# Fiscal Policy and Inflation Targets: Does Credibility Matters?

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by Marco Lossani, Piergiovanna Natale and Patrizio Tirelli

## 0. Introduction

Following the seminal work of Barro - Gordon (1983), a number of proposals have been put forward to correct the inflation bias. Some are inherently sub-optimal, in the sense that lower inflation may be attained only if distortionary stabilisation policies are implemented. Policy delegation to a weight-conservative central banker *à la* Rogoff-Lohmann[1] is the classical example. The inflation bias is reduced and output variability increased to the extent that the central bank is more inflation-averse than society *and* institutional arrangements preserve its independence. More recently, advocates of the principal-agent approach (Walsh, 1995; Persson - Tabellini, 1993) claim that the trade-off between credibility and flexibility is probably overstated. By means of a relatively simple performance-based contract, society can entirely remove the inflation bias and yet avoid distortionary responses to shocks. Instead of relying on the banker's specific attitude towards inflation, society itself can provide the right incentives for the banker to deliver low inflation. The contractualist approach has renewed interest in the issue, and has been subject to sharp criticisms as well. McCallum (1995) argues that if the lack of commitment technology causes the inflation bias, performance-based contracts simply relocate the time-inconsistency problem at a different level, i.e. the contract credibility – or lack of it[2]. In fact, ex-post contract en-

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[1] See Rogoff (1985) and Lohmann (1992).

[2] On this, see also Jensen (1997).

forcement cannot be taken for granted if the bank and the government share the same view on the output-inflation trade-off and both regard equilibrium output as inefficiently low. As pointed out in Waller (1995), contracts may increase policy credibility relative to simple announcements only to the extent that renegotiation costs are sufficiently high.

If the pioneering work of Walsh set the stage for the contractualist research agenda, Svensson's inflation target (Svensson, 1995) is meant to bridge the gap with the reality of monetary policy-making. While performance-based contracts are seldom observed in practice, in several countries central banks have endorsed inflation targets following the early failure of money supply targets and the difficulties met with nominal exchange rate pegs. Svensson shows that by an appropriate choice of the target, society can replicate the outcome which would obtain under an optimal contract. Two interpretations may be given of this result. If the central banker can be held accountable, a target is a non-distortionary performance-based contract. Alternatively, Svensson's proposal may be interpreted as a suggestion that monetary policy be delegated to a genuinely target-conservative central banker, that is, a banker who implements non-distortionary responses to shocks but prefers an expected inflation rate lower than the socially optimal one.

This paper explores the implications that either interpretation bears to the working of the inflation target proposal, by means of a model where – as in Alesina – Tabellini (1987) – distortionary taxes and seigniorage revenues are needed to finance public expenditures. We follow a three-step strategy. First, we compute the socially optimal inflation rate. Then, we derive the inflation bias, which arises as a consequence of discretionary monetary policies when the supply function is adversely affected by tax distortions and labour market imperfections. Finally, we focus on the two alternative interpretations of the inflation targeting proposal, assuming that the government and the central bank independently set their policy instruments, respectively the tax and the inflation rate.

We show that the optimal contract is substantially different from the one discussed in Svensson: either the inflation target is implausibly negative or a linear penalty in inflation must be added to the contract[3]. Moreover, if the commitment technology is imperfect, i.e. if the cost of reneging on the assigned target is small, any target so low to generate an *ex-post* loss in excess of the renegotiation cost will lack credibility. It follows that only «highish» inflation targets are credible. To make an impact on inflation expectations, imperfectly credible targets must be inversely related to renegotiation costs.

We present a new perspective also on the alternative view, which regards the inflation target proposal as a form of delegation to a target-conservative central banker. In principle, the task of credibility-building should be easier. Since the central banker has no incentive to *ex-post* collude with the govern-

[3] For a criticism of negative inflation targets, see De Grauwe (1996).

ment, all we need are sufficient legal guarantees of the central bank independence. But why should a central banker be target-conservative? In our model a target-conservative central banker *à la* Svensson is an expenditures-conservative banker, that is, an agent or an institution whose public expenditures target falls short of the socially optimal one. However, no more than an idiosyncratic view about the benefits from public expenditures can be invoked to explain expenditures-conservatism, implying that target-conservative agents are also weight-conservative.

The rest of the paper is organised as follows. In section 1, we review Svensson's inflation targeting proposal. In section 2, we present a model of the socially optimal inflation rate following a typical public finance approach. In section 3, we define the optimal contract. In section 4, we discuss the credibility issue. Section 5 shows that non-distortionary, target-conservative central bankers must be expenditures-conservative agents. Section 6 concludes.

## 1. The simple analytics of inflation targeting

In this section, we provide a brief overview of inflation targeting, as proposed in Svensson (1995).

Consider an economy described by the following aggregate supply function:

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

Output $y$ – expressed in logarithms – depends on inflation surprises ($\pi - \pi^e$), a term capturing distortions in the economy, $\hat{y}$, and a shock $\varepsilon$, whose realisations are independently distributed with zero mean and finite variance $\sigma_\varepsilon^2$. Observe that $Ey = -\hat{y}$, that is, expected output falls short of the socially optimal level, assumed to be zero. The private sector submits wage demands before observing the realisation of the supply shock and thus it has to form expectations about inflation. We assume inflation expectations are rational:

$$E\pi = \pi^e \tag{2}$$

where $E$ is the expectations operator.

