty is a "free lunch": it will both lower inflation biases and improve stabilisation effort. The extent of the additional inflation bias is clearly conditional on σ_x^2.[21] It is also 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.[22] 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.[23] 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 - $\sigma_x^2 = 0$ - then the expected inflation rate will be 1%. Now consider letting $\sigma_x^2 = 3.35$. Expected inflation doubles to more than 2%. And while the variance in this example is extreme, this at least illustrates the potential for preference-uncertainties to increase signficantly inflation biases.

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%. And, perhaps most interestingly, if we now set $\sigma_x^2 = 3.35$ this raises expected inflation only marginally, to 0.22%. 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 look at the empirical link between central bank accountability, independence and credibility in Section 7.

(d) Reputation

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: 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.[24] After all, "price stability" is as much or more to do with the variation in inflation as with its mean value. For example, in Japan revealing information on inflation preferences through stability-oriented policy actions has arguably been central in helping to maintain low inflation, 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. 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) above. 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. None of this is to say that the United Kingdom model could not be improved further: either by granting central bank independence - shifting the mean of a* upwards, or by writing a Walsh-type contract - provided this is feasible.[25,26] 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 improve their credibility. 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.[27]

This analysis stands in some contrast to the central bank "secrecy" literature, some of which has attempted to explain secrecy in monetary policymaking as a rational Pareto-improving outcome.[28] The rationale behind recent moves towards greater transparency stands in sharp contrast to this literature. 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, by voluntarily forgoing one means of camouflaging inflation surprises.

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."

Part of the motivation behind the Bank of England'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, Crediblity and Independence in the Cross-Section

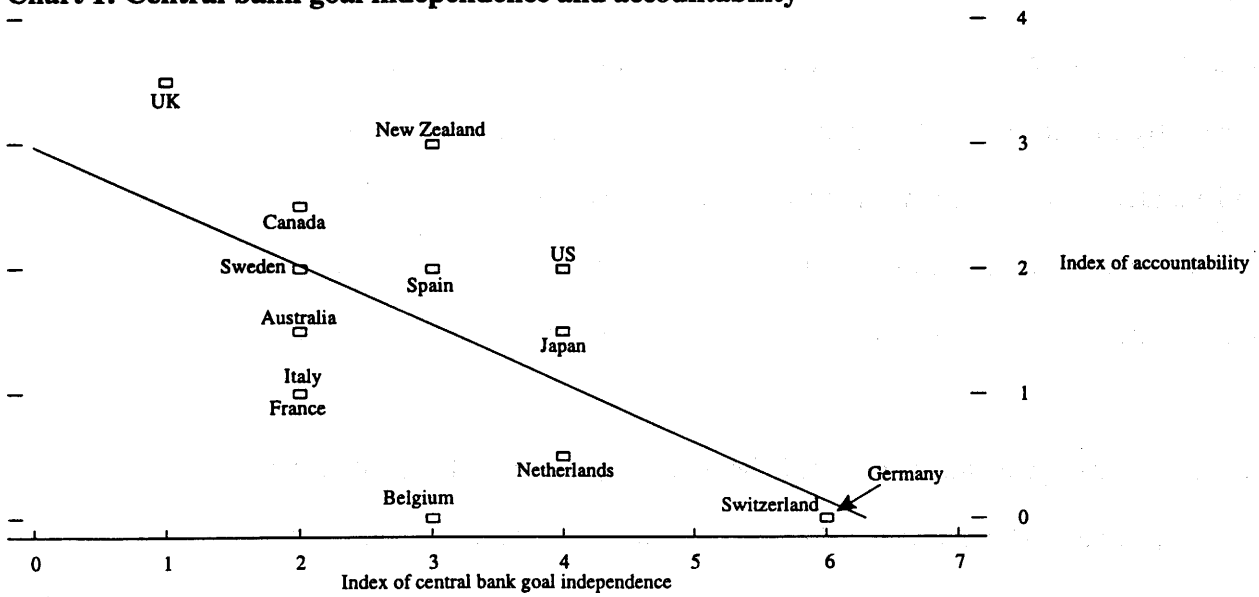
So far we have attempted to link our models to existing central bank practices through "words". Now we see what evidence there is from some "numbers". To do this, we need to create an index of accountability, in a similar spirit to the central bank independence indices. To our knowledge, only one author 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 (see Annex). This is based on four criteria: (a) whether the central bank is subject to external monitoring by parliament (as, for example, in France, the US and the UK); (b) whether the minutes of meetings to decide monetary policy are published (as in the US and UK); (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.[29] Some of them could, in certain circumstances, be used to diminish the independence of a central bank through political interference. And 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.

