Optimal Perception of Inflation Persistence at an Inflation-Targeting Central Bank*

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Abstract

Delegating monetary policy to a Governor with a particular view of the monetary transmission mechanism may improve the discretionary policy equilibrium. This note argues that the optimal Governor should believe that inflation persistence is (much) greater than it actually is.

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1. Introduction

Since the seminal article of Kydland and Prescott (1977), it has been known that there is a time-inconsistency problem in monetary policymaking. If the central bank lacks commitment technology, policies are restricted to the set of sub-optimal, but time-consistent policies. Researcher's have suggested ways of reducing the policy inefficiency by appointing a Governor with some specific preferences for policy.[1]

This article argues that instead of the Government choosing a Governor with appropriate preferences, it may choose a Governor with a particular view of the transmission mechanism. More spesifically, this note argues that the Governor should believe that there is more inflation persistence than there actually is. Given that the literature has found estimates of inflation persistence in the entire zero-unity interval,[2] there should in principle be several candidates to choose from.

Section 2 presents the model and sets up the policy problem. Section 3 analyses what determines the optimal inflation persistence perception and Section 4 offers some concluding remarks.

2. Model and policy problem

The model of the economy is given by a simple expectations-augmented Phillips curve which allows for both forward-looking and backward-looking expectations formation,

$$\pi_{t+1} = (1-\theta)\, E_t\pi_{t+2} + \theta\pi_t + \gamma E_t x_{t+1} + \varepsilon_{t+1}, \tag{1}$$

where π is inflation, x is the output gap, ε_t is a white-noise cost-push shock, θ is the degree of inflation persistence, and E_t is the conditional rational expectations operator.

The central bank is assigned a quadratic, "inflation-targeting"[3] social loss function,

$$L_t = (\pi_t - \pi^*)^2 + \lambda x_t^2, \tag{2}$$

where π^* is the inflation target which is normalized to zero in the remainder of the paper and $1 \geq \lambda \geq 0$ is the weight placed on output-gap stabilization. The central bank objective is to minimize the expected value of the periodic loss function, i.e.,

$$\min E_{t_0} \sum_{t=t_0}^{\infty} L_t,$$

subject to the Governor's view of the transmission mechanism and using the output gap as the policy instrument. The Governor, by selection, believes that inflation is determined by

$$\pi_{t+1} = (1-\theta_g)\, E_t\pi_{t+2} + \theta_g\pi_t + \gamma E_t x_{t+1} + \varepsilon^g_{t+1}, \tag{3}$$

[1] See, e.g., Rogoff (1985), Walsh (1995), Svensson (1997) for proposals within the New Classical framework, and Walsh (2002), Woodford (1999) and Söderström (2001) for proposals in the New Keynesian framework.

[2] See, e.g., Fuhrer (1997), Rudebusch and Svensson (1999), Rudebusch (2002), Gali and Gertler (1999) and Gali et al. (2001).

[3] See, e.g., **??**.

where θ_g may be different from θ.

The Lagrangean to this policy problem is given by

$$\mathcal{L} = E_{t_0} \sum_{t=t_0}^{\infty} \left\{ \pi_t^2 + \lambda x_t^2 + \mu_t \left(\pi_{t+1} - (1-\theta_g)\, \pi_{t+2} - \theta_g \pi_t - \gamma x_{t+1} - \varepsilon_{t+1}^g \right) \right\}.$$

The first-order conditions for a discretionary equilibrium, taking private-sector expectations about future inflation as given, are

$$\begin{aligned} \frac{\partial \mathcal{L}}{\partial \pi_{t+1}} &= E_t^g \left[2\pi_{t+1} - \mu_t - \theta_g \mu_{t+1} \right] = 0, \quad \forall t \geq t_0, \\ \frac{\partial \mathcal{L}}{\partial x_{t+1}} &= E_t^g \left[2\lambda x_{t+1} - \gamma \mu_t \right] = 0, \quad \forall t \geq t_0. \end{aligned}$$

By substituting out the Lagrange mulitiplier, the first-order condition is given by

$$E_t^g x_{t+1} = \theta_g E_t^g x_{t+2} - \frac{\gamma}{\lambda} E_t^g \pi_{t+1}, \tag{4}$$

where Governor's expectations, denoted E^g, are evaluated using equations (3) and (4). The complete model now consists of the Phillips curve (1), and the policy rule (4) evaluated using (3). Expected social loss,

$$\Omega = \min E_{t_0} \sum_{t=t_0}^{\infty} L_t,$$

will be a function of the perceived and true model parameters and the variance of the cost-push shock, $\Omega = f(\theta_g; \theta, \beta, \gamma, \sigma_\varepsilon^2)$.

The problem of the Government is to choose a Governor with optimal inflation persistence perception, that is, $\theta_g = \theta_g^*$ where $\theta_g^* = \arg\min f(\theta_g; \theta, \beta, \gamma, \sigma_\varepsilon^2)$. The analytical solution is unfortunately intractable, and we need to resort to numerical methods in finding θ_g^*.[4] Parameters in the benchmark case are set at $\gamma = 0.05$, $\lambda = 1$ and $\sigma_\varepsilon = 0.01$.

