



# Robust delegation with uncertain monetary policy preferences

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## ABSTRACT

Recent research has renewed interest in the exploration of the optimal design of monetary policy institutions in the presence of uncertainty. In this paper, we revisit the rationale for delegation to a weight-conservative central banker when the social planner's knowledge about the true preferences of delegates is ex ante ambiguous and he exhibits a preference for robustness. In this context, a robust (worst-case oriented) delegation strategy is intended to minimize the maximum welfare loss over the uncertainty set, when no prior probability distribution for the preference bias is available. We find that both effective over- and underconservatism may emerge with respect to the certainty case, for robust delegation is shown to be model-dependent. Most importantly, under reasonable model's parameterizations, Rogoff's principle is reversed: it is optimal for society to appoint a weight-liberal central banker.

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## 1. Introduction

In recent years, several studies have emphasized the importance of model uncertainty for the conduct and performance of monetary policy (e.g. Blinder et al., 2008; Cukierman and Meltzer, 1986; Dennis, 2010; Leitmo and Söderström, 2008; Levin and Williams, 2003; Onatski and Williams, 2003; Vickers, 1986). As a natural step forward, this strand of research has renewed interest in the exploration of the optimal design of monetary policy institutions under several sources of model misspecification and uncertainty (e.g. Beetsma and Jensen, 1998; Hefeker and Zimmer, 2011; Muscatelli, 1998; Tillmann, 2009a).

The present paper aims at contributing to this literature by addressing the case of robust monetary policy delegation in the presence of ex ante ambiguity about the *true* preferences of delegates, once in office.<sup>1</sup> In this respect, Tillmann (2008) studies the welfare costs to society of appointing a central bank who exhibits a conservatism-gap with respect to the optimal scheme according to Rogoff (1985). While Tillmann (2008) only allows for an ex post deviation in the central banker's optimal degree of conservatism, the presence of imperfect predictability of monetary policy due to uncertain central bank preferences also has crucial implications from an ex ante perspective, as it might affect the underlying rationale for

delegation, i.e. the stabilization bias, and hence modify society's optimal commitment to price stability.

It is well-known from the early literature on time-inconsistency of monetary policy (e.g. Barro and Gordon, 1983; Kydland and Prescott, 1977) that discretionary policy under an expectations-augmented aggregate supply gives rise to an average inflation bias. According to Rogoff's (1985) seminal analysis, delegating monetary policy to an independent central bank with a lower relative weight on output gap stabilization would provide the government with a way to commit itself to a zero inflation policy. While this has the effect to mitigate the average inflation bias, the relative stabilization of inflation and output is no longer optimal. This *stabilization bias* issue carries over to the recent generation of New Keynesian business cycles models featuring forward-looking inflation dynamics, if the latter are subject to persistent cost-push shocks (Clarida et al., 1999). In this sense, the rationale for delegating monetary policy to an inflation-averse central banker remains valid.

Rogoff's (1985) approach to solving the inflation bias of discretion focuses directly on the preferences of the central bank. To this end, it posits that monetary policy preferences with respect to conflicting objectives are perfectly identifiable ex ante. In this paper, we analyze the optimal delegation arrangement when the social planner's knowledge about the true degree of conservatism of delegates is ex ante ambiguous and he has a preference for robustness.<sup>2</sup> The notion of Knightian uncertainty (ambiguity) is employed to capture situations where randomness surrounding a decision-making problem

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<sup>1</sup> Tillmann (2009b) is the first to introduce the notion of robust delegation. Nonetheless, he analyzes the mechanism of robust delegation when the social planner faces uncertainty about the persistence of cost-push shocks. Diana and Sidiropoulos (2007) and Tillmann (2009a) both address the problem of how to design an optimal delegation arrangement in the sense of Rogoff (1985), when the policy-maker faces unstructured (Knightian) model uncertainty.

<sup>2</sup> In this regard, our paper differs from Qin et al. (2010), who study robust monetary policy when society is unaware of the true preferences for robustness of the policy-maker.

can not be described by a probability measure. We study the optimal degree of commitment of an ambiguity averse social planner who is unable to assign any prior probability distribution to the monetary authority preferences bias. Under this non-Bayesian approach, the ex ante information available to the appointing player simply consists in the knowledge of the (bounded) support of the unknown bias. In order to hedge against this form of ambiguity, he then adopts a minmax approach (e.g. Hansen and Sargent, 2008) to delegation. A robust (worst-case oriented) delegation mechanism is intended to minimize the expected welfare loss to society over the uncertainty set. Following Tillmann (2009b), we refer to such an optimal delegation arrangement as *robust delegation*.

Our most important contribution is to show that society's incentives to delegate monetary policy responsibility to a conservative central bank are dramatically altered by the presence of ex ante preference uncertainty, as conjectured in Tillmann (2008). Specifically, we show that both over- and underconservatism may effectively emerge with respect to the certainty case, for robust delegation is model-dependent. Most significantly, under reasonable parameterizations of the model and a sufficiently high degree of uncertainty, Rogoff's principle is reversed: the optimal commitment to inflation stability entails the appointment of a (supposedly) more liberal central banker than society's.<sup>3</sup>

