Monetary Policy in an Uncertain Environment: A Case for Robust Monetary Rules[1]

Paul Levine

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The Problem of Uncertainty in Monetary Policy

"Uncertainty is not just an important feature of the monetary policy landscape; it is the defining characteristic of that landscape."
Alan Greenspan

Sources of Uncertainty

Central Banks face a number of **sources of uncertainty**:

- From changes occurring in the economy
- From limitations of economic data
- From the unobservability of parts of the economy and macroeconomic variables
- From disagreements over theoretical models

To handle such uncertainty policymakers need to incorporate into the conduct of policy rules:

- risk assessment
- robustness

We Are All Bayesians Now

- .... the conduct of monetary policy in the US has come to involve, at its core, crucial elements of risk management. This conceptual framework emphasizes **understanding as much as possible** the many sources of risk and uncertainty that policymakers faces, **quantifying those risks when possible**, and assessing the costs associated with each of the risks. In essence, the risk management approach to monetary policymaking is **an application of Bayesian decision-making** (Alan Greenspan, 1/3/2004).

- ....He (S. James Press) was a Bayesian before being Bayesian was "cool" (Reviewer in JASA, 2005, quoted by Christopher Sims).

In Praise of Robustness

..... the Governing Council of the ECB has no intention of being the prisoner of a single system ... We highly praise robustness. There is no substitute for a comprehensive analysis of the risks to price stability (Jean-Claude Trichet, 2005)

Monetary Policy Strategy

1. Conventional Objectives: to stabilize
   - output about some reference level
   - inflation about a low reference level
2. Or Maximize Expected Welfare of the Representative Household
3. An **information structure** –a framework for translating information into a form useful for policymakers
4. An **operational procedure** for determining the setting of the chosen instrument
   - A model or set of alternative models
   - Simple rules – i.e., 'Taylor rules': e.g., nominal interest rate responds to inflation and the output gap

Towards a Common Modelling Methodology

- Early Keynesian Economics
- From Real Business Cycle Models to Dynamic Stochastic General Equilibrium (DSGE) Models
- Some Other Approaches
  - **Alternatives to rationality** and **Expected Utility Maximization**: 'behavioural' approaches based on psychology – [Shiller(1999)]
  - **Endogenous Growth** – see work of Thorvaldur Gylfason including