FEASIBLE MECHANISMS FOR ACHIEVING MONETARY STABILITY: A COMPARISON OF INFLATION TARGETING AND THE ERM*

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Abstract

This paper re-examines the credibility-flexibility trade-off in monetary policy given recent suggestions that contractual solutions are readily available. Absent the feasibility of a fully state-contingent contract, an aversion on the part of the authorities to the level of the real interest rate, akin to the traditional output distortion, generates an inflation bias which is a function of the supply shock. The state-contingent inflation bias means the optimal contract is no longer a first-best solution. Comparing a second best contract with another regime for achieving monetary stability, a stylized ERM, demonstrates that which is more desirable depends on the nature of the 'political economy' distortions. We discuss which of these two mechanisms may be more practicable in the real world.

I Introduction

Prior to the exchange rate crises of 1992 and 1993, the inflation credibility of a number of European countries was thought to derive from the ERM, and the independence of the Bundesbank. Many feared that a collapse of the ERM, or even a serious questioning of existing parities, would reignite inflationary expectations and take Europe back to the high inflation rates of an earlier decade. The fact that this has not yet happened may cast some doubt on the notion that the ERM was responsible for the monetary stability of the last decade.[1] But in any case, after the widening of the ERM bands, only France, the Netherlands, Austria, Belgium and Denmark have clung to their old policies of pegging to the DM. The others have looked elsewhere for a means of determining monetary policy and achieving inflation credibility.

Several countries have joined Canada and New Zealand in adopting the mechanism of inflation targeting.[2] Given the instability of velocity, inflation targeting has an obvious advantage over targeting a money aggregate, but what gives inflation targeting credibility? Recent papers by Walsh (1995) and Persson and Tabellini (1993), along with the earlier papers of Canzoneri (1985) and Rogoff (1985), provide one possible answer. They all suggest that inflation penalties can be imposed upon (or embraced by) a central bank to give it better inflation fighting credentials.[3] However, the approach of Canzoneri and Rogoff (denoted by C&R in what follows) differs from that of Walsh, Persson and Tabellini (denoted by W, P & T) in two potentially important ways: (1) the types of penalties that are imposed, and (2) the methods that are used to impose them.

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[1] See Giavazzi and Pagano (1988) for a statement of the original notion. It can be argued that longer term bond rates do exhibit inflationary expectations, and that the weak state of most European economies has kept inflationary pressures at bay. In other words, the new regime has yet to be tested.

[2] The UK, Sweden, Finland and (most recently) Spain have announced official inflation targets. See Ammer and Freeman (1994) for a listing of targets and definitions for the first three countries; see the Banco de España's *Economic Bulletin* (January 1995) for Spain. Freedman (1994) discusses the Canadian case; Bowen (1994) discusses the UK case; and Svensson (1994) discusses the Swedish case.

[3] There is also a literature on first best solutions to the credibility problem. For example, Svensson (1994) discusses controlling the fiscal deficit, issuing indexed (or foreign currency) debt, and making labor markets more flexible. Our lack of attention to first best approaches is not meant to detract from their importance, perhaps in conjunction with an inflation target procedure.

C&R discuss penalties or restrictions on deviations from the optimal inflation target, while W, P & T advocate a linear inflation penalty on any observed inflation, even if it is below target. The difference would appear to be important, in the popular Barro-Gordon model anyway. C&R argued that there is a fundamental tradeoff between commitment to an inflation target and flexibility for stabilisation: adding penalties for missing the inflation target will lower the Barro-Gordon inflation bias, but it will also decrease the central bank's incentive to stabilise output. By contrast, W, P & T found that their linear penalty on all inflation could eliminate the inflation bias without interfering with the stabilisation effort; they argued that there is no fundamental tradeoff between credibility and stabilisation in the Barro-Gordon model.

C&R suggested that additional penalties could be placed on deviations from the inflation target by delegation (appointing a 'conservative' bank governor who placed more weight on the inflation objective) or by legislation (requiring average targeting rules).[4] W, P & T envisaged their linear penalties on inflation being written into a performance contract for the central bank governor. The differences here may, however, be more apparent than real. Neither approach (except possibly delegation) has a literal application in the real world, but something like the symmetric penalty suggested by C&R, and something like the linear penalty advocated by W, P & T, can be observed in the institutional design of central banks and in the behaviour of central bankers. Both approaches have therefore been given generous interpretations. The questions here should be put more operationally: What methods are available for actually instituting the symmetric C&R penalty or the linear W, P & T penalty? Is one kind of penalty easier to manufacture than the other? Indeed, is either approach feasible in the real world?

There is of course an equivalent question about the ERM: what gave it credibility? Put bluntly, if the government can't keep a promise (of low inflation) to its own electorate, then why should it be able to keep a promise (of a fixed exchanged rate) to foreigners? The answer usually given is once again 'costs', costs for leaving the ERM. But, what exactly are the costs? Are they easier to manufacture than the costs that support inflation targeting? Why did they fail? Can inflation targeting succeed where the (old) ERM did not?

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[4] Lohmann (1992) studied a hybrid solution in which the government delegates policy within certain bounds (that is, provided shocks are not too big).

In this paper, we try to compare the two mechanisms for monetary stability: inflation targeting (cum inflation penalties) vs the ERM. In section IV, we discuss the feasibility of actually implementing either mechanism. We try to identify the methods of imposing (or embracing) them. In the case of inflation targeting, we ask which kind of penalty (the symmetric C&R penalty or the linear W, P & T penalty) a given method will accommodate, since the theory suggests that the distinction is important. We also assess the recent suggestion of Svensson (1995) that the two penalties are isomorphic. Finally, we give a reason why inflation targeting may be able to survive in an environment where the (old) ERM did not. Section IV is undoubtedly the most difficult in the paper, and the least rigorous. However, it may also be the most important: feasibility may be the determining factor in a choice between inflation targeting and the ERM, or in a choice between the symmetric and linear inflation penalties.

In section III, we turn to an easier question. We ask whether inflation targeting (cum inflation penalties) or the ERM would bring a more efficient resolution of the credibility-stabilisation tradeoff in (a variant of) the Barro-Gordon model. Both mechanisms eliminate the expected inflation bias; the difference between the two lies in the stabilisation effort. After joining the ERM, the home country just imports German monetary policy, and German policy may be responding to current economic conditions in a way that is not appropriate at home. Inflation targeting allows independence from the Bundesbank, and the flexibility to respond to economic conditions in a more appropriate manner. If, however, inflation targeting does not provide a very good resolution to the credibility-stabilisation tradeoff, then the home response may be worse than the imported German policy.

