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On Robust Monetary Policy with Structural Uncertainty

Discussion of John C. Williams' "Robust Estimation and Monetary Policy with Unobserved Structural Change"

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It is a pleasure to help honor my friends and former colleagues Dale Henderson, Dick Porter, and Peter Tinsley, by discussing Williams' fine paper and the important ongoing research program to which it contributes, all of which is very much in the Henderson-Porter-Tinsley tradition of path-breaking application of optimal control methods to the conduct of monetary policy.

1. Beauty and the Beast

The recent robust control literature in general, and Williams' paper in particular, hits a very sweet spot. First, it has an beautiful theoretical purity, very much the latest step in the rigorous and stunningly influential prediction and control program of Weiner, Kolmogorov, Kalman, Whittle, Sargent, and Hansen. The essence of robust control is acknowledgment and incorporation of *model uncertainty* in optimal control.[1] Effectively, the robust control framework is a flexible and powerful laboratory for exploring local perturbations to rational expectations.[2]

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[1] For a masterful survey, see Hansen and Sargent (2004).

[2] I borrowed this insight from Tom Sargent.

Second, Williams' robust control perspective has a complementary and equally-appealing applied relevance. Surely, in practice, we do not know the "true" macroeconomic model with respect to which we seek to perform control. Hence control methods robust to lack of knowledge of the true model should contribute significantly to improved policy deliberations.

Against this optimistic background, however, a tension arises: the theoretical robust control framework as presently developed may not be fully up to the applied challenge. That is, realistic monetary policy environments may involve deviations from model certainty best characterized as *global*, rather than local, so that naive implementations and interpretations of robust control may promote an inappropriate complacency – a feeling that the robustness problem has been fully solved, and that monetary policy is now robust to model uncertainty.

2. How Robust is Robust Control?

Over the years, we have made progress in acknowledging various forms of uncertainty in control environments:

(1) Initially, we acknowledged only parameter uncertainty; that is, we assumed the true model known but acknowledged that its parameters were estimated.

(2) Next, we acknowledged both model and parameter uncertainty; we assumed the true model *un*known but a member of a well-defined set, and we acknowledged that the fitted model's parameters were estimated.

(3) Most recently – in the present paper – Williams treats model uncertainty, parameter uncertainty, *and* structure uncertainty. He assumes the true model unknown but a member of a well-defined set, acknowledges that the fitted model's parameters are estimated, *and* acknowledges that the fitted model's parameter(s) may possibly change over time.

The progress claimed above really *is* progress, but unfortunately it may be more limited than it appears at first glance. In particular, in every case, we heroically assume that the set of possible models is known. That is, we assume that the models under consideration constitute the universe of relevant models. In (1) we assume a single fixed-parameter model, in (2) we assume a set of possible fixed-parameter models, and in (3) we assume a set of possible fixed-parameter models augmented with structural change models.

The assumption of a known model set ensures that posterior probabilities sum to unity and hence delivers powerful results. For example, combined forecasts may be constructed trivially as posterior weighted averages across the individual model forecasts. Moreover, and of more direct relevance to the present paper, the assumption facilitates robust (minimax) control by rendering the minimax calculation well-posed. However, a serious issue arises. If the assumed model set is too small, with potentially relevant models omitted, then the corresponding minimax robust control will be incompletely robustified.[3]

Consider Williams' paper, in which he represents structural change by variation in the natural rate of unemployment. Surely one could take issue with that representation, as structural change may be operative in many other ways. The key point, however, is that *even within that representation*, the assumed set of potential natural rate models (stationary ARMA, ARFIMA, and Markov-switching) is very limited. Indeed, as shown by Diebold and Rudebusch (1991) and Diebold and Inoue (1998), in many typical cases the seemingly-different ARMA, ARFIMA, and Markov-switching models may be almost indistinguishable, which suggests that Williams' "robust control" may indeed be under-robustified relative to an appropriate model set with more diversity.

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[3] The situation roughly parallels the specification of the model set in White's (2000) "Reality Check" for data-snooping bias.

3. On the Evolution of Central Bankers' Implicit and Explicit Contracts

Williams' paper is normative, or prescriptive. It tells what *should* be done to obtain robust optimal control in a certain environment under certain assumptions. Interestingly, it seems clear that his paper may also provide a powerful tool for positive, or descriptive, purposes.[4] In particular, the last twenty years have witnessed a clear worldwide evolution in central bankers' explicit and implicit contracts, toward the targeting of low and stable inflation.[5] This happened without the explicit insights of robust control, the application of which to monetary policy is a comparatively new phenomenon. Instead, it is "as if" central banks took to heart the insights of Friedman (1959), Lucas (1972), and Sargent and Wallace (1975), among others, eventually recognizing that the optimal contract for a central bank may appropriately put much less weight on output gaps than on inflation gaps, because too little is known about the money-output link to exploit it reliably. That's precisely what Wiliams' model says and formalizes: when the natural rate is uncertain, stay away from trying to fine-tune employment, and focus instead on what can actually be achieved – low and stable inflation.

4. Final Thoughts

To paraphrase a popular wall poster from some years ago, central bankers seeking robust policies need (1) the skill to model quantitatively that which can be modeled quantitatively, (2) the forbearance to avoid attempting to model quantitatively that which can not be modeled quantitatively, and (3) the wisdom to know the difference. The robust control literature has made impressive strides regarding (1). I look forward to similar progress on (2) and (3), which will require explicitly recognizing that some potentially important forms of model uncertainty are

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[4] For additional perspective on this theme, see Orphanides and Williams (2003).

[5] For a colorful and informative portrait, see Bernanke, Laubach, Mishkin and Posen (1999).

unknown and perhaps even unknowable, and hence not amenable to a tidy quantitative minimax analysis over a pre-specified model set. Hopefully, the incomplete contracting perspective, which has proved so successful in areas such as organization and compensation design, will help lead us to central bank contracts robust to model uncertainty of unknown form.[6]

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[6] For additional insights, see King (2004).