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

Kai Leitemo†
The Norwegian School of Management BI and Norges Bank
March 2003

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.

Keywords: Monetary policy, time inconsistency, inflation persistence.

JEL classification codes: E52,E61,E63.

*Comments from Hilde C. Bjørnland, Sheetal Chand, Dag Morten Dalen, Tron Foss, Takako Greve, Erik Gronn, Arne Jon Isachsen, Halvor Mehlum, Tommy Sveen and seminar participants at the Norwegian School of Management BI and the National Research Meeting for Economists are gratefully acknowledged. Views expressed are those of the author and do not necessarily reflect the views of Norges Bank.

†Address of the author: Department of Economics, Norwegian School of Management BI, PO Box 580, 1302 Sandvika, Norway. Tel/Fax:+47 67 55 74 77/76 75. E-mail: kai.leitemo@bi.no
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. Researchers 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 specifically, 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,

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

(1)

where \( \pi \) is inflation, \( x \) is the output gap, \( \varepsilon_t \) is a white-noise cost-push shock, \( \theta \) 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,

\[ L_t = (\pi_t - \pi^*)^2 + \lambda x_t^2, \]

(2)

where \( \pi^* \) 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

\[ \pi_{t+1} = (1 - \theta_g) E_t \pi_{t+2} + \theta_g \pi_t + \gamma E_t x_{t+1} + \varepsilon_{t+1}^g, \]

(3)


³See, e.g., ??.
where \( \theta_g \) may be different from \( \theta \).

The Lagrangean to this policy problem is given by

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

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

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

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

\[
E_t^g x_{t+1} = \theta_g E_t^g x_{t+2} - \frac{\gamma}{\lambda} E_t^g \pi_{t+1}, \quad (4)
\]

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, \( \Omega = f(\theta_g; \theta, \beta, \gamma, \sigma^2_\varepsilon) \).

The problem of the Government is to choose a Governor with optimal inflation persistence perception, that is, \( \theta_g = \theta_g^* \) where \( \theta_g^* = \arg \min f(\theta_g; \theta, \beta, \gamma, \sigma^2_\varepsilon) \). The analytical solution is unfortunately intractable, and we need to resort to numerical methods in finding \( \theta_g^* \). 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’ incentive 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 \( \theta \) and \( \lambda \), the optimally perceived inflation persistence \( (\theta_g^*) \), 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 \( \frac{L_{dis} - \Omega_{com}}{L_{dis}} \times 100 \), 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 $\theta^*_g$ (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 $\theta$ and $\lambda$.

If $\theta$ is close to unity, privat-sector price setters are predominantly backward-looking and the time-inconsistency problem is unimportant and the discretionary equilibrium is efficient. If, on the other hand, $\theta$ 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 $\theta$ 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. $\theta^*_g$ will be equal to $\theta$ for $\theta = \{0, 1\}$.

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

Moreover, the analysis suggests that as $\lambda$ decreases towards zero, and inflation persistence is moderate to high, the benefits from misperception decreases. A larger $\lambda$ implies that the response on output to a cost-push shock should be smaller. Since a larger $\theta_g$ 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 $\theta^*_g$ (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 $\theta$ and $\gamma$.

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, $\text{var}(\pi) = \sigma^2_e$, and there are no benefits from inflation persistence misperception.

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