But before going on to this analysis, we need to modify the Barro-Gordon model in a rather significant way. As already mentioned, Walsh (1995) has shown that in standard formulations of the Barro-Gordon model, there is no real tradeoff between credibility and stabilisation; a linear penalty on observed inflation eliminates the inflation bias without impinging on the discretion of the central bank to respond to shocks in an efficient manner. If this is indeed the case, then there is no horse race: inflation targeting is a first best policy that can not be dominated by the ERM. Those who take this result at face value need read no further. We suspect, however, that the credibility-stabilisation tradeoff is not so easily eliminated in the real world, and we take the result to be a methodological criticism of the Barro-Gordon model. In section II, we modify the preferences

of the central bank to restore the tradeoff, even when a W&PT contract is implemented.[5] Another shortcoming of the Barro-Gordon model is that political pressures on the central banks are not modelled explicitly. Our modification phrases the credibility problem in terms of political pressures, but this is a poor substitute for a real political economy model.

II Modifying the Barro-Gordon Model to Restore the Tradeoff

In this section, we show how the Barro-Gordon model can be modified to restore the credibility-stabilisation tradeoff, even when a W&PT performance contract is imposed on the central bank governor. We start with a very simple framework:

$$y_t = y_t^n + (\pi_t - \pi_{t|t-1}) + x_t, \qquad (1)$$

$$i_t - \pi_{t+1|t} = r - \delta(y_t), \qquad (2)$$

where p_t is the log of the price level in period t, and $\pi_{t|t-1} \equiv E_{t-1}(p_t - p_{t-1})$ and $\pi_{t+1|t} \equiv E_t(p_{t+1} - p_t)$ are expectations of inflation. **(1)** is a 'Lucas' supply curve, which states that output depends on an inflation prediction error and a productivity shock; x_t is *i.i.d.* and has expected value zero. **(2)** is an IS curve, which states that the real rate of interest depends inversely on the level of output. We assume that the central bank sets the inflation rate, π_t, directly each period.[6]

y_t^n is the 'natural' rate of output and $r_t^n = r - \delta y_t^n$ is the corresponding 'natural' rate of interest; they are the values these variables would take in a full information equilibrium, where agents in the private sector see and respond to

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[5] Walsh (JMCB, forthcoming) has recently shown that this can also be accomplished by changing the specification of the labor market. We suspect, however, that our modification is more relevant.
[6] Adding velocity shocks would not matter since they would be fully accommodated in the examples of this section and the next. Adding an LM curve with nominal interest rates would complicate the algebra in this section, and it would add 'game' aspects to national policy making in the next. Neither complication would seem to add to the basic insights.

all of the shocks. In the 'contract' models of Fischer and Gray, and in the 'islands' models of Barro and Lucas, the natural rate of output generally depends on the realisation of the supply shock; that is why we have given y_t^n and r_t^n time subscripts. We need not be concerned with the details of this in what follows, but we will take y_t^n and r_t^n to be the socially optimal values. We denote the optimal rate of inflation by π_t^n. The loss function of the central bank (or its governor) is:

$$L = .5[y_t - (y_t^n + \bar{y})]^2 + .5(\pi_t - \pi_t^n)^2 + \omega\pi + .5\beta[i_t - \pi_{t+1|t} - (r_t^n - \bar{r})]^2, \quad (3)$$

where $\bar{y}$ and $\bar{r}$ are positive constants. We assume that the central bank sees the productivity shock, x_t, before it has to choose the inflation rate, π_t.

Here, it may be useful to review the literature leading up to our discussion. If the loss function were limited to the first two terms, then we would have a typical example of the original Barro-Gordon model. The central bank tries to stabilise the economy against the productivity shock, x_t. It also tries to achieve an inflation target, π_t^n, and a level of output that is higher than the natural rate, y_t^n, which is the equilibrium rate that the private sector is chasing. Thus, $\bar{y}$ represents a distortion.[7] We view it as a political distortion; the central bank is under pressure to create a higher rate of employment than the market will on average allow. The private sector understands this and expects the central bank to try to pump the economy up. More specifically, the private sector expects the central bank to raise the rate of inflation until it conflicts enough with the inflation goal that the bank finally resists any further pressure to raise employment. As is well known, in a rational expectations equilibrium, the central bank is not able to increase the rate of employment on average, and the economy is left with an inflation bias that benefits no one.

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[7] In some versions of the model, $y_t^n + \bar{y}$ is taken as the socially optimal rate of output; see for example Canzoneri (1985).

The inflation bias could of course be eliminated by constraining the central bank to follow a k% rule for money growth, but this would leave it with no discretion to respond to shocks. Alternatively, the bank could be constrained by a rule that states exactly how it should respond to all of the shocks that might affect the economy, but this is generally thought to be infeasible.[8] Thus, the Barro-Gordon model seemed to provide a useful vehicle for studying the credibility problem that central banks are generally thought to face: the bank needs to find a way of committing itself not to respond to political pressures to inflate while at the same time retaining the flexibility to respond to unforeseen events.

Rogoff (1985) showed that the inflation bias could be reduced by increasing the weight on inflation in the central bank's loss function; however, this would distort the stabilisation effort, since the bank would give too little weight to employment when responding to shocks. Canzoneri (1985) showed that targeting rules for money growth would reduce the inflation bias, but again at the expense of flexibility in the stabilisation effort. And indeed, a very large literature has developed using the Barro-Gordon model to explore this credibility-stabilisation tradeoff. Then, Walsh (1995) found a way of eliminating the tradeoff altogether. The third term in **(3)** represents the penalty on observed inflation in the performance contract that W, P & T envisage. We will see that an appropriately chosen 'price', ω, will induce the central bank to implement the first best policy. As stated in the introduction, we view this result as a methodological criticism of the Barro-Gordon model, rather than a statement about the ease with which the tradeoff can be resolved. Thus, we want to modify the model in a way that restores the tradeoff, even when a linear penalty on inflation can be imposed.