The government's loss function is[4]:

$$L^G = \frac{1}{2}\left[y^2 + k_1(\pi - \tilde{\pi})^2\right] \tag{3}$$

[4] As customary in the literature on monetary policy delegation, the government's loss function reflects society's preferences.

where $\tilde{\pi}$ defines the socially optimal inflation rate and it is assumed to be positive. The government choice variable is the inflation rate, set after observing the realisation of the supply shock. Under rational expectations, it would be optimal for the government to announce an inflation rate $\pi$ equal to $\tilde{\pi}$. As in equilibrium inflation expectations are correct, any other inflation rate imposes a cost in terms of deviation from the socially optimal level without generating output benefits. However, absent a commitment technology, such announcement is not credible. Inflation is set after expectations are formed and hence the policymaker takes them as given, i.e. she ignores the impact of her action on inflation expectations[5]. Thus, the policymaker's loss function is minimised at:

$$\pi^D = \frac{k_1 \tilde{\pi}}{1+k_1} + \frac{(\pi^e - \varepsilon + \hat{y})}{1+k_1} \tag{4}$$

The private sector anticipates it and solving for rational expectations yields:

$$\pi^D = \tilde{\pi} + \frac{\hat{y}}{k_1} - \frac{\varepsilon}{1+k_1} \tag{5}$$

where the term $\frac{\hat{y}}{k_1}$ is the inflation bias.

From (5), it is apparent that inflation is systematically above the socially optimal level. To curb inflation, monetary policy can be delegated to a central banker whose loss function is by statute defined as follows:

$$L^B = \frac{1}{2}\left[y^2 + k_1^b(\pi - \tilde{\pi}^b)^2\right] \tag{6}$$

where $k_1^b$ and $\tilde{\pi}^b$ are selected by the policymaker to minimise her loss function (2). As the central banker implements:

$$\pi^B = \frac{k_1^b \tilde{\pi}^b}{1+k_1^b} + \frac{(\pi^e - \varepsilon + \hat{y})}{1+k_1^b} \tag{7}$$

[5] Following the jargon, we say that the policymaker acts in a regime of full discretion.

the policymaker finds it optimal to set $k_1^b = k_1$ and $\tilde{\pi}^b = \tilde{\pi} - \frac{\hat{y}}{k_1}$, i.e. to assign an explicit inflation target below the socially optimal inflation rate to a central banker who shares the policymaker's preferences over the output and inflation trade-off. The inflation bias is eliminated and the central bank implements the optimal monetary response to shocks, that is, complete output stabilisation of random disturbances is achieved[6]. However, note that the inflation targeting proposal has empirical relevance only if the socially optimal inflation rate is positive and sufficiently large relative to the inflation bias. Otherwise, removal of the inflation bias would require the endorsement of a negative target, that is, the central bank should pursue – implausibly – systematic deflation.

Svensson offers two interpretations of his result. Expressions (6) and (7) can be seen as the reduced form of a model where the central bank is bound by a performance-based contract *à la* Walsh[7]. The proposal may be also interpreted as a suggestion that monetary policy be delegated to a genuinely target-conservative central banker, that is, a banker who implements non-distortionary responses to shocks but prefers an expected inflation rate lower than the socially optimal one. Thus, Svensson's inflation targeting proposal is meant as a bridge over the gap between the theory and the reality of monetary policy making. In the following, we argue that this is not the case. In particular, we show that the proposed interpretations of inflation targeting make sense only if monetary policy is modelled in isolation from fiscal policy. But this can hardly be done. In fact, alongside with labour market imperfections (Svensson, 1995), distortionary taxation is likely to be at the root of the inflation bias (Alesina - Tabellini, 1987). If deviation of output from the socially optimal level are assumed to reflect labour market imperfections, $u$, as well as distortionary taxation, $\tau$: $\hat{y} = u + \tau$, fiscal and monetary policies must be jointly determined. We carry out this task in the next section. As it will be clear soon, this modelling strategy allows us to endogeneise the positive socially optimal inflation rate, which Svensson (1995) only postulates.

[6] The inflation bias can be eliminated also by delegating monetary policy to a weight-conservative central banker – $k_1^b < k_1$ – who shares the policymaker's inflation target $\tilde{\pi}$ (Rogoff, 1985; Lohmann, 1992). Still, this arrangement entails incomplete output stabilisation and thus it can not be preferred to inflation targeting, on welfare grounds.

[7] The contract would take the form $W = \frac{k_1}{2}(\tilde{\pi}^b)^2 - k_1 \pi \tilde{\pi}^b - \underline{w}$, where $\tilde{\pi}^b$ is an explicit inflation target and $\underline{w}$ ensures that the central banker's participation constraint is satisfied.

## 2. A model of the socially optimal inflation rate

Consider an economy described by the aggregate supply function (1), where $\hat{y} = \tau + u$. In this economy, the government provides a certain amount $g$ of public goods[8], to be financed by means of distortionary taxes, $\tau$, and seigniorage revenues proportional to inflation, $k_0\pi$ $(0 < k_0 \leq 1)$[9]:

(8) $$g = t + k_0\pi$$

Equation (8) approximately holds if money demand, specified according to a quantity theory, is independent of fiscal policy and $g$ is defined as a fraction of nominal income[10]. The government's loss function is:

(9) $$L^G = \frac{1}{2}\left[y^2 + k_1\pi^2 + k_2(g - \tilde{g})^2\right]$$

where $\tilde{g}$ defines the government expenditures target.