3. Analysis

Woodford (1999) showed that persistence (inertia) in policymaking is welfare improving. If a policy stance is expected to prevail, then it will have a stronger influence on future inflation expectations and reduce firms' insentive to increase prices when facing a cost-push shock. If inflation is persistent, then providing a stronger link between the policy instrument and inflation will induce greater policy persistence. Hence, inflation persistence offers a channel through which output can be made more persistent.

Figure 1 plots for different configurations of θ and λ, the optimally perceived inflation persistence (θ_g^*), social loss improvement on the discretionary equilibrium, the percentage of the policy inefficiency removed[5] and the change in the variability of inflation and output relative to the discretionary equilibrium. Some interesting observations can be made.

[4] We used a grid search with steps of 0.005 in finding the optimal parameter.

[5] The percentage of policy inefficiency removed is computed as $\frac{L_{dis}-\Omega}{L_{dis}-L_{com}} 100$, where L_{dis} is expected loss under the discretionary equilibrium (where $\theta_g = \theta$) and L_{com} is expected loss in the timeless commitment equilibrium.

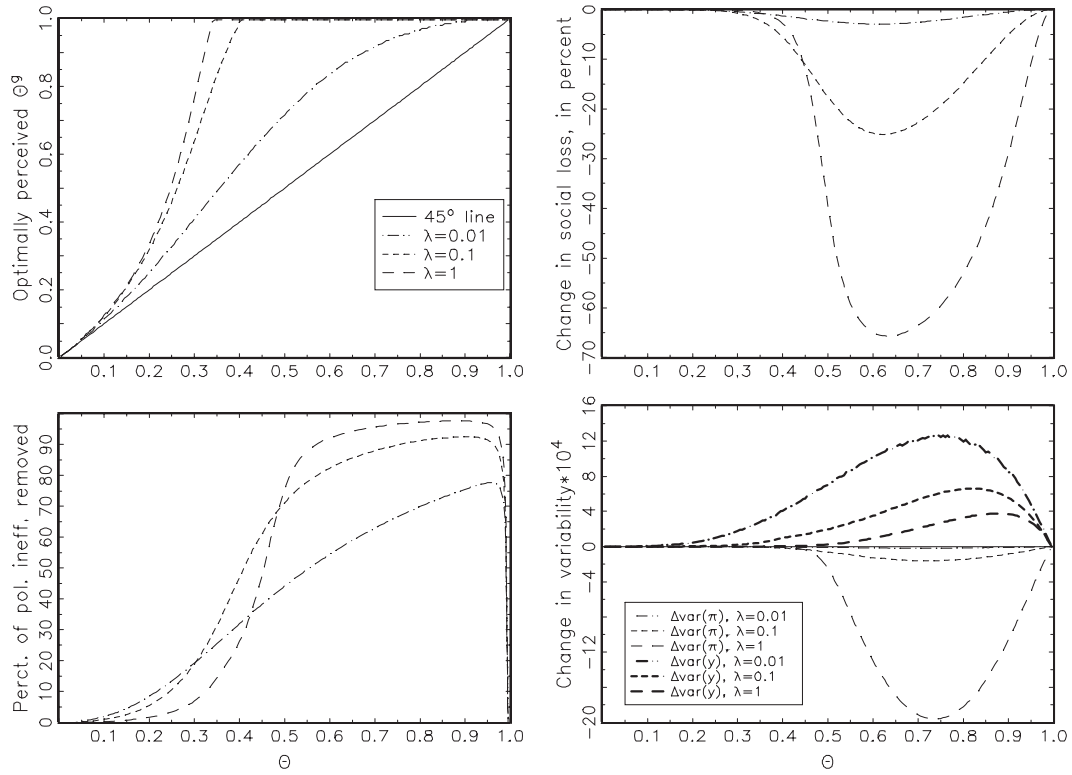

Figure 1: The upper diagrams show θ_g^* (left) and the improvement on the discretionary equilibrium (right), the lower diagrams show percentage of the policy inefficiency improved (left) and the change in inflation and output-gap variability from the discretionary equilibrium (right), for different configurations of θ and λ.

If θ is close to unity, privat-sector price setters are predominately backward-looking and the time-inconsistency problem is unimportant and the discretionary equilibrium is efficient. If, on the other hand, θ is low, inflation persistence is low and it does not provide an efficient channel for which output may become persistent. It will not be beneficial to have the Governor believe that inflation is persistent since his forecasts are expected by the private agents to be revised considerably in every period as inflation shifts, inducing only a small degree of output persistence. Consequently, the degree of optimal inflation persistence misperception $(\theta_g^* - \theta)$ reaches a maximum for θ in its inner region.

We also note that $\theta_g^* \geq \theta$. The reason is that only a higher perceived inflation persistence that provides more output persistence and thus a welfare increase. θ_g^* will be equal to θ for $\theta = \{0, 1\}$.