To do this, we must understand how the performance contract works. Walsh's result rides on a curious feature of the Barro-Gordon model that seems to have gone unnoticed by those of us who have asserted that the model exhibits a fundamental tradeoff between credibility and stabilisation. In particular, the Barro-Gordon inflation bias is not state contingent. It does not depend on the shocks that cause the stabilisation problem; it just depends on the size of the

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[8] In the real world, unlike our model, the structure of the economy, and the source and distribution of shocks, are not very well understood. The targeting procedures of New Zealand and Canada do have some rather well specified escape clauses (see Ammer and Freeman (1994)), and a tactful definition of inflation can allow for some contingencies. However, no one would argue that such provisions can constitute a complete contingent contract. To capture this fact in our analysis, we simply rule out contingent contracts.

distortion embodied in $\bar{y}$. Or to put it another way, no matter what the state of the economy, at the first best outcome the central bank has a fixed marginal incentive to inflate, related only the size of $\bar{y}$. The performance contract just imposes an offsetting marginal cost, ω. Having eliminated the marginal incentive to inflate, the central bank can be relied upon to implement the first best stabilisation policy, at its own discretion and without any further monitoring.

The way to break up this result is obvious: modify the model so that the inflation bias is state contingent, and depends on the shocks that are causing the stabilisation problem. But, this is not as straightforward as it may at first seem. The inflation bias is caused by the inflationary expectations of agents on the supply side of the economy. If these agents are to incorporate a shock into their expectations and pass it on to the inflation bias, then they must be able to see the shock, and respond to it. This creates a problem for us, since the stabilisation problem is caused by the inability of agents to see and respond to shocks. In our model for example, if the agents in the supply curve see the productivity shock, then output will always be at its natural rate, y_t^n. We have to make the inflation bias state contingent, but we can't eliminate the stabilisation problem in the process.

The way round this difficulty is to shift the credibility problem to other agents in the model. Let them see shocks that agents in the supply side do not, and let them incorporate the information into their actions in a way that creates an inflation bias. The Barro-Gordon model is basically an IS-LM model. The only other agents are savers, and the only other relative price is the real interest rate. If we are to stay within the basic confines of the Barro-Gordon model, we have to shift the credibility problem to savers. Fortunately, it seems reasonable to assume that these agents make their decisions on the basis of more recent information than agents on the supply side. Indeed, the IS-LM model makes exactly that assumption: the interest rate in (**2**) responds to the productivity shock, x_t, that is not incorporated into the inflation expectations in (**1**).

This leads us to add the last term in the central bank loss function, which states that the bank tries to keep the real interest rate a level that is below the natural rate. Once again, we interpret the distortion embodied in $\bar{r}$ as coming form

political pressure, pressure to keep the interest rate low. We do now know of a political economy model that explains this pressure, but we certainly do observe it in practice.[9] Perhaps there is not a political awareness of how high the natural rate of interest is, just as it was difficult for some to accept the rising natural rate of unemployment. Charles Goodhart has suggested to us that the pressure may be due to the dispersion of lenders and the concentration of borrowers, who can form effective lobby groups. In the US, high interest rates have been criticised by Democratic and Republican administrations for being in conflict with growth policy. In Europe, high interest rates make it difficult for governments to finance their deficits and meet the fiscal convergence criteria specified in the Maastricht Treaty. In any case, political complaints about interest rates have been quite prevalent in recent years. The distortion in $\bar{r}$ would seem to be at least as relevant as the one presented by $\bar{y}$.

The central bank's first order condition is

$$L_{\pi} = (\pi_t - \pi_{t|t-1} + x_t - \bar{y}) + (\pi_t - \pi_t^n) + \omega - \delta\beta[\bar{r} - \delta(\pi_t - \pi_{t|t-1} + x_t)] = 0. \quad (4)$$

Since the private sector understands the motives of the central bank, it can use this first order condition to derive $\pi_{t|t-1}$. Taking expectations of (**4**), conditional on t-1 information, we have

$$\pi_{t|t-1} = \pi_t^n + \bar{y} + \delta\beta\bar{r} - \omega. \quad (5)$$

Using this in (**4**), we find the *discretionary solution*:

$$\begin{aligned} \pi_t^d &= \pi_t^n + (\bar{y} + \delta\beta\bar{r} - \omega) - (.5 + \beta\Delta)x_t, \\ y_t^d &= y_t^n + (.5 - \beta\Delta)x_t, \quad (6) \\ i_t^d - \pi_{t+1}^d &= (i_t - \pi_{t+1|t}) - (\pi_{t+1} - \pi_{t+1|t}) = r - \delta y_t^d - (5. - \beta\Delta)x_{t+1} \end{aligned}$$

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[9] We have modeled the pressure in terms of real rates. A focus on nominal rates would produce the same basic results, as long as the nominal interest rate target was consistent with the inflation target in the Fisher equation (that is, as long as $\bar{i} < r_t^n + \pi_t^n$).

where $\Delta = .5\delta^2 / (2 + \beta\delta^2)$, *and therefore* $0 < \beta\Delta < .5$.

If there were no political distortions ($\bar{y} = \beta = 0$), the *optimal solution* would be

$$\pi_t^o = \pi_t^n - .5x_t,$$
$$y_t^o = y_t^n + .5x_t. \qquad (7)$$

(Here, we have set $\omega = 0$, as it is not needed.) Note that it is optimal to accommodate half of the productivity shock. The *inflation bias* is

$$\pi_t^d - \pi_t^o = (\bar{y} + \delta\beta\bar{r} - \omega) - \beta\Delta x_t. \qquad (8)$$

In the discretionary solution, the private sector gets its way on average. Political pressures do not raise output or lower interest rates because the private sector anticipates their effect on the central bank and incorporate inflationary expectations into wage, price and nominal interest rate settings. Political pressures do create an inflation bias, and the interest rate pressure distorts the stabilisation effort as well.

Equations **(6)**, **(7)** and **(8)** confirm our earlier discussion. Beginning with the original Barro-Gordon model (by setting $\omega = \beta = 0$), we see the inflation bias, $\bar{y}$, is independent of the shock that is causing the stabilisation problem. However, the stabilisation effort is efficient; that is, the central bank is responding appropriately to the productivity shock in this case. Adding a symmetric C&R penalty for deviations from the inflation target (by putting more weight on the squared inflation term in the loss function) would make the bank respond too little to the shock. However, the linear W, P & T penalty can eliminate the inflation bias without distorting the stabilisation effort; that is, setting $\omega = \bar{y}$, the discretionary solution reduces to the optimal solution.