The first step in our analysis is the determination of the optimal inflation and tax rates, that is, the rates which would obtain if the government were able to commit. Next, we examine a regime of policy discretion.

### 2.1. *Commitment*

Following Svensson (1995), the optimal inflation rate is obtained minimising (9) with respect to $\pi$, $\pi^e$[11] and $\tau$ under the constraints (1), (2) and (8). The first-order conditions are:

(10a) $$y + k_1\pi + k_2(g - \tilde{g})k_0 + \lambda = 0$$

(10b) $$-E(y) - \lambda = 0$$

(10c) $$-y + k_2(g - \tilde{g}) = 0$$

where $\lambda$ is the Lagrange multiplier for the rational expectations constraint.

[8] Alternatively, $g$ could be interpreted as public expenditures inclusive of service on outstanding public debt. None of the results would be affected.

[9] To simplify the analysis, we follow Alesina - Tabellini (1987) in ruling out the possibility that public expenditures be financed issuing debt. The implications of debt accumulation are discussed in a companion paper (Lossani - Natale - Tirelli, 1998).

[10] This is shown in Alesina - Tabellini (1987, p. 622).

[11] By so doing, the policymaker takes into account the effects of her policy action on inflation expectations.

Combining (1), (2), (8) and equations (10a), (10b) and (10c), we obtain the solutions for the optimal inflation, taxes and public expenditures:

$$(11a) \qquad \pi^C = \frac{k_0(k_2/k_1)(u+\tilde{g})}{1+k_2+k_0^2(k_2/k_1)} - \frac{(1+k_0)(k_2/k_1)\varepsilon}{1+k_2+(1+k_0)^2(k_2/k_1)}$$

$$(11b) \qquad \tau^C = -\frac{[1+k_0^2(k_2/k_1)]u - k_1\tilde{g}}{1+k_2+k_0^2(k_2/k_1)} + \frac{1+k_0(1+k_0)(k_2/k_1)\varepsilon}{1+k_2+(1+k_0)^2(k_2/k_1)}$$

$$(11c) \qquad (g^C - \tilde{g}) = -\frac{(u+\tilde{g})}{1+k_2+k_0^2(k_2/k_1)} + \frac{\varepsilon}{1+k_2+(1+k_0)^2(k_2/k_1)}$$

Inspection of (11a) reveals that the socially optimal inflation rate can be positive, as postulated in Svensson (1995). This occurs when a seigniorage tax is available, i.e. $k_0 > 0$. As taxes $\tau$ are distortionary, the policymaker is willing to bear some inflation in order to reduce them and meet the budget (Phelps, 1973; Mankiw, 1987)[12]. In this vein, a number of recent papers (Beetsma - Bovenberg, 1998, 1999; Leith - Wren-Lewis, 2000; Poutineau-Hamiache, 2000) analyse the working of EMU fiscal and monetary policies under the assumption of positive seigniorage revenues. As a matter of fact, seigniorage is not the only reason why society may opt for a second-best positive equilibrium inflation rate. One might consider the potential effect of inflation on output through the Tobin-Mundell effect on the real interest rate[13] or the role played by inflation in removing nominal rigidities (Akerlof - Dickens - Perry, 1996). Still, empirical evidence suggests that even in the recent past, governments have relied heavily on seigniorage revenues. Click (1998, p. 155) reports that in a sample of up to ninety countries, including most OCDE members, over the period 1971-1990 *seigniorage on average amounts to 2.5% of GDP and finances 10.5% of government spending*. Using data from a sample of sixty-two countries over the period 1973-1994, Campillo - Miron (1996) show that optimal tax considerations are an important determinant of inflation rates.

[12] Chari - Christiano - Kehoe (1996) show that the Phelps result need not to apply to a number of specifications for the agents' utility functions. On the deciding over the relevance of the seigniorage motive to inflation, we find the empirical evidence discussed below compelling.

[13] However, the sign of the latter, traditionally expected to be positive, is reversed in plausible models (Stockman, 1981; Sweeney, 1987).

Finally, expression (11a) shows that the socially optimal inflation rate is negatively related to $\varepsilon$ and is affected by the weight attached to the output-inflation trade-off. Instead, taxes and public expenditures are positively related to $\varepsilon$. Adverse supply shocks raise the marginal cost of taxes, thus governments are less willing to finance expenditures. Note that our framework succeeds in integrating two issues usually treated as logically distinct[14], that is, the determination of the optimal tax mix and the analysis of stabilisation policies.

