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Robust inflation-forecast-based rules to shield against indeterminacy ☆

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Abstract

This paper provides a first attempt to quantify and at the same time utilize estimated measures of uncertainty for the design of robust interest rate rules. We estimate several variants of a linearized form of a New Keynesian model using quarterly US data. Both our theoretical and numerical results indicate that inflation-forecast-based (IFB) rules are increasingly prone to the problem of indeterminacy as the forward horizon increases. As a consequence the stabilization performance of optimized rules of this type worsens too. Robust IFB rules can be designed to avoid indeterminacy in an uncertain environment, but at an increasing utility loss as rules become more forward-looking.
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1. Introduction

'Uncertainty is not just an important feature of the monetary policy landscape; it is the defining characteristic of that landscape' (Alan Greenspan[1]).

This paper adopts a consistently Bayesian approach to the measurement of uncertainty and the design of robust rules for the conduct of monetary policy. Employing a closed-economy dynamic stochastic general equilibrium (DSGE) model, the sources of uncertainty are the structural parameters and the volatility of the white noise disturbances. We estimate several variants of a linearized form of the model using quarterly US data. From these competing specifications we obtain estimates for posterior model probabilities and, for each model variant, estimates of the posterior densities of the parameters.

Throughout we focus on Taylor-type rules, and in particular on inflation-forecast-based (IFB) rules. These are 'simple' rules as in Taylor (1993), but where the policy instrument responds to deviations of expected, rather than current inflation from target. In most applications, the inflation forecasts underlying IFB rules are taken to be the endogenous rational-expectation forecasts conditional on an intertemporal equilibrium of the model. These rules are of interest because, as shown in Clarida et al. (2000) and Castelnuovo (2003), estimates of IFB-type rules appear to be a good fit to the actual monetary policy in the US and Europe of recent years. They are also of specific interest because similar reaction functions are used in the forecasting models of the Bank of Canada and the Reserve Bank of New Zealand, two prominent inflation-targeting central banks. In these countries and elsewhere, central bankers extol the virtues of IFB rules on the grounds that they 'pre-empt inflation' and 'enhance low-inflation credibility'.

The literature on IFB interest-rate rules highlights two forms of possible indeterminacy: if the response of interest rates to a rise in expected inflation is insufficient, then real interest rates fall, thus raising demand and confirming any exogenous expected inflation. But indeterminacy is also possible if the rule is overly aggressive or overly forward-looking or both (Bernanke and Woodford, 1997; Batini and Pearlman, 2002; Giannoni and Woodford, 2002; Carlstrom and Fuerst, 1999; Benhabib et al., 2001; Woodford, 2003; Batini et al., 2004a, BLP hereafter). We provide a theoretical analysis of both these forms of indeterminacy.

Using our estimated rival models, the estimated model probabilities and posterior densities of parameters, we then proceed to design IFB rules that are robust in two senses with respect to our *estimated* measures of uncertainty[2]: '*weakly robust*' rules are guaranteed to be stable and determinate in all the possible central variants of the model whereas '*strongly robust*' rules, also guarantee stable and unique equilibria and, in addition, use the probabilities to minimize an expected loss function of the

[1]Federal Reserve Bank of Kansas (2003), Opening Remarks.

[2]The literature gives multiple interpretations of the concept of 'robustness'. The way we intend it here is akin to that used by the literature on robust control, which defines robust monetary policy rules as rules designed to work well in worst-case scenarios thanks to their reduced sensitivity to parameter variations and modelling errors.

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