Adding political pressure on interest rates (by letting $\beta > 0$), the inflation bias becomes larger (on average) and shock dependent. Moreover, the stabilisation effort is distorted; the central bank responds too vigorously to the productivity

shock. The linear W, P & T penalty can eliminate the expected inflation bias (by setting $\omega = \bar{y} + \delta\beta\bar{r}$), but the stabilisation effort is still distorted.[10]

Thus, our modification of the Barro-Gordon model has restored the tradeoff between credibility and stabilisation. The linear W, P & T penalty represents one approach to that tradeoff: it eliminates the expected part of the inflation bias. But since the performance contract does not achieve the first best solution, it is quite possible that other approaches will be more attractive. For example, a k% rule would completely eliminate the inflation bias. The k% rule would leave no room for stabilisation, but it would still be better than the performance contract if interest rate pressures were badly distorting the stabilisation effort. The symmetric C&R penalty may also be preferable to the linear W, P & T penalty in some circumstances; we have not investigated this possibility.

III Inflation Targeting versus the ERM

A different mechanism for achieving monetary stability has received more attention in recent years. Giavazzi and Pagano (1988), and many others, have argued that by fixing the exchange rate with a low inflation currency, credibility can be simply imported. The basic problem with this approach is that the low inflation country's stabilisation policy (or lack of one) is imported as well, and this policy may not be appropriate at home. However, in certain circumstances it may provide a better approach to the credibility-stabilisation tradeoff than a performance contract with the linear W, P & T penalty. We turn now to a comparison of these two mechanisms for achieving monetary stability.

First, the model of the last section must be extended to include a second country. For concreteness, we will call the home country Great Britain and the foreign country Germany, and we will assume that the Bundesbank is immune to the political pressures discussed in the last section. The supply curves for Great Britain and Germany are

$$y_t = y_t^n + \pi_t - \pi_{t|t-1} + x_t + z_t,$$
$$y_t^* = y_t^{n*} + \pi_t^* - \pi_{t|t-1}^* + x_t^* + z_t, \qquad (9)$$

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[10] Of course, a shock contingent performance contract could achieve the first best solution. However, we are ruling them out for the reasons given earlier.

where z_t is a common productivity shock, and x_t and x_t^* are country specific shocks. We assume that the goods produced in Great Britain and Germany are perfect substitutes. The aggregate IS curve is

$$i_t - \pi_{t+1|t} = i_t^* - \pi_{t+1|t}^* = r - \delta(y_t + y_t^*). \qquad (10)$$

The law of one price and interest rate arbitrage force real interest rates to equalise across countries. The IS curve states that the common real interest rate is inversely related to total output: $r_t^n = r - \delta(y_t^n + y_t^{n*})$ is the natural rate of interest.

The central bank loss functions are:

$$\begin{aligned} L &= .5[y_t - (y_t^n + \bar{y})]^2 + .5(\pi_t - \pi_t^n)^2 + \omega\pi + .5\beta[i_t - \pi_{t+1|t} - (r_t^n - \bar{r})]^2, \\ L^* &= .5(y_t^* - y_t^{n*})^2 + .5(\pi_t^* - \pi_t^{n*})^2. \end{aligned} \qquad (11)$$

Since the Bundesbank is immune to political pressures, it always implements the optimal (from the German point of view) policy:

$$\begin{aligned} \pi_t^{o*} &= \pi_t^{n*} - .5(x_t^* + z_t), \\ y_t^{o*} &= y_t^{n*} + .5(x_t^* + z_t). \end{aligned} \qquad (12)$$

This is the outcome for Germany in either the ERM or the flexible rate regime.[11] If Great Britain faced no political pressures ($\bar{y} . = \beta = 0$), then its central bank would also implement the *optimal solution*:

$$\begin{aligned} \pi_t^o &= \pi_t^n - .5(x_t + z_t), \\ y_t^o &= y_t^n + .5(x_t + z_t). \end{aligned} \qquad (13)$$

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[11] We have specified the model so that 'game' aspects associated with the productivity shocks are suppressed.

As in the last section, it is optimal to accommodate half of the productivity shock. Great Britain's discretionary solution is calculated as before. Expected inflation is:

$$\pi_{t|t-1} = \pi_t^n + \bar{y} + \delta\beta\bar{r} - \omega, \tag{14}$$

and the performance contract can be used to eliminate the expected inflation bias (by setting $\omega = \bar{y} + \delta\beta\bar{r}$). The *inflation targeting solution* for Great Britain is:

$$\begin{aligned} \pi_t^{it} &= \pi_t^n - (.5 + \beta\Delta)(x_t + z_t) + \beta\Delta(x_t^* + z_t), \\ y_t^{it} &= y_t^n + (.5 - \beta\Delta)(x_t + z_t) + \beta\Delta(x_t^* + z_t). \end{aligned} \tag{15}$$

where $\Delta = .5\delta^2 / (2 + \beta\delta^2)$. The inflation bias is given by

$$\pi_t^{it} - \pi^o = -\beta\Delta(x_t + z_t) + \beta\Delta(x_t^* + z_t). \tag{16}$$

As before, the performance contract eliminates the expected inflation bias, but interest rate pressure distorts the stabilisation effort. If this pressure is not too great, then inflation targeting does quite well; that is, as β goes to zero, the inflation targeting solution converges on the optimal solution.

If Great Britain fixes its DM exchange rate, then it simply imports the German inflation rate; that is, $\pi_t = \pi_t^*$. The *ERM solution* for great Britain is:

$$\begin{aligned} \pi_t^{erm} &= \pi_t^{n*} - .5(x_t^* + z_t), \\ y_t^{erm} &= y_t^n + .5(x_t^* + z_t) + x_t \end{aligned} \tag{17}$$

Here, the inflation bias is given by

$$\pi_t^{erm} - \pi_t^o = (\pi_t^{n*} - \pi_t^n) + .5(x_t - x_t^*). \tag{18}$$

The ERM makes British policy immune to domestic political pressures. However, the ERM imposes other costs, most of which are well known. The Bundesbank is pursuing its own objectives, and the policy it exports need not be appropriate for the rest of Europe. It may be aiming at an inflation target that is inappropriate, a problem that has been discussed by Canzoneri and Rogers (1990), and it may be responding inappropriately to shocks. Here, the Bundesbank responds appropriately to the common shock (the global productivity shock, z_t), but it transfers German problems to the British economy (as illustrated by the German productivity shock, x_t^*), and it does not respond at all to British problems (as illustrated by the British productivity shock, x_t). These results are quite familiar from the literature on fixed versus flexible exchange rates, and also the game theory literature: fixed rate regimes work well for global shocks, but flexible rates are better for regional shocks.

