A Bayesian Approach to Optimal Monetary Policy with Parameter and Model Uncertainty

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What is the central issue?

Policymakers would like to implement policies that are robust to the uncertainties that they face. In this context, this paper aims to

- Use Bayesian methods to consider how monetary policy should be conducted in the face of model, parameter, and future-shock uncertainty.
- Use the results to devise a simple, robustly-optimal, monetary policy rule for the U.K.

How is the issue approached?

The paper estimates four models for the U.K.

- These models differ greatly
  - Three of the models are of closed economies.
  - One model is densely parameterized.
  - One model allows for a financial accelerator mechanism.
  - One model is estimated under three priors.

The estimation provides posterior parameter distributions that describes parameter uncertainty, and, after conditioning on a particular dataset, it also provides posterior model probabilities.

How is the issue approached? - continued

With the monetary policy rule assumed to take the form

$$i_t = \phi_i i_{t-1} + (1 - \phi_i)\left(\phi_\pi \pi_t + \phi_y y_t\right) + \phi_{dy}\left(y_t - y_{t-1}\right),$$

and the policy loss function, for model j, parameter realization θ_{jk}, and policy ϕ, given by

$$l_j\left(\phi, \theta_{jk}\right) = \mathrm{E}\left[var\left(4\pi_t\right) + \lambda_y var\left(y_t - y_t^*\right) + \lambda_i var\left(4i_t\right) | \phi, \theta_{jk}\right]$$

the paper

- Solves for the rule that is robust to parameter uncertainty for each model.
- Uses fault tolerance to identify models that are rule-sensitive.
- Uses posterior model probabilities and subsequently a discrete uniform posterior to solve for policy rules that are robust to both model and parameter uncertainty.

What are the main findings?

- The rule that is optimally robust to parameter uncertainty in each model differs substantially across models.
  - In two of the models the optimal response to the output gap is negative and in one (BGG) the response to both the gap and output growth is negative.
- The forward-looking models have low fault tolerance with respect to policies designed for the backward-looking models.
  - This result contrasts with Levin and Williams (2003).
- The rule that is robust to both model and parameter uncertainty is determined primarily by the model that has the highest posterior model probability, but it is also influenced by models that have low fault tolerance.
- For two of the three model suites, and with estimated model probabilities, the robust simple rule is essentially a difference rule.
  - Consistent with Levin and Williams (2003) and Levin, Wieland, and Williams (1999).

Some initial reactions

- Performing the analysis using three model-suites makes the findings model-specific and partly defeats the point of model averaging.
  - Enlarge the model set to include all 6 specifications or drop the Rudebusch-Svensson model and replace it with something else.
- The estimation and analysis is performed for a given dataset, but the shocks entering each model, and hence the flex-price gaps, differ. This seems to matter a lot:

Table 3: Optimal policy coefficients in the individual models

Coefficients	**SW**	**BGG**	**SOE**	**RS1**	**RS2**	**RS3**
Smoothing	0.99	0.03	0.61	0.06	0.81	0.05
Inflation	65.3	100	42.19	0.01	1.01	0.01
Output	7.71	-0.06	-0.20	0.03	0.08	0.05
Output growth	1.71	-0.20	4.10	0.00	0.10	0.00
Loss	5.62	0.035	0.83	3.45	6.75	3.28

- Use detrended output in the loss function?

Four issues/questions

1. Does the Bayesian model averaging approach actually produce robustness to model uncertainty?
    - Models too "similar" versus models too "different".
2. Can we really rely on posterior model probabilities?
    - Probabilities are very sensitive to the prior and to the data.
3. How can we use this type of analysis to think about estimated policy rules?
    - Estimated rules do not look that much like some of the rules in this paper. Are U.K. policymakers not being robust or are the models they place probability on very different to the models considered in this paper?
4. Are these policy rules actually robust? How can we tell?
    - Enlarge the model space or test outside the model space.

One suggestion

Drawing on Epstein and Wang (1994), Kuester and Wieland (2010) propose that the preferences of the robust policymaker take the form

$$L^A = \min_{\phi} \left\{ (1-e) \sum_{j \in M} L_j p\left(j \middle| Y\right) + e \max_{j \in M} L_j \right\}.$$

To overcome the dependence on the level of *loss*, the maximization term might instead include a measure of *regret* (Savage, 1951).