The analysis presented here is related to different lines of research. Previous studies on the role of asymmetric information in monetary policy-making, in which the public is uncertain about the central banker's type (among others, Backus and Driffil, 1985; Cukierman and Meltzer, 1986; Vickers, 1986; Tabellini, 1988), differ from the present one in that they typically focus on the problem of preferences inference on the part of agents endowed with limited information, and how the central bank's decision to preserve its reputation may help to overcome the stabilization bias arising under discretionary monetary policy. Rather, our goal is to identify the optimal appointment scheme in the sense of Rogoff (1985), when the central bank preferences are not perfectly controllable and the social planner is ambiguity averse. Remarkably, in our setting the monetary policy stage remains a complete information game as in Rogoff (1985), since upon conclusion of the delegation process, the monetary authority is assumed to credibly commit to a full transparency regime (e.g. Geraats, 2002). Under these circumstances, once in office the true type of the central banker is common knowledge, and the monetary policy outcome is the usual rational expectations equilibrium with cost-push inflation.<sup>4</sup>

More closely related to our analysis are the seminal contributions of Beetsma and Jensen (1998) and Muscatelli (1998), who investigate the role of uncertain central bank preferences for the optimal design of monetary institutions. A central prediction of these studies is that a higher degree of conservatism may be advisable for it constrains the volatility of monetary policy behavior in the presence of uncertainty. Our analysis differs from this work along two relevant dimensions. First, from a modeling perspective, the uncertainty introduced by the preference bias in our model is Knightian (ambiguity), while Beetsma and Jensen (1998) and Muscatelli (1998) deal with several forms of stochastic uncertainty. Second, our model's predictions are only in part in line with those derived in the mentioned papers, for we show that (ex ante) preference uncertainty may well drive the delegation process towards a less conservative or even weight-liberal central banker.

<sup>3</sup> Alternative arguments for this result have been offered, among others, in the works of Guzzo and Velasco (1999); Lagerlöf (2001) and Lippi (2002).

<sup>4</sup> Hence, exploiting the standard version of the New Keynesian model as the baseline framework of analysis is consistent with the use of a non-Bayesian approach to monetary policy delegation. The implications of incomplete information on the central banker's type for the optimal design of monetary policy institutions have been discussed in Sibert (2002) with respect to the delegation approach. See also Dai and Spyromitros (2010) for an analysis of the transparency issue in the standard monetary policy delegation framework.

The paper proceeds as follows. Section 2 briefly reviews standard results about optimal policy delegation under certainty, which are then used as a benchmark. In Section 3 we introduce Knightian uncertainty about monetary policy preferences and discuss the case of robust delegation. Section 4 offers concluding remarks.

## 2. Optimal policy delegation under certainty

We consider the log-linearized form of the New Keynesian sticky-price general equilibrium model (e.g. Walsh, 2003a), where inflation dynamics are captured by the following forward-looking Phillips curve:

$$\pi_t = \beta E_t(\pi_{t+1}) + \kappa x_t + e_t, \beta \in (0, 1), \kappa > 0 \quad (1)$$

In (1),  $\pi_t$  is the inflation rate,  $x_t$  the output gap, and  $E_t$  denotes conditional expectations. Let the state of  $e_t$  be described by the following AR(1) process:

$$e_t = \rho e_{t-1} + \epsilon_t, \epsilon_t \sim N(0, 1) \quad (2)$$

with  $\rho \in (0, 1)$ . Hence, the cost-push shock exhibits a nonzero degree of persistence.

Monetary policy is intended to minimize the loss function  $L$ , which is in the form of a weighted sum of inflation volatility and output gap volatility<sup>5</sup>:

$$L := E_0 \left\{ \sum_{t=0}^{\infty} \beta^t (\pi_t^2 + \lambda x_t^2) \right\}, \lambda > 0 \quad (3)$$

where  $\lambda$  captures society's optimal concern with output gap stability.

Under discretionary policy, optimal decision-making does not involve commitment to any future actions. Hence, the monetary authority takes expectations as given to solve:

$$\min_{x_t, \pi_t} \{ \pi_t^2 + \lambda x_t^2 \} \quad (4)$$

subject to (1). The optimality conditions for the problem above imply:

$$\kappa \pi_t + \lambda x_t = 0, t = 0, 1, \dots \quad (5)$$

from which equilibrium inflation and output gap result in the following:

$$\pi_{t,dis} = \frac{\lambda}{\lambda(1-\beta\rho) + \kappa^2} e_t \quad (6)$$

$$x_{t,dis} = -\frac{\kappa}{\lambda(1-\beta\rho) + \kappa^2} e_t \quad (7)$$

It is well-known that, in the presence of serially correlated cost-push shocks, discretionary policy suffers from a stabilization bias, i.e. inflation proves inefficiently stabilized with respect to the commitment case.<sup>6</sup> The stabilization bias problem can be removed through delegation to a weight-conservative central banker, i.e. when the social planner assigns monetary policy responsibility to an independent central bank which places a relatively lower weight  $\lambda_{CB}$  on the output gap objective. More specifically, for a given  $\lambda_p$ , with which the social planner weights

<sup>5</sup> More precisely, it can be shown that the welfare losses experienced by the representative household are proportional to Eq. (3) up to a second order approximation (e.g. Walsh, 2003a). Without loss of generality, the target values for output and inflation are normalized to zero. The sequence of constraints (1) is sufficient to determine the equilibrium path for output and inflation under the optimal policy.

<sup>6</sup> That is,  $\text{var}(\pi_{t,dis}) > \text{var}(\pi_{t,rule})$ , where  $\pi_{t,rule}$  is the equilibrium inflation resulting under commitment and  $\text{var}(\cdot)$  denotes unconditional variance.

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