Thus, the choice between inflation targeting and the ERM involves a number of considerations, and unfortunately the way costs and benefits add up need not be robust across models. However, the basic strengths and weaknesses of the two mechanisms are clear. Inflation targeting works well when political pressures are not too great in the first place, when the Bundesbank is pursuing very different policy goals, or when shocks causing the stabilisation problem are primarily regional. The ERM is preferable when domestic political pressures are great, policy preferences are similar, and shocks are Europe wide.

In this section, we have assumed that inflation targeting is supported by the linear W, P & T penalty on observed inflation rather than the symmetric C&R penalty for deviating from an announced target, and we have used the language of 'performance contracts'. We chose to do this because the W, P & T approach is new. However, it should be clear that when comparing inflation targeting to the ERM, the C&R penalty would produce much the same results. It would be interesting to compare the two approaches to inflation targeting in an international context, but once again we have left this to future research.

IV Credible Implementation of Mechanisms for Monetary Stability

So, what happened in 1992/1993? Why were so many countries forced to abandon their tight peg with the DM? And, why did some adopt inflation targeting instead? Was it because of fundamental differences with German policy, as explained by the analysis of the last section? Were competitiveness problems and German reunification the asymmetric shocks that made the ERM

in its hard form too costly to continue? Perhaps, but here we suggest another possibility: with the abolition of capital controls, the ERM may no longer have been feasible. We will return to these questions towards the end of the section.

In the last two sections, we simply assumed that inflation targeting could be implemented, using either the W, P & T penalty on any observed inflation or the C&R penalty for deviations from the optimal inflation target. We also assumed that the ERM was a viable option. In this section, we discuss the feasibility of actually implementing either mechanism. Indeed, feasibility may be the determining factor in a choice between the two, efficiency in stabilisation may be icing on the cake.

IVa Ways of Supporting the Inflation Targeting Mechanism

A number of ways have been suggested for implementing the linear W&PT penalty on inflation or the symmetric C&R penalty for deviations from announced optimal targets. Some of them are already in use. In this subsection, we try to assess their strengths and weaknesses.

We begin with performance contracts, since they have been the focus of the recent literature. There are no examples in practice that come very close to the theoretical model W, P & T laid out, though the New Zealand 'contract' came close: graduated inflation penalties were evidently considered, but not adopted in the end.[12] Instead, the contract implies that the governor can be dismissed if inflation performance does not conform with agreed targets.[13] Since there are no examples in practice, we will have to rely on theoretical arguments to determine whether or not performance contracts are feasible.

The most immediate question that comes to mind is: would they be binding? Walsh (1995) says that 'if the (penalty on inflation) represents the employment contract of the central banker, then the legal enforceability of contracts ensures that the government can credibly commit to the (penalty) scheme.' We suspect the issue is more complicated than Walsh makes it sound. Contracts can resolve

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[12]See Goodhart and Viñals (1994).

[13]Walsh (JMCB, forthcoming) has reformulated the contract model to show that an optimal dismissal rule can support the first best policy. However, the dismissal rule has to be written in terms of the supply shock, and we have been assuming that contingent contracts are not feasible. New Zealand's 'contract' does include some well defined escape clauses (see Ammer and Freeman (1994)), but Walsh finally concludes that 'the procedures .... are time inconsistent.'

principal-agent problems in the private sector because there is a higher authority, the law courts, that will enforce them. But, is there a higher authority who will enforce a contract between two governmental agencies, or between a member of the public and the government? Here, the electorate is presumably the principal, the central bank governor is the agent, and the government is an intermediate 'executive' agent who negotiates the contract and monitors compliance. In a US context, the question might be posed as follows: Suppose one of the principals, say Alan Meltzer, thinks that the agent, Alan Greenspan, is not in compliance with his contract, and that the monitor, Bill Clinton, is being lax; or suppose Bill Clinton simply renegotiates the contract after an inflationary episode. What higher authorities does Alan Meltzer take Bill Clinton and Alan Greenspan to for redress? Does it all boil down to this: the government has to negotiate, monitor and enforce the contract?

If so, we seem to have come full circle in the literature on central bank independence. The original argument for an independent central bank was that the government could not commit to the optimal policy. How can we now just assume that the government will enforce an employment contract that will bring the optimal policy about? As McCallum (1995) has argued, 'contracts between governments and central banks do not overcome the motivation for dynamic inconsistency, they merely relocate it.'

Pursuing the notion of legal enforceability is not the comparative advantage of an economist, and it is probably beside the point in any case. The basic question addressed by the commitment literature is this: how can a sovereign policy maker - who by definition can not even ask to be regulated from above - credibly commit to a decision that might be tempting to change at some later date?

A more useful way of proceeding is to look for 'costs', costs that make it difficult to reverse a previously made decision. A sovereign policy maker might welcome costs that make it more difficult to renege on a commitment. Fischer (1990) outlined the approach quite succinctly: 'Discretionary policies, such as monetary policy, can be changed at low cost; rules fixed by law such as much of fiscal policy are changeable at greater cost; rules fixed by constitutional law such as the rights of private property or interstate commerce are in principle changeable but at yet greater cost.' Persson and Tabellini (1993) use this view of commitment when they make their argument for the enforceability of performance contracts: '(It) is a reasonable assumption if we view the contract as a statute for the central bank. Clearly, it is possible to change the central bank law, but only according to a preset procedure which requires time.'

The argument can easily be extended to include political costs. A sympathetic (or appreciative?) government might be tempted to be lenient with the bank governor after an inflationary episode, but an open abrogation of the inflation contract would probably be viewed as a blatant political payoff, and the government would almost surely be subjected to public criticism. This is another example of the kind of cost we are looking for.

