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Journal of Monetary Economics 54 (2007) 2083–2101
Journal of MONETARY ECONOMICS
www.elsevier.com/locate/jme

Monetary policy under model and data-parameter uncertainty

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Received 27 January 2005; received in revised form 15 November 2006; accepted 15 November 2006
Available online 4 January 2007

Abstract

Empirical Taylor rules are much less aggressive than those derived from optimization-based models. This paper analyzes whether accounting for uncertainty across competing models and (or) real-time data considerations can explain this discrepancy. It considers a central bank that chooses a Taylor rule in a framework that allows for an aversion to the *second-order risk* associated with facing multiple models and measurement-error configurations. The paper finds that if the central bank cares strongly enough about stabilizing the output gap, this aversion leads to significant declines in the coefficients of the Taylor rule *even if* the central bank's loss function assigns little weight to reducing interest rate variability. Furthermore, a small degree of aversion can generate an optimal rule that matches the empirical Taylor rule.

JEL classifications: E5; E58; D8; D81

Keywords: Taylor rule; Uncertainty; Non-reduction two-stage lotteries

1. Introduction

Since Taylor (1993), the monetary policy literature has increasingly focused on characterizing desirable monetary policy in terms of simple interest rate rules. Typically, given some structural model linking inflation, output and the interest rate, the central bank sets policy according to the interest rate feedback rule to minimize a weighted average of

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doi:10.1016/j.jmoneco.2006.11.004

inflation, output and interest rate variability. The result of that exercise is often puzzling, however, unless the central bank assigns an implausibly high weight to controlling the variability of changes to the interest rate, parameters of optimal policy rules call for much stronger responses to inflation and output than those estimated from historical data (Rudebusch, 2001).

What can explain this apparent reluctance of policy-makers to act aggressively? One important branch of this literature argues that attenuated policy is the result of policy-makers facing uncertainty, whether regarding the model parameters or the data. Since Brainard (1967), it has generally been accepted that parameter uncertainty can lead to less aggressive policy. However, most studies that formally incorporate parameter uncertainty in the central bank's decision process find that it has a negligible effect on policy (Estrella and Mishkin, 1999; Peersman and Smets, 1999). Similarly, although considerable differences can exist between real-time and final estimates of inflation and the output gap (Orphanides, 2001), various authors have found that sensible degrees of measurement error do not lead to a high enough attenuation in the policy rule parameters (Rudebusch, 2001).

The papers cited above assume no model uncertainty: although the central bank is unsure about the model parameters or fears data uncertainty, it is confident that the structure of the model is the right one for policy-making. A related strand of the literature examines whether a direct concern for model uncertainty can help to explain why policy-makers may prefer less aggressive policy. Much of that literature assumes that policy-makers have one good reference model for setting policy but are concerned about uncertain possible deviations from it. Therefore, they use a robust control approach (Hansen and Sargent, 2004; Onatski and Stock, 2002) to design policy rules that resist deviations from their particular reference model. But what if the central bank is uncertain between competing *reference* models of the economy (Levin and Williams, 2003)?

This paper considers a central bank that finds various models of the economy plausible. The problem of the central bank is to choose a Taylor rule that *performs reasonably well* given its difficulty to choose between the competing models. How can the central bank choose such a rule? The literature proposes two main approaches: the central bank can take a worst-case approach if it values robustness or it can use a Bayesian criterion (Brock et al., 2003) if it values good average performance.

In this paper, the central bank achieves a trade-off between average performance and robustness by using a decision-making framework that exhibits the *non-reduction of two-stage lotteries* (Segal, 1990; Klibanoff et al., 2005; Ergin and Gul, 2004). What this means in my context, is that, when dealing with model uncertainty, the central bank distinguishes between two distinct kinds of risks: a *first-order risk* (or *within-model risk*), which arises given a particular model and its stochastic properties, and a *second-order risk* (or *across-model risk*), which is associated with the multiplicity of models. It is the central bank's attitude towards the across-model risk (i.e., its degree of aversion to the across-model risk) that determines the extent to which it wants to trade-off average performance for robustness. Indeed, the framework nests both the Bayesian and worst-case approach as special cases: the worst-case approach is the limiting case where the central bank's degree of aversion to the across-model risk tends to positive infinity while the Bayesian approach is the special case where the degree of aversion is zero. Therefore, a positive and finite degree of aversion to the across-model risk implies a trade-off between average performance and robustness.