## 2.2. *Discretion*

We now turn to the analysis of monetary and fiscal policies in case of full discretion, i.e. when the government optimises taking inflation expectations as given. The government minimises loss function (9) with respect to $\pi$ and $\tau$, but not $\pi^e$, under the constraints (1), (2) and (8). The following first-order conditions obtain:

$$(12a) \qquad y + k_1\pi + k_2(g - \tilde{g})k_0 = 0$$

$$(12b) \qquad -y + k_2(g - \tilde{g}) = 0$$

Combining (1), (2), (8) and equations (12a) and (12b), the solutions for inflation, tax rate and public expenditures are:

$$(13a) \qquad \pi^D = \pi^C + (k_2/k_1)(1 + k_2)(u + \tilde{g})K^{-1}$$

$$(13b) \qquad \tau^D = \tau^C - [k_0k_2(k_2/k_1)](u + \tilde{g})K^{-1}$$

$$(13c) \qquad (g^D - \tilde{g}) = (g^C - \tilde{g}) + k_0(k_2/k_1)(u + \tilde{g})K^{-1}$$

where $K = [1 + k_1 + k_0^2(k_2/k_1)][1 + k_2 + k_0(1 + k_0)(k_2/k_1)]$.

Relative to the commitment solutions, inflation and public expenditures increase whereas taxes and output distortions fall. In this set-up, the government uses monetary policy to correct for fiscal distortions and under rational expectations, this gives rise to a positive inflation bias, the second addendum

[14] See for instance Alesina - Tabellini (1987), Van der Ploeg (1995) and Svensson (1995).

in (13a). The inflation bias is decreasing in the seigniorage tax, as a large $k_0$ increases revenues for any inflation rate and thus reduce the need for distortionary taxes[15].

Equipped with these results, we are able to analyse the working of an inflation targeting regime.

## 3. Inflation targets as credible contracts

Suppose the government delegates monetary policy to a central banker who shares the government's loss function (9)[16], but is bound by contract $W$. The central banker's loss function becomes:

$$L^B = \frac{1}{2}[y^2 + k_1\pi^2 + k_2(g - \tilde{g})^2] + W \tag{14}$$

where

$$W = \frac{k_1}{2}(\tilde{\pi}^b)^2 - k_1\pi\tilde{\pi}^b + \sigma\pi - \underline{w} \tag{15}$$

Contract $W$ entails an explicit inflation target – $\pi^b$ – plus a penalty in inflation – $\sigma\pi$[17] – while $\underline{w}$ ensures that the central banker's participation constraint is satisfied. Thus, the loss function (14) can be written as[18]:

[15] To put it differently, the above result and all that follows from it – in particular C.1 and C.2 – are robust to a model specification where seigniorage is absent.

[16] This is in keeping with the literature on inflation targeting which postulates that the central bank is just a branch of government (Persson - Tabellini, 1993). Moreover, it allows to separate the effects of a performance-based contract from those of special features of the central banker's loss function.

[17] Such penalty is deemed superfluous in Svensson's model. But, as it will be made clear in a moment, this is an artifact of the exogenous specification of a positive socially optimal inflation rate.

[18] A number of papers (Debelle, 1996; Debelle - Fischer, 1994; Beetsma - Bovenberg, 1995) define central bank's independence as neglect for seigniorage revenues, i.e. $L^B = \frac{1}{2}[y^2 + \gamma k_1\pi^2]$, where $\gamma$ is a choice variable in institutional design. None of the results in this and the following sections would change under the above specification, granted $\gamma = 1/(1 + k_0)$. See the appendix. Still, we object to the argument underlying the above specification. In our view, independence is better defined as the set of legal provisions that limit the government's ability to override the central bank's decisions (Lohmann, 1992). For a detailed discussion of the issue, see section 3.

(16) $$L^B = \frac{1}{2}[y^2 + k_1(\pi - \tilde{\pi}^b)^2 + k_2(g - \tilde{g})^2] + \sigma\pi - \underline{w}$$

In this framework, akin to Svensson (1995), the government and the central bank simultaneously minimise (9) and (16) by setting the tax and the inflation rate, respectively. Imposing rational expectations, the solution to the above game is:

(17a) $$\pi^B = \pi^D + \frac{(1+k_2)(\tilde{\pi}^b - \sigma/k_1)}{1+k_2+k_0(1+k_0)(k_2/k_1)}$$

(17b) $$\tau^B = \tau^D - \frac{k_0 k_2(\tilde{\pi}^b - \sigma/k_1)}{1+k_2+k_0(1+k_0)(k_2/k_1)}$$

(17c) $$(g^B - \tilde{g}) = (g^D - \tilde{g}) + \frac{k_0(\tilde{\pi}^b - \sigma/k_1)}{1+k_2+k_0(1+k_0)(k_2/k_1)}$$

In setting the contract terms, the government aims at achieving the socially optimal inflation rate. This is obtained by any pair ($\tilde{\pi}^b$; $\sigma$), which satisfies:

(C.1) $$\tilde{\pi}^b - \sigma/k_2 = -\frac{(k_2/k_1)(u+\tilde{g})}{1+k_2+k_0^2(k_2/k_1)}$$

Relative to discretion, adoption of contract C.1 entails lower inflation, as higher taxes and lower expenditures. It is easy to see that, absent the linear penalty in inflation, the optimal inflation target is negative. Within this framework, setting a non-negative inflation target is neither necessary nor sufficient to reduce inflation expectations, whereas the linear penalty $\sigma$ is necessary and sufficient if contract enforcement is credible. In fact, when accompanied by a suitably selected penalty, any target can deliver the socially optimal inflation rate. This result holds because in the present model society's bliss point is at zero inflation, in contrast with Svensson (1995) where it is achieved for a positive inflation rate. Absent non-distortionary taxes, a positive inflation rate is optimal, but nonetheless costly for society.