We distinguish goal and instrument indices of independence. For goal independence we use four criteria, 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; (c) whether there are government officials on the board; and (d) whether the central bank does in practice set its own goals (for example monetary or inflation

targets). An index of instrument independence would add little value, however, 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.

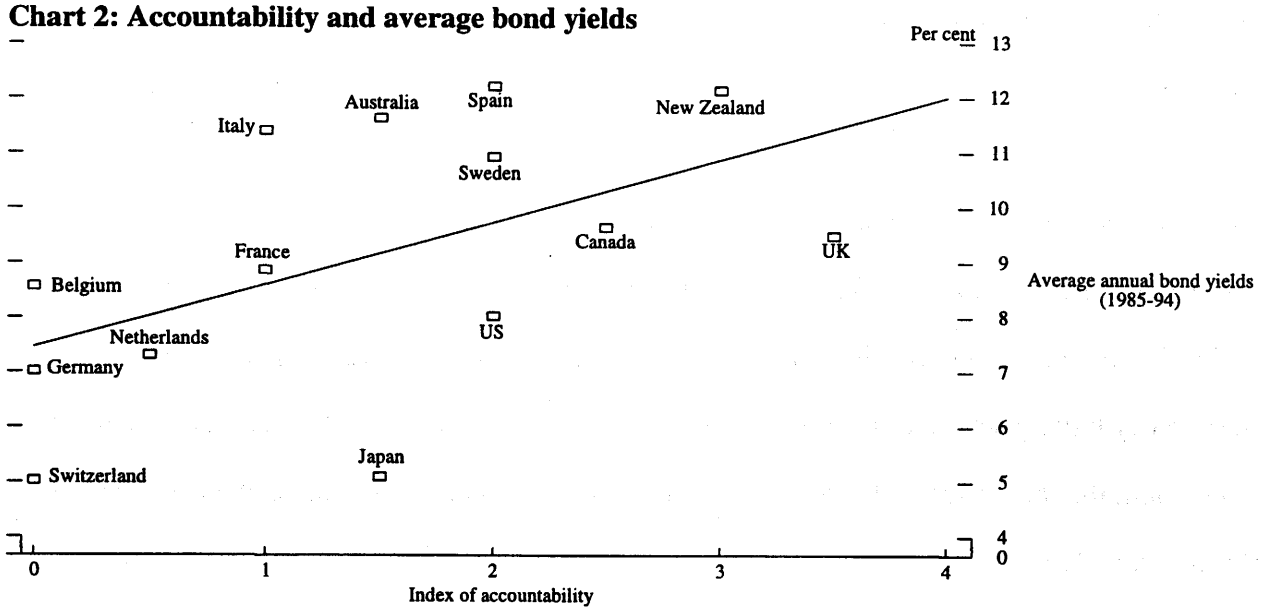
Chart 1 plots central bank goal independence against our accountability index. The correlation is clearly negative.[30] Interestingly, this is precisely the relationship the Rogoff and optimal contract models, when taken together, would predict. The greater is a central bank's goal independence, the 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. However, the negative correlation in Chart 1 is inconsistent with a purely democratic or political explanation of accountability, which would assert that independence and accountability should run in parallel.