The penalty for inflation in a performance contract is pecuniary; it would come out of the budget of the central bank, the salary of its governor, or the salary of the finance minister if the central bank was not independent. Pecuniary costs are flexible. They could take the form of a W, P & T penalty on all inflation or a C&R penalty for missing an optimal inflation target. Choosing the appropriate parameters to conform with either theory might however be quite difficult in practice. Consider the calibration problem. We have assumed that the central bank governor (or finance minister) is already motivated to maximise social utility (the first two terms in equation (3)); this may come from a genuine desire to do the right thing, or to make a place in history, or it may come from the desire to establish credentials for a future career.[14] The governor is also motivated by pecuniary rewards. The question is: how does the governor trade off these two motivations? This would be very difficult to know in practice. Moreover, we could not hope to learn much by trial and error. Small pecuniary incentives may be sufficient for one governor; large ones may be necessary for another. Fine tuning the penalty structures would be difficult in practice, even if the cost structure is flexible enough to allow it.

Persson and Tabellini (1993) suggested that fixing salaries or budgets in nominal terms would be a step in the right direction. This would appear to be quite doable; and in fact, the budget for the central bank of New Zealand is set in nominal terms for a five year period. A sympathetic (or appreciative) government would presumably have the option of making extra allotments after an inflationary episode, or at the start of the next five year contract. If however this had to be done in a public way, say as an act of parliament, then it would probably be viewed as a blatant payoff for reneging on the inflation goal, and the government would be subjected to criticism. This is, once again, the type of cost we are looking for.

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[14] One might object to this use of the social utility function. It's maximisation is essentially a reduced form for an important part of the political process we are trying to analyse.

Nominal salaries clearly impose the lineary W, P & T penalty. The penalty could be fine tuned, through the use of partial indexation. There would be a calibration problem in practice. However, nominal salaries would seem to have all the ingredients of an explicit performance contract, and they may be more straightforward to write and enforce.

Walsh (1995) and Persson and Tabellini (1993) both alluded to the public embarrassment that comes from missing an announced target. The prestige of the central bank (or the government) and the career of its governor (or finance minister) are at stake. Moreover, the central bank can choose the degree of embarrassment risk that it wishes to expose itself to. Some countries (the US, for example) minimise the risk by only stating their inflation objectives in general terms. Other countries (like Canada, Finland, Sweden, New Zealand and the UK) go out of their way to increase the risk by adopting official targets. Somewhere in between are countries (like France, Germany, and Switzerland) that allude to numerical goals, but only within context of a broader economic plan.[15] The fine tuning problem would again be difficult in practice. However, the self imposed embarrassment risk would seem to be just the kind of cost we are looking for, and indeed it may be the most prevalent example in practice.

Transparency is key here: the central bank has to make its objectives clear and assume the appropriate degree of responsibility for meeting them. The cases of Italy and Splain illustrate some of the practical and institutional problems that can make this difficult. A number of observers have been urging the Banca d'Italia to adopt an official inflation target. However, the Italian government already announces an inflation target, in connection with its budgetary plan. The history of this:[16] Italian inflation has come down dramatically over the last decade, but the announced targets have been part of a rosy scenario, perhaps best characterised as wishful thinking; the targets were rarely met. Currently, the Bank d'Italia neither ascribes to the government's target nor does it announce its own. Indeed, it is very difficult to see how the Banca d'Italia could announce its own target, especially if it was more realistic (and therefore higher) than the government target. The Bank would risk appearing 'soft' on inflation.

The Banca de España got round a similar problem by announcing targets for inflation that were further in the future. However, it had other problems. First,

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[15] Ammer and Freeman (1994) called them 'quantified inflation objectives', and *The Economist* magazine (April, 1995 issue) called them 'informal targets'.
[16] See Visco (1995).

the Bank announced its target on what turned out to be a very heavy news day, and the announcement seems to have gone largely unnoticed. Official Spanish documents and the European Monetary Institute's first annual report list formal inflation targets,[17] but the popular financial press gives a different impression.[18] The Bank's transparency problem is further complicated by a need to establish the primacy of its inflation target without eschewing Spain's commitment to the ERM.[19]

Public embarrassment over missing an announced target clearly imposes the symmetric C&R penalty. It is therefore somewhat surprising that both Walsh (1995) and Persson and Tabellini (1993) mention it in support of their case. A symmetric penalty for deviations from the optimal inflation rate does not work for them, even if it is linear. To see why, consider the following example: Suppose the announced inflation target (π_t^n in (3)) is 2%, but suppose the realisation of shocks implies the optimal inflation rate for this period is just 1%. A penalty that punishes deviations from the announced 2% will just add to the incentives that were causing the original inflation bias. It can not bring about the first best policy.

It is interesting to speculate whether embarrassment risk could somehow be reshaped to reflect the monotonic W&PT penalty on any observed inflation. The distinctions here are rather subtle: the central bank would have to acknowledge an inflation (corresponding to π_t^n in (3)), but it might also be able to suggest that it is really embarrassed to see any inflation at all. Making such a distinction may be difficult in practice. For one thing, it might sound like a questioning of the true social welfare function, and be quite confusing.

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[17] See for example the Banco de España's *Economic Bulletin* (January 1995).
[18] See for example the April 22 issue of *The Economist*, which groups Spain along with Germany, Italy and France as a setter of 'informal' targets.
[19] The Banco de España's *Economic Bulletin* (January 1995) makes a valiant attempt to do just that.

Svensson (1995) suggested a more promising approach, though it ultimately runs into similar difficulties. Svensson (1995) noted that (with quadratic utility) the linear penalty could be generated by simply announcing an inflation target, τ, that is lower than the social optimum:

$$
\begin{aligned}
L &= .5[y_t - (y_t^n + \bar{y})]^2 + .5(\pi_t - \tau_t)^2 \\
L &= .5y_t - (y_t^n + \bar{y})]^2 + .5[(\pi_t - \pi_t^n) + (\pi_t^n - \tau_t)]^2 \\
L &= .5[y_t - (y_t^n + \bar{y})]^2 + .5(\pi_t - \pi_t^n)^2 + (\pi_t^n - \tau_t)\pi_t - .5(\pi_t^n - \tau_t)(\pi_t^n + \tau_t),
\end{aligned}
\tag{19}
$$

and choosing τ_t so that $\pi_t^n - \tau_t = \omega$, we have the linear W, P & T penalty. Again, the question is, can the central bank credibly announce a target that is inconsistent with the true social function? Trying to explain why its target should be lower than the optimal inflation rate could prove difficult. (Indeed, if the required ω is large, the implied τ_t might even be negative.) In any case, the fact that there has been so little complaint about the level of announced targets suggests that this option has not been adopted in practice.