Given the above results, one is tempted to ask: why to have a target then? Targets, being visible, can act as a co-ordination device for expectations. From this viewpoint, it seems reasonable to select the contract terms as specified in C.2:

(C.2) $$\tilde{\pi}^b = \pi^C; \sigma^* = \frac{k_1(1+k_0)(u+\tilde{g})}{1+k_1+k_0^2(k_1/k_2)}$$

Contract C.2 specifies that the central banker targets the socially optimal inflation rate, so that systematic deflation is no longer an issue. Moreover, the central banker is penalised in the level of inflation. As one would expect, the penalty is increasing in the incentive to inflate, namely the perceived marginal benefit from inflation. From first-order conditions for the central banker and policymaker optimisation problems[19], the latter amounts to $k_2(1+k_0)(g-\tilde{g})$. Substituting for the expected value of the expenditures gap under commitment[20], $\sigma^*$ as in (C.2) obtains.

## 4. Renegotiation costs and contract credibility

Let us now turn to the issue of credibility. Early empirical tests cast doubts on the size of credibility gains following the adoption of inflation targets. Svensson's (1993) tests of inflation target credibility are inconclusive for Canada, reject the credibility hypothesis for New Zealand in the early days of the new arrangement – but not later on – and again reject it for Sweden. Almeida – Goodhart (1998) are unable to find a statistically significant difference between countries, which adopted inflation targets, and countries, which opted for alternative disinflationary strategies. They conclude that the case for inflation targets is unproven. In the face of the observed imperfect credibility of inflation targets, Svensson states that: *Nevertheless*, *if the inflation target is sufficiently low*, *the resulting inflation may be lower than it would have been without the target* (Svensson, 1995). In our view, this argument is misleading, as it postulates that an inflation target – or a contract – *per se* may determine expectations, whereas it is the size of renegotiation costs that ultimately generates the credibility of the regime. In this section we present a formal discussion of this issue.

The incentives to *ex-post* renegotiate the contract are obvious. To the extent that inflation expectations attach credibility to the target, *ex-post* both the government and the central banker are made worse off by any monetary stance more «conservative» than the one which would be implemented under discretion[21]. In fact, for any pair ($\tilde{\pi}^b$; $\sigma$) and across shocks, the loss from

[19] They are not stated as akin to (12a) and (12b).

[20] See expression (11a).

[21] Al-Nowaihi - Levine (1996) identify other reasons to support the view that Walsh contracts are not renegotiation-proof. The first is that the distortionary taxes needed to finance the bank generate adverse selection problems. The second is moral hazard and arises when the bank is risk-averse.

sticking to one's commitment $[L^G(\pi = \pi^B)]$ exceeds the loss from tearing up the existing contract and running monetary policy as under discretion $[L^G(\pi)]$[22]:

$$L^G(\pi = \pi^B) - L^G(\pi) = \tag{18}$$

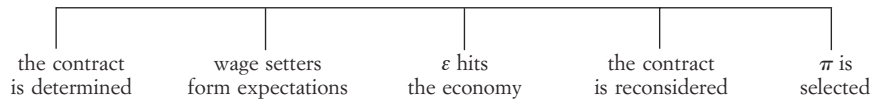
$$\frac{1}{2}(1+k_2)\left[k_2(1+k_0)^2 + k_1(1+k_2)\right]\left[\frac{\tilde{\pi}^b - \sigma/k_1}{1+k_2+(1+k_0)^2(k_2/k_1)}\right]^2$$

Therefore the contract is credible only if the government's decision to renegotiate is costly. Lohmann (1992) presents an exhaustive analysis of the link between the size of renegotiation costs and the credibility of monetary policy delegation schemes, treating renegotiation costs as a control variable for the government together with the central bank degree of weight-conservatism. In her model, this assumption is justified because the central banker's conservatism generates a conflict of interests in the conduct of monetary policy. Hence central bank independence can be graduated – as in fact it is number of countries (Grilli - Masciandaro - Tabellini, 1991) – to obtain the optimal combination of commitment and flexibility.

In the contractualist framework, the bank and the government hold identical views on the benefits from *ex-post* surprises. Thus, legal arrangements aiming to preserve the bank independence cannot prevent collusive behaviour, unless either the bank or the government, or both, incur some other cost in reneging on the contract. Such cost may in fact be linked to reputational factors and «ego-rents» if inflation targets provide a highly visible benchmark to assess the consistency of the policy stance (Persson – Tabellini, 1993). Cukierman (1992) emphasises the role of policy announcement, showing that institutional adherence to precision in monetary announcements exerts a moderating influence on monetary activism. This may explain why countries, which recently endorsed monetary targets, attempted to increase the transparency of monetary policy decisions. For instance, in New Zealand the Reserve Bank Act creates an institutional environment, which compels the bank to publicly state in advance its intended policy action, and to motivate subsequent revisions. Similar procedures have been followed in the UK (Haldane, 1995) and are presently invoked for the ECB (Buiter, 1999). Al-Nowaihi - Levine (1994) redefine the time-inconsistency issue in terms of a signal-extraction problem for the private sector, who is unable to observe shocks and to correctly interpret the monetary stance. They show that Walsh contracts may alleviate such informative inefficiencies by making monetary policy more open and accountable. As a result, reputational equi-