Chart 1: 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. Chart 2 plots the accountability index against the average level of bond yields over the past decade - a crude proxy for (the inverse of) credibility - for our fourteen countries. The correlation is clearly positive.[31] It is patricularly striking to note how many inflation target countries lie in the low credibility/high accountability segment. They have seemingly used transparency as a surrogate for credibility - indeed, in the United Kingdom case, perhaps as a partial substitute for independence.

Chart 2: Accountability and average bond yields



8. Conclusions

Making a 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 policymaking.

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 does not imply that accountability by itself is necessarily sufficient for a monetary institution; merely that it could help reduce inflation bias, either by itself or in conjunction with other institutional procedures (conservative central banks, optimal contracts etc).

Second, we have considered the forms which accountability might take. And we have illustrated this by attempting to match each of the existing theoretical solutions for the inflation bias problem to existing real-world central banking institutions: for example, 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. 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 vice-versa. 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.

Central Bank Accountability Index

	Parliamentary monitoring	Minutes published	Inflation/ monetary policy report published	Override clause	Total
Australia	*	-	-	1/2	1 1/2
Belgium	-	-	-	-	0
Canada	*	-	*	1/2	2 1/2
France	*	-	-	-	1
Germany	-	-	-	-	0
Italy	*	-	-	-	1
Japan	*	-	-	1/2	1 1/2
Netherlands	-	-	-	1/2	1/2
New Zealand	*	-	*	*	3
Spain	*	-	*	-	2
Sweden	*	-	*	-	2
Switzerland	-	-	-	-	0
United Kingdom	*	*	*	1/2	3 1/2
United States	*	*	-	-	2

Endnotes

[1] Bank of England, Threadneedle Street, London, EC2R 8AH. We acknowledge the important contributions of Suzanne Hudson, Charles Nolan, Eric Schaling and Tony Yates in preparing this paper and the thoughtful comments of our discussants; of other participants at the Bank of Japan conference; and of Bill Allen, Jag Chadha, Howard Davies, Charles Goodhart and Lars Svensson. Remaining errors are of course our own, as are the views expressed within.

[2] 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).

[3] 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 (see King (1995)).

[4] Again, comparing the loss function under the rule:

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

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

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

[6] 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.

[7] See also De Haan and Sturm (1992), and Debelle and Fischer (1994).

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

[9] Though the Bundesbank President is appointed by Government.

[10] Fischer (1994) uses precisely this argument to pinpoint a potential danger facing the Bundesbank - the desire to target inflation below its socially optimal level. And, of course, such a danger then applies equally to the embryonic European Central Bank.

[11] 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.

[12] Correspondingly, the value of the loss function under the Walsh contract is exactly equal to L_O.

[13] We are again simplifying by assuming the socially optimal inflation rate is zero.

[14] 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.

[15] 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.

[16] 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.

[17] 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.

[18] 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.

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

[20] 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 (1996).

[21] Moreover, the risk premium rises at an increasing rate with σ_x^2. Formally, $\partial \pi^e_{DU} / \partial \sigma_x^2 > 0$ and $\partial^2 \pi^e_{DU} / (\partial \sigma_x^2)^2 > 0$.

[22] 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%.

[23] 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 UK, β is around 0.8, which gives b=4. Obviously, different assumptions could generate different values for b.

[24] 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)). But analytically this can prove cumbersome, as an infinity of solutions is often liable to obtain.

[25] 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.

[26] Or, alternatively, countries could attempt to establish 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.

[27] Transparency may also be useful in helping reveal information on the authorities' preferred "model" of how the world works. This 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.

[28] See, for example, Stein (1989), Cukierman and Meltzer (1986), Dotsey (1987) and Garfinkel and Oh (1995). Goodfriend (1986) provides a good summary and critique of the arguments used by the Fed to rationalise secrecy.

[29] 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. 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.

[30] This relationship is statistically significant at 95%; the t-ratio is 2.84.

[31] This relationship is also statistically significant at 95%; the t-ratio is 2.16.

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