E C O N O M I C S B U L L E T I N

Central bank transparency about model uncertainty and wage setters

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Abstract

This paper addresses the issue of monetary policy transparency in a context of model uncertainty by adapting the robust control approach. We find that even if the desire of robustness induces an aggressive response of union and central bank, the central bank should reveal its preference about model robustness.

We would like to thank an anonymous referee and Moïse Sidiropoulos for their helpful comments.
Citation: SPYROMITROS, Eleftherios and Li QIN, (2006) "Central bank transparency about model uncertainty and wage setters." *Economics Bulletin*, Vol. 5, No. 18 pp. 1-5
Submitted: October 14, 2006. **Accepted:** November 2, 2006.
URL: http://economicsbulletin.vanderbilt.edu/2006/volume5/EB-06E50022A.pdf

1 Introduction

Central bank transparency has been one of the major developments in central banking over the past decade. In the existing studies, policymakers are assumed to know the true model of the economy and observe accurately all relevant macroeconomic variables. However, the reality is much more complex. The policymaker's choice is made in the face of tremendous uncertainty about the true structure of the economy and the impact of policy actions to the economy. This complexity means the policymaker may be unsure about his model. The resulting question is how model uncertainty affects the optimal choice of central bank transparency.

Recently, monetary policy decision making in presence of uncertainty has received much attention in the literature (Onatski and Williams, 2003; Giordani and Söderlind, 2004; Walsh, 2004). Taking into account possible model misspecification, the central bank views its model as an approximation of the model corresponding with the true structure of economy. In this context, we identify two sources of uncertainty: first, uncertainty concerning central bank preferences about model robustness by which we mean a lack of transparency and second, model uncertainty which comes from ignorance of the true structure of the economy.

The paper adapts the robust control approach (Hansen and Sargent, 2004) to a model that studies the interaction between a monopoly union and the central bank. Contrary to intuition, we show that an increase in preference for model robustness induces more wage claims and thus a higher inflation. Nevertheless, transparency about central bank preferences concerning model robustness is desirable.

2 The model

We consider a two stages game between a monopoly union and a central bank. First, the monopoly union fixes the log of the nominal wage w and second, the inflation rate is fixed by the central bank.

The central bank cares about inflation and employment but also views its model as an approximation. We apply robust control techniques developed by Hansen and Sargent (2004) and we model uncertainty about the process that governs the unemployment rate as follows:

$$u = aW + h \tag{1}$$

where $W = w - \pi$ is the log real wage. Without loss of generality, we assume that $a = 1$. In the spirit of Hansen and Sargent (2004), h represent model misspecification errors introducing ambiguity to the model. More precisely, it can be considered as a deterministic disturbance controlled by a fictitious "evil agent" who aims to maximize the policymaker's loss. The parameter η is assumed to be the budget allocated from the central bank to the evil agent in order to create misspecification. Thus, the budget constraint for the evil agent is $h^2 \leq \eta^2$.

The latter restriction together with Eq.(1) define a set of models which the central bank considers as being possible outcomes.

The policy maker sets the inflation rate to maximize the value of its utility function, while the evil agent sets its controls to minimize the central bank's utility, given the constraints on misspecification. To introduce this ambiguity into the decision making problem, we replace the standard quadratic utility function of the central bank by an *uncertainty averse* quadratic utility function :

$$\max_{\pi} \min_{h} V_{cb} = -\lambda\pi^2 - u^2 + \theta h^2 \tag{2}$$

subject to the model with misspecifications in Eq.(1). $\lambda > 0$ is a parameter which measures the weight policymakers assigned to inflation stabilization with respect to output stabilization and $\theta \in (1, \infty]$[1] is a parameter which reflects the degree of the model robustness or a penalty parameter restraining the minimization of misspecifications errors h. Thus, the design of a robust control policy becomes a min-max problem subject to the linear constraint (1) where the central bank acts as a Stackelberg leader against the evil agent.

Concerning the labor market of the economy, we suppose that all the workers are organized in a single union which chooses their nominal wage w to minimize the following loss function

$$V = W - \frac{B}{2}u^2; \qquad B > 0 \tag{3}$$

The parameter B denotes the union's relative concern for unemployment.

2.1 Equilibrium

The reaction function of the central bank can be derived from the resolution of the min-max problem of the central bank as:

$$\pi = \frac{\theta}{1 + (1+\lambda)(\theta - 1)} w \tag{4}$$

$$h = \frac{\lambda}{1 + (1+\lambda)(\theta - 1)} w \tag{5}$$

At stage one, we analyze wage setting in the economy by minimizing union's loss function subject to the reaction function of central bank as follows:

$$V = \left[\left(w - \frac{\theta}{1 + (1+\lambda)(\theta - 1)} w \right) - \frac{B}{2} \left(w - \frac{\theta}{1 + (1+\lambda)(\theta - 1)} w + h_t \right)^2 \right] \tag{6}$$

Hence, the solution of the problem is :

$$w = \frac{(\theta - 1)\left[\theta + \lambda\left(\theta - 1\right)\right]}{\lambda B \theta^2} \tag{7}$$

From equation (7), we get the following proposition:

[1] The second order condition of Eq.(2) with respect to h shows that the evil agent's problem is well defined and concave iff $\theta > 1$. Thus, $\theta = 1$ is a lower bound for θ or a breakdown point. (see Hansen and Sargent, 2004)

Proposition 1 *An increase in the degree of model robustness θ raises wages and the inflation rate.*

Proof. Taking first order condition of equation (7) with respect to θ it is straightforward to find that

$$\frac{\partial w}{\partial \theta} = \frac{\theta + 2\lambda(\theta - 1)}{\lambda B \theta^3} > 0 \tag{8}$$

$$\frac{\partial \pi}{\partial \theta} = \frac{1}{\lambda B \theta^2} > 0 \tag{9}$$

■

The intuition behind this result is that in a less uncertain economic environment (a more robust monetary policy) trade unions will be more aggressive about their wage claims. An increase in the degree of model robustness diminishes the perception of the union concerning the impact of a wage increase on inflation and unemployment, leading thus to an increase in wage claims. In response to the increasing wage claims, the central bank raises the inflation rate.