Both of the 'costs' we have discussed so far - embarrassment risk and pecuniary penalties - suffer from the fact that they are delayed reactions. Persson and Tabellini (1993) describe the problem this way: 'The effect of policy actions on asset prices or the money supply is readily observable. The effect on prices is observable only with substantial delay. It may thus be harder for society to commit to 'punishing' a central bank for actions undertaken six months or a year ago. If the central bank deviates from a financial target, the penalty is more immediately related to the policy actions. It may, therefore, be easier to sustain such penalties than in the case of inflation targets.' Indeed, with inflation targeting, the policy maker may not even expect to be in office when it comes time to reap the consequences. The link between action and consequence may be hard to establish, in the eye of the policy maker or in the eyes of the public.

A natural approach to this problem is to shift the cost away from observed inflation, and over to expected inflation. As Svensson (1994) has noted, a number of central banks in Europe have been using expected inflation as an operational guide ever since the widening of the ERM bands. If expected inflation is the guide for monetary policy, then inflationary expectations might be the natural yardstick by which current decisions are judged. The expectations

would have to be measured in some objective way.[20] The asset market is an obvious place to look. For example, a long term bond rate could be written into a performance contract (as in the Maastricht Treaty), or it could be announced as a target along with the inflation target. The market would then render an immediate verdict on current policy actions, and the appropriate 'cost' could be administered. We will return to this topic shortly.

Finally, we have the most popular interpretation of the Rogoff (1985) analysis. A government can simply delegate monetary policy to a 'conservative' central banker (or finance minister), someone who is perversely inflation conscious. The cost here is of course the difficulty a government would have in firing a conservative central banker; it would look like a blatant reneging on the inflation goal. There may well be examples of delegation in practice, but it is difficult to be certain: candidates for the job may have an incentive to appear 'conservative', and incumbents almost certainly have an incentive to look tough to keep private sector expectations in line. Similarly, it is difficult to tell whether delegation imposes the linear W, P & T penalty or a symmetric C&R penalty. Here again, the fine tuning envisaged by the theory is difficult in practice.

IVb Ways of Supporting the ERM

Next, we turn to costs that support the ERM. Once again, embarrassment risk looms large. Having to leave the ERM (or even ask for realignment) is a highly focused news event. It can be quite embarrassing politically, calling the entire economic policy into question; the finance minister may have to resign. The government also runs the risk of looking 'un-European', with all the consequent costs (or benefits).

The final thing to note here is that the ERM does not have two problems that were emphasised in the case of inflation targeting: (1) The costs do not have to be fine tuned, just sufficient to deter exit; and (2) there is no delay between

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[20] The Bank of England also announces its inflation projections, and these projections might be compared with private forecasts. It should be noted however that these projections are conditioned on the assumption of no change in policy. They need not be consistent with private forecasts (if private forecasters expect a change in policy), or with announced inflation targets (if a change in policy is needed). The conditioning of these official forecasts may therefore be problematic in terms of the issues discussed above.

actions and consequences, since the exchange rate is an asset price that renders an immediate verdict.

IVc Market Evaluation of Policy: the Good, the Bad, and the Ugly

Implementing the ERM may seem easier than supporting inflation targeting. So, we return to the two questions that were posed earlier: What went wrong in 1992/1993? And, can inflation targeting be expected to survive where the (old) ERM did not?

We begin by noting that there is some slippage in the argument for market evaluation of policy. The market does not just render a verdict on current policy actions; it also takes a stand on expected future policy. The ERM has no way of separating the two; the market might punish a policy maker for actions that are not being contemplated, or even for the actions that it expects of the next government.

The 'good' of market based policy evaluation is that it renders an immediate verdict. The 'bad' is that it may not distinguish between current and expected future policy. And the 'ugly' is what it can do to an incumbent with even the best of intentions.

There is of course a debate as to what happened in 1992/1993. One side is represented by the Committee of Central Bank Governors (1993a, b). Their view is that the crises were caused by the unsustainable policy stances of weak currency countries; the old ERM would be workable with timely realignments. The other side is represented by Eichengreen and Wyplosz (1993) and Eichengreen, Rose and Wyplosz (1994), Obstfeld (1994) and Portes (1993), who change the focus from the slow build up of imbalances to the liberalisation of capital markets and the possibility of self fulfilling speculative attacks. In this view, say Eichengreen, Rose and Wyplosz (1994), 'the speculative attacks which forced (governments) to raise interest rates created incipient macroeconomic imbalances rather than the other way round and more generally increased the cost of defending the prevailing currency pegs.'

What might the lessons of 1992/1993 be? If the first view is correct, then the good in market evaluation of policy may be sufficient to support the ERM. On the other hand, if the second view is correct, then the bad and the ugly may prevail. We can also see why inflation targeting may be sustainable where the old ERM was not. In section IVa, we showed that the costs supporting inflation

targeting need not rely on a market evaluation of policy; they could be based on observed inflation instead.

We also suggested that a delayed reward for current policy actions might create a credibility problem, and that targeting a long term bond rate along with the inflation rate would introduce an immediate market evaluation. But, a long term bond rate, like the spot exchange rate, reflects expectations of both current and future inflation, and the experience of 1992/1993 suggests that targeting a long term bond rate might invite testing, in much the same way that the narrow exchange rate bands were tested. Market based policy evaluation is a two edged sword that should be approached cautiously. It is interesting to speculate whether the term structure of interest rates could be exploited to separate the good in market policy evaluation from the bad and the ugly, but this too is left to future research.

V Summary and Conclusions

In this paper, we studied two mechanisms for achieving monetary stability: inflation targeting (cum inflation penalties) and the ERM. First, we modified the Barro-Gordon model by introducing political pressure to keep interest rates low. This modification (or something like it) was necessary, in light of recent work by Walsh (1995), to retain the tradeoff between achieving credibility and retaining flexibility for stabilisation. Without such a tradeoff, the model loses its usefulness for studying the commitment problem.

Once this was done, we compared the efficiency of inflation targeting and the ERM in addressing the tradeoff. Either can eliminate the expected inflation bias. We found that inflation targeting is better than the ERM when political pressures do not distort the stabilisation effort much in the first place, when the Bundesbank is pursuing very different policy objectives, or when shocks causing the stabilisation problem are primarily regional in nature. These results are consistent with a popular view of what caused the demise of the (old) ERM: the monetary policy which suited Germany did not suit the needs of the rest of Europe.