Interestingly, θ_g^* increases rapidly in θ and reaches unity for $\theta \geq 0.4$ if $\lambda \geq 0.1$. That is, θ_g^* is unity also when society cares only a little about output variability. If the true degree of inflation persistence is in the inverval $\theta \in [0.5, 0.95]$, and $\lambda > 0.1$, the by believeing that inflation is fully persistent, more than 70 percent of the policy inefficiency is removed. In the case where λ is equal to unity, more than 85 percent of the policy inefficiency is removed.

Moreover, the analysis suggests that as λ decreases towards zero, and inflation persistence is moderate to high, the benefits from misperception decreases. A larger λ implies that the response on output to a cost-push shock should be smaller. Since a larger θ_g implies a stronger response, however, such a change will only be beneficial if the benefits from the inflation per-

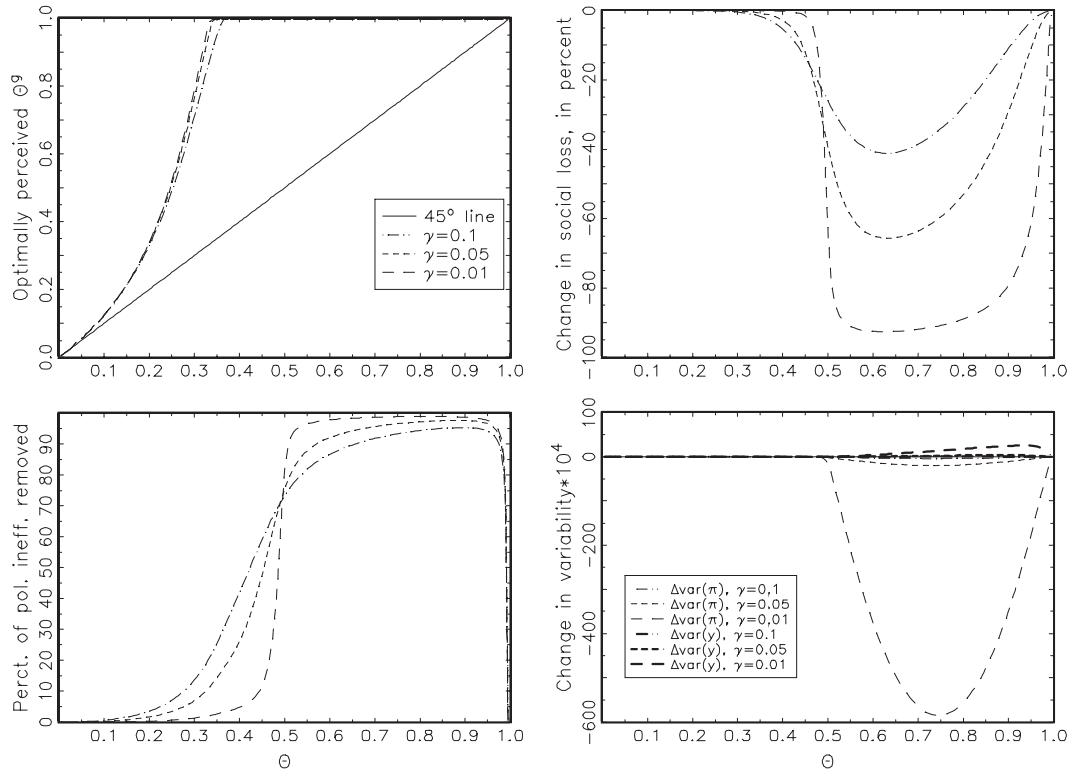

Figure 2: The upper diagrams show θ_g^* (left) and the improvement on the discretionary equilibrium (right), the lower diagrams show percentage of the policy inefficiency improved (left) and the change in inflation and output-gap variability from the discretionary equilibrium (right), for different configurations of θ and γ.

sistence channel on output is large enough to outweigh the effects of a sub-optimally strong output response. This will be the case when true inflation persistence is high enough to provide large enough benefits.

In the limit, where inflation stability is the only concern for policy ($\lambda = 0$), the discretionary equilibrium is efficient as inflation variability is at its minimum, $var(\pi) = \sigma_\varepsilon^2$, and there are no benefits from inflation persistence misperception.

Figure 2 shows the same information as Figure 1 under different configurations of θ and γ. We see that θ_g^* is not sensitive to the choice of γ. However, it has important effects on the efficiency of our solution. As γ decreases, the policymaker faces a worse trade-off between inflation and output variability and the inefficiency of a discretionary policy increases. Since a smaller γ implies that the output response to a cost-push shock should be smaller (as with a larger λ), and higher percieved inflation persistence implies stronger responses, our solution will only provide greater improvement to the discretionary equilibrium if inflation persistence is large enough to create enough output persistence.

4. Concluding remarks

We find by using an expectations-augmented Phillips curve that the Governor should believe that inflation is more persistent than it actually is. For a wide range of parameter configurations, the optimal perception of inflation persistence should be unity. This would considerably improve

on the policy inefficiency. Given that there is uncertainty about θ around some intermediate to high level, there is an additional advantage of misperception; the true value may not matter for policymaking.

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