[22] Remember that the government and the central banker share the same loss function net of contract *W*.

libria may be sustained at least for a non-negligible time-span. However, their conclusion is open to standard criticisms concerning the difficulties with models based on reputation building, that is, the requirement of long horizons and the possibility of multiple equilibria (Persson – Tabellini, 1990). All in all, although Walsh contracts probably increase the cost of monetary surprises, it seems unlikely that institutional design is able to raise renegotiation costs at will. Indeed, if simple policy announcements provided an adequate commitment technology, time inconsistency would hardly be an issue in monetary policy games[23]. Therefore, following Lohmann (1992), we posit that the government's decision to renegotiate the contract entails an exogenous cost, $c > 0$. We assume the following sequence of events:




Under these circumstances a government would stick to its commitments only if:

$$L^G(\pi = \pi^B) - L^G(\pi) \leq c \tag{19}$$

This sets a lower bound on the inflation target and the penalty that the government can credibly assign to the central banker. It is easy to see that across shocks, (19) holds in the form of identity for:

$$\pi = \pi^D - \left\{ \frac{2c(1+k_2)}{1+k_2+(1+k_0)^2(k_2/k_1)} \right\}^{\frac{1}{2}} \tag{20}$$

Thus, the contract ( $\tilde{\pi}^b = \pi^C$; $\sigma^*$) defined in (C.2) is credible and attains the goal of removing entirely the inflation bias only if:

$$c \geq \frac{k_2(1+k_2)(k_2/k_1)(u+\tilde{g})^2}{2[1+k_2+(1+k_0)^2(k_2/k_1)][1+k_2+k_0^2(k_2/k_1)]^2} \equiv \underline{c} \tag{21}$$

Absent appropriate renegotiation costs, i.e. for any $c < \underline{c}$, the best feasible contract is the pair ( $\tilde{\pi}^b$; $\sigma$) that solves

$$[\tilde{\pi}^b - \sigma/k_1]^2 - \left\{ \frac{2c\,(k_2/k_1)[1+k_2+(1+k_0)^2(k_2/k_1)]}{k_2(1+k_2)} \right\} = 0 \tag{22}$$

[23] Jensen (1997) correctly points out that if the government could choose the costs of its actions, delegations would not be necessary.

From inspection of (13a), we see that only the negative root is an admissible solution. Thus, the best feasible contract is:

$$(C.3) \qquad [\tilde{\pi}^b - \sigma/k_2] = -\left\{\frac{2c\,(k_1/k_2)\left[1+k_1+(1+k_0)^2(k_1/k_2)\right]}{k_1(1+k_1)}\right\}^{\frac{1}{2}}$$

For $c < \underline{c}$, the R.H.S of (C.3) exceeds the R.H.S of (C.1). This proves the fallacy in Svensson's argument that by suitably lowering the target the government can compensate for the apparent lack of credibility. In fact, it is only when an adequate commitment technology is available that sufficiently low targets may be credibly implemented.

Jensen (1997) addresses the issue of credible delegation arrangements by postulating that renegotiation costs are proportional to the discrepancy between the existing contract and the newly agreed one. Under this assumption, the optimal contract specifies a penalty in inflation, which falls as renegotiation costs increase. Moreover, the optimal *ex-ante* contract is always renegotiated. Which cost specification is more appropriate is ultimately an empirical matter and we share Jensen's pessimism about the viability of contractual schemes. On the other hand, we are sceptical that – as suggested by Jensen – the same degree of pessimism should be applied to other arrangements where a conflict interest does persist between government and the central bank, as it is the case for weight-conservative central bankers *à la* Rogoff. As pointed out in Waller (1995), the tension between the conservative banker and the government wipes out the scope for collusive behaviour. Thus, it should be possible to increase the credibility of a weight-conservative central banker by setting an appropriate system of checks and balances and the procedures for resolving conflicts between the two institutions, as discussed for instance in Lohmann (1994). However, output distortions would unambiguously remain. From this point of view, the alternative interpretation of the Svensson's proposal has the merit of raising an important point: to escape from the commitment versus flexibility dilemma, society should be able to find a target-conservative central banker who is not weight-conservative. In the next section we explore this issue.

## 5. Can central bankers be expenditures-conservative?

As mentioned in section 1, the inflation targeting proposal has been interpreted also as delegation of monetary policy to a genuinely target-conservative central banker, that is, a banker who implements non-distortionary responses to shocks but prefers an expected inflation rate lower than the socially optimal one. However, when the inflation bias has a fiscal root, the

central banker preferred inflation rate can be negative. Under these circumstances, the proposal is devoid of empirical relevance.