Then, we tried to identify 'costs' that keep a policy maker from reversing a previously announced decision. We argued that such costs are necessary to make either inflation targeting or the ERM feasible. For inflation targeting, we also asked whether the cost that was identified could be used to impose the linear W&PT penalty on all observed inflation or the symmetric C&R penalty

for deviations from an announced optimal inflation target; theory suggests the distinction is important.

For inflation targeting, the risk of embarrassment (of missing an announced target) seems to be the most prevalent 'cost' in practice. This cost can clearly be used to impose the symmetric C&R penalty, and this is what is done in practice. However, it could also be used to support the linear W, P & T penalty, if announcing an inflation target that is too low (ie, one that is lower than the optimal rate of inflation) can be made to sound credible. The performance contract described by Walsh (1995) and Persson and Tabellini (1993) may or may not be feasible; there are no close examples in practice. However, it may well be possible to concoct the linear penalty they envisage by some other means; nominal salaries or budgets are the most obvious possibility. New Zealand is a case in point. Theory requires that the penalty structure be finely calibrated to produce the promised results, and we argued that this is very difficult in practice. The theory should be revised to account for this difficulty, especially when comparing the two types of penalties.

For the ERM, the risk of embarrassment (for having to leave, or even for having to ask for a realignment) is the most obvious 'cost'. However, the risk of seeming 'un-European' and losing influence in the EU is undoubtedly a factor in some countries. The ERM employs a market based system of policy evaluation that does not distinguish between current policy actions and expected future policy. This made policy vulnerable to 'testing' once capital markets were liberalised, and it provides an alternative explanation for the crises of 1992/1993, one that is consistent with the literature on self fulfilling speculative attacks.

Finally, we argued that inflation targeting might be more flexible than the ERM in its need for, and in its use of, the market to evaluate policy. As currently practised, inflation targeting does not use the market at all, and that may explain its ability to exist where the (old) ERM could not. Could the market be used in the future, exploiting for example the term structure of interest rates? This question is left to future research.

REFERENCES

Ammer, J, and Freeman, R, 'Inflation Targeting in the 1990s: The Experiences of New Zealand, Canada, and the United Kingdom', *IFDP #473*, Board of Governors of the Federal Reserve System, 1994.

Barro, R, and Gordon, D, 'Rules, Discretion and Reputation in a Model of Monetary Policy,' *Journal of Monetary Economics*, July 1983, 101-122.

Bowen, A, 'British Experience with Inflation Targetry,' *mimeo*, Bank of England, 1994.

Canzoneri, M, 'Monetary Policy Games and the Role of Private Information,' *American Econmic Review*, December, 1985, 1056-1070.

Canzoneri, M and Henderson, D, Monetary Policy in Interdependent Economies, MIT Press, 1991.

Canzoneri, M and Rogers, C, 'Is the EC an Optimal Currency Area? Optimal Taxation versus the Cost of multiple Currencies' (with C Rogers), *American Economic Review*, June, 1990, 419-433.

Committee of Governors of the Central Banks of the Members of the European Community (1993a), Annual Report 1992, Basle: Committee of Governors.

Committee of Governors of the Central Banks of the Members of the European Economic Community (1993b), 'The Implications and Lessons to be drawn from the Recent Exchange Rate Crisis: Report of the Committee of Governors,' processed, 21 April.

Eichengreen, B, and Wyplosz, C, 'The Unstable EMS', *Brookings Papers on Economic Activity* 1, 1993, 51-143.

Eichengreen, B, Rose, A K and Wyplosz, C, 'Speculative Attacks on Pegged Exchange Rates: An Empirical Exploration with Special Reference to the European Monetary System', *mimeo*, 1994.

Fischer, S, 'Rules versus discretion in monetary policy', in Friedman, Ben and Hahn, Frank, '*Handbook of Monetary Economics*', 1156-1184, Vol 2, 1990, North-Holland.

Freedman, C, 'The Canadian Experience with Targets for Reducing and Controlling Inflation,' *mimeo*, Bank of Canada, 1994.

Giavazzi, F and Giovannini, A, *Limiting Exchange Rate Flexibility*, MIT Press, 1989.

Giavazzi, F and Pagano, M, 'The advantage of tying one's hands: EMS Discipline and Central Bank Credibility', *European Economic Review*, Vol 32, 1988, 1055-1082.

Goodhart, C and Viñals, J, 'Strategy and Tactics of Monetary Policy: Examples from Europe and the Antipodes, *LSE Financial Markets Group* Special Paper No 61, August 1994.

Lohmann, S, 'Optimal Commitment in Monetary Policy: Credibility versus Flexibility,' *American Economic Review*, March 1992, 273-286.

McCallum, B, 'Two Fallacies Concerning Central Bank Independence', *NBER Working Paper* No 5075, March 1995.

Obstfeld, M, 'The Logic of Currency Crises', *NBER Working Paper No 4640*, February 1994.

Persson, T, and Tabellini, G, 'Designing Institutions for Monetary Stability', *Carnegie-Rochester Conference Series on Public Policy*, 39, 1993, 53-84.

Portes, R, 'EMS and EMU After the Fall', *The World Economy* 19, 1993, 1-16.

Rogoff, K, 'The Optimal Degree of Commitment to an Intermediate Monetary Target,' *Quarterly Journal of Economics*, Nov 1985, 1169-1190.

Svensson, L, 'Estimating and Interpreting Forward Interest Rates: Sweden 1992-4,' *CEPR discussion paper* No 1051, 1994.

Svensson, L, 'Inflation Targeting Need not Increase Output Variability: Comment on Rogoff and Walsh,' *mimeo*, April 1995.

Visco, I, 'Inflation Targeting and Monetary Policy. Notes for Discussion on the Italian Experience,' in Leiderman, Leonardo and Lars Svenssen (ed), *Inflation Targets*, CEPR, 1995.

Walsh, C, 'Optimal Contracts for Central Bankers', *American Economic Review*, March, 1995, 150-167.

Walsh, C, 'Is New Zealand's Reserve Bank Act of 1989 an Optimal Central Bank Contract?', *Journal of Money, Credit and Banking*, forthcoming.

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