2.2 Uncertainty about the degree of robustness

We suppose that the trade union is not perfectly informed about θ , the degree of model robustness, when it fixes w. Equation (10) specifies the stochastic behavior of the parameter θ

$$\theta = \bar{\theta} + \mu, \text{with } E\mu = 0 \text{ and } E\mu^2 = \sigma_\mu^2 \tag{10}$$

This implies that the union is correct on average, but may be mistaken when making guesses about the central bank preferences for robustness in individual cases or at certain points in time. σ_μ^2 measures the degree of opacity of the central banker. We assume that a more transparent decision process reduces σ_μ^2. Taking into account uncertainty about the central bank's preference for robustness, the union maximizes the following function:

$$EV = E\left[\left(w - \frac{\theta}{1 + (1+\lambda)(\theta - 1)} w\right) - \frac{B}{2}\left(w - \frac{\theta}{1 + (1+\lambda)(\theta - 1)} w + h_t\right)^2\right] \tag{11}$$

and the solution of this problem is:

$$w = \frac{(1+\lambda)\left(\bar{\theta}^2 + \sigma_\mu^2 - 2\bar{\theta} + 1\right) + \left(\bar{\theta} - 1\right)}{\lambda B\left(\bar{\theta}^2 + \sigma_\mu^2\right)} \tag{12}$$

An immediate consequence of the above equation is the following proposition:

Proposition 2 *Uncertainty about the central bank's preference for robustness θ raises wages, average inflation and unemployment.*

Proof. It is easy to verify from the following equation that wages increase with σ_μ^2.

$$\frac{\partial w}{\partial \sigma_\mu^2} = \frac{\bar{\theta} + \lambda\left(2\bar{\theta} - 1\right)}{\lambda B\left(\bar{\theta}^2 + \sigma_\mu^2\right)^2} > 0 \tag{13}$$

Similarly, an increase in σ_μ^2 causes higher average inflation and unemployment

$$\frac{\partial \pi}{\partial \sigma_\mu^2} = \frac{\theta}{1 + (1+\lambda)(\theta - 1)} \frac{\bar{\theta} + \lambda\left(2\bar{\theta} - 1\right)}{\lambda B\left(\bar{\theta}^2 + \sigma_\mu^2\right)^2} > 0$$

$$\frac{\partial u}{\partial \sigma_\mu^2} = \frac{\theta}{1 + (1+\lambda)(\theta - 1)} \frac{\bar{\theta} + \lambda\left(2\bar{\theta} - 1\right)}{B\left(\bar{\theta}^2 + \sigma_\mu^2\right)^2} > 0$$

■

The intuition behind this result is that the trade union does not know the exact value of the degree of robustness and its perception about this value increases in this uncertain economic environment leading to an increase in wages, average inflation and unemployment. More precisely, higher opacity about the degree of robustness may be followed by an aggressive response from the trade union which anticipates an increase in the value of θ.

Next we analyze, in the sense of Gruner (2002), the impact of more uncertainty about the degree of robustness θ on inflation uncertainty σ_π^2. The latter is defined as $\sigma_\pi^2 = E\left[(\pi - \bar{\pi})^2\right]$.

Using a second order Taylor approximation yields

$$\sigma_\pi^2 = \frac{1}{\lambda^2 B^2} \frac{\sigma_\mu^2\left[\bar{\theta}^2\left(4\bar{\theta} - 5\right) - \sigma_\mu^2\right]}{\bar{\theta}^6} \quad \text{with } \bar{\theta}^2\left(4\bar{\theta} - 5\right) > \sigma_\mu^2 \tag{14}$$

Taking the first order condition of (14) with respect to σ_μ^2, we get

$$\frac{\partial \sigma_\pi^2}{\partial \sigma_\mu^2} = \frac{\bar{\theta}^2\left(4\bar{\theta} - 5\right) - 2\sigma_\mu^2}{\lambda^2 B^2 \bar{\theta}^6} \tag{15}$$

This derivative is positive iff

$$\frac{\bar{\theta}^2\left(4\bar{\theta} - 5\right)}{2} > \sigma_\mu^2 \tag{16}$$

Hence we have:

Proposition 3 *Inflation uncertainty increases with uncertainty about central bank's preference for robustness θ when the latter is low. It increases when uncertainty about θ is high.*

Proof. see above. ■

3 Discussion

Grüner (2002) argued that limited central bank transparency was favorable. Our analysis, in this context of economic uncertainty, shows that the central bank should reveal its preference about the degree of model robustness. In spite of the fact that a preference for higher model robustness leads to higher wage claims, an increase in the central banker's transparency about the preference of model robustness reduces inflation and nominal wage claims. As a consequence, unemployment is diminished when monetary policy is more transparent.

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