The central banker's preferences may still have a role to play if we do not restrict our attention to the most preferred inflation rate. As selected within society, central bankers are likely to have preferences over public expenditures which reflect those of their constituencies. To take this element into account, suppose that monetary policy is delegated to a central banker whose loss function is characterised as follows:

$$(23) \qquad L^B = \frac{1}{2}[y^2 + k_1\pi^2 + k_2(g - \tilde{g}^b)^2]$$

We assume that the government and the central bank – having observed expectations – play non-co-operatively. The government minimises (9) with respect to $\tau$, taking $\pi$ as given, and the central banker does just the opposite in order to minimise (23). Policy variables take the following values:

$$(24a) \qquad \pi^B = \pi^D - \frac{k_0(k_2/k_1)(1+k_2)(\tilde{g} - \tilde{g}^b)}{1 + k_2 + k_0(1+k_0)(k_2/k_1)}$$

$$(24b) \qquad \tau^B = \tau^D + \frac{k_0^2 k_2(k_2/k_1)(\tilde{g} - \tilde{g}^b)}{1 + k_2 + k_0(1+k_0)(k_2/k_1)}$$

$$(24c) \qquad (g^B - \tilde{g}) = (g^D - \tilde{g}) - \frac{k_0^2(k_2/k_1)(\tilde{g} - \tilde{g}^b)}{1 + k_2 + k_0(1+k_0)(k_2/k_1)}$$

For any $\tilde{g}^b$ such that

$$(G.1) \qquad \tilde{g} - \tilde{g}^b = \frac{u + \tilde{g}}{k_0[1 + k_2 + k_0^2(k_2/k_1)]}$$

expected inflation, taxes and public expenditures correspond to the socially optimal levels. Moreover, stabilisation policy is carried out as under discretion and no output cost is incurred. Delegation of monetary policy to an expenditure-conservative central banker offers an other advantage. The socially optimal inflation rate is achieved without announcing an explicit inflation target, which is systematically missed.

However, a close inspection of G.1 provides firmer ground to the criticism that targets have little or no empirical relevance. In our framework, the relative degree of expenditures conservatism required to a central banker, i.e.

$\tilde{g} - \tilde{g}^b$, increases in the labour market imperfections as well as in the government expenditures target. Likewise, when little weight is attached to deviations of public expenditures from target[24], $\tilde{g} - \tilde{g}^b$ increases. Thus, negative values for $\tilde{g}^b$ can not be ruled out. Indeed, this is the case when the scope for seigniorage is very small, $k_0 \cong 0$. It follows that, absent the seigniorage motive, expenditures conservatism ceases to be an option for institutional design.

Adding to these difficulties, observe that the literature on monetary policy delegation does not provide any insight on how to select an expenditures-conservative central banker. The weight-conservative banker *à la* Rogoff-Lohmann was easily labelled as a member of the financial community, whose sectoral interests are clearly identifiable on the grounds of economic theory (Posen, 1993). In our case the task of selecting the central banker's preferences is more complex as the constraints on her preferences are tighter. Lindbeck (1985) identifies three main forces, which determine the level of public spending: efficiency-driven motivations, the ability of pressure groups to influence political decisions and «welfare altruism». It seems natural to rule out the first motivation, as it is difficult to explain why an agent should be opposed to the provision of public goods. Turning to the second one, the *public choice school* (Buchanan - Tullock, 1962; Musgrave, 1985) posits that – whatever the ideological preferences of the incumbent government – the political decision-making process is biased towards excessive budget growth, which does not entirely reflect the preferences of the public. High inflation should be interpreted as a by-product of political distortions. In our model, an inflation bias arises absent political distortions. Thus, simply assigning monetary policy to an unelected official would not eliminate the bias. We are left with the third motive. Partisan models suggest that expenditures-conservatism is usually correlated with stronger aversion to inflation. Hibbs (1987) and Tabellini - La Via (1989) document partisan influences in the US budget deficit, just as Alesina (1988) and Alesina - Roubini (1992) argue that left-wing parties are less inflation-averse than their ideological rivals are. It seems likely that a partisan expenditures-conservative banker is also a weight-conservative one, thus resurrecting the familiar output versus inflation trade-off[25].

[24] That is, $k_2$ is small.

[25] This result has some bearing also on the Alesina and Summers (Alesina – Summers, 1993) puzzle, according to which conservative central bankers *à la* Rogoff-Lohmann have achieved low inflation with no adverse effects on output volatility. If weight-conservatism is inherently linked to target-conservatism, and constituencies are aware of it, central bankers exhibiting a moderate degree of weight conservatism are likely to be preferred to more hawkish ones.

## 6. Conclusions

This paper raises two points. First, we show that an inflation target *à la* Svensson fails to mimic a Walsh contract when the optimal inflation rate is endogenous. Under these circumstances, either the inflation target is negative or it must be supplemented with a linear penalty in inflation. Second, we are concerned with the credibility of monetary arrangements: setting a contract between the government and a central banker, who share the same preferences over the policy outcomes, may increase the cost of monetary surprises, but it is unlikely to remove the inflation bias. Credibility requires a genuine conflict of interests between the central banker and her principal. When inflation has a fiscal root, such a conflict could arise if the appointed central banker were expenditures-conservative, rather than weight-conservative *à la* Rogoff-Lohmann. Unfortunately, this is unlikely to work. As we show, under a number of circumstances delegation of monetary policy requires the appointment of a an extremely expenditures-conservative central banker. Moreover, the empirical literature suggests that weight conservatism and expenditure conservatism are positively correlated features, thus resurrecting the familiar commitment versus flexibility trade-off.

## Appendix

Suppose the government delegates monetary policy to a central banker whose loss function is:

$$L^B = \frac{1}{2}[y^2 + \gamma k_1 \pi^2] + W \tag{A.1}$$

where

$$W = \frac{k_1}{2}(\tilde{\pi}^b)^2 - k_1 \pi \tilde{\pi}^b + \sigma \pi - \underline{w} \tag{A.2}$$

Thus, the loss function (A.1) can be written as:

$$L^B = \frac{1}{2}[y^2 + k_1(\pi - \tilde{\pi}^b)^2 + k_2(g - \tilde{g})^2] + \sigma \pi - \underline{w} \tag{A.3}$$

The government and the central bank simultaneously minimise their loss functions (9) and (A.1) by setting the tax and the inflation rate, respectively. Imposing rational expectations, the solution to the above game is:

(A.4a) $$\pi^B = \frac{(k_2/\gamma k_1)(u+\tilde{g}) + (1+k_2)(\tilde{\pi}^b - \sigma/\gamma k_1)}{1+k_2+k_0(k_2/\gamma k_1)} - \frac{(k_2/\gamma k_1)\varepsilon}{1+k+(1+k_0)(k_2/\gamma k_1)}$$

(A.4b) $$\tau^B = -\frac{[1+k_0(k_2/\gamma k_1)]u - k_2\tilde{g} + k_0 k_2(\tilde{\pi}^b - \sigma/\gamma k_1)}{1+k_2+k_0(k_2/\gamma k_1)} + \frac{1+k_0(k_2/\gamma k_1)\varepsilon}{1+k_2+(1+k_0)(k_2/\gamma k_1)}$$

(A.4.c) $$(g^B - \tilde{g}) = -\frac{(u+\tilde{g}) - k_0(\tilde{\pi}^b - \sigma/\gamma k_1)}{1+k_2+k_0(k_2/\gamma k_1)} + \frac{\varepsilon}{1+k_2+(1+k_0)(k_2/\gamma k_1)}$$

The policymaker selects the parameters $\tilde{\pi}^b$, $\sigma$ and $\gamma$ to achieve the socially optimal inflation rate. If $\gamma = 1/(1 + k_0)$, the central banker's response to shocks is optimal, that is, the last addendum in (A.4a) coincides with the last addendum in (11a). Thus, $\gamma^* = 1/(1 + k_0)$. Given $\gamma^*$, the inflation bias is eliminated by any pair ($\tilde{\pi}^b$; $\sigma$), which satisfies:

(C.1.A) $$\tilde{\pi}^b - \sigma/\gamma^* k_1 = -\frac{(k_2/k_1)(u+\tilde{g})}{1+k_2+k_0^2(k_2/k_1)}$$

Absent the linear penalty in inflation, the optimal inflation target is negative. Moreover, if the policymaker assigns to the central banker an inflation target $\tilde{\pi}^b = \pi^C$, the optimal penalty in inflation is:

(A.5) $$\sigma^{**} = \frac{k_2(u+\tilde{g})}{1+k_2+k_0^2(k_2/k_1)}$$

We turn now to the issue of credibility. The government would stick to its commitments only if:

(A.6) $$L^G(\pi = \pi^B) - L^G(\pi) \leq c$$

For $\tilde{\pi}^b = \pi^C$, $\sigma = \sigma^{**}$ and $\gamma = \gamma^*$, the central banker's policy delivers the socially optimal inflation rate. Thus (A.6) holds only if:

(A.7) $$c \geq \frac{k_2(1+k_2)(k_2/k_1)(u+\tilde{g})^2}{2[1+k_2+(1+k_0)^2(k_2/k_1)][1+k_2+k_0^2(k_2/k_1)]^2} \equiv \underline{c}$$

as in (21). Absent appropriate renegotiation costs, i.e. for any $c < \underline{c}$, the best feasible contract is the pair ($\tilde{\pi}^b$; $\sigma$) that solves:

$$(A.8) \qquad [\tilde{\pi}^b - \sigma(1+k_0)/k_1]^2 - \left\{\frac{2c\,(k_2/k_1)\,[1+k_2+(1+k_0)^2(k_2/k_1)]}{k_2(1+k_2)}\right\} = 0$$

From inspection of (13a), we see that only the negative root is an admissible solution. Thus, the best feasible contract is:

$$(C.2.A.) \quad [\tilde{\pi}^b - \sigma(1+k_0)/k_1] = -\left\{\frac{2c\,(k_2/k_1)\,[1+k_2+(1+k_0)^2(k_2/k_1)]}{k_2(1+k_2)}\right\}^{\frac{1}{2}}$$

As anticipated in the text, none of the results in section 2, 3 and 4 is affected by the specification of the central banker's loss function in (A.1).

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*Summary*: Fiscal Policy and Inflation Targets: Does Credibility Matter? (J.E.L. E520, E580)

We reconsider Svensson's inflation-targeting proposal in a model where the need to raise seigniorage revenues determines the socially optimal inflation rate and distortionary taxes cause the inflation bias. Interpreting the targets as contracts, we show that the interaction between fiscal and monetary policy complicates the structure of the optimal contract. Moreover, if the commitment technology is imperfect, «highish» targets generate lower inflation than targets, which are too low to be credible. Alternatively, interpreting inflation targets as policy delegation to a non-distortionary target-conservative agent, we show that target-conservative bankers are public-expenditures conservative. Unfortunately, only idiosyncratic views about the benefits from public expenditures can be invoked to justify expenditures-conservatism, implying that target-conservative agents are also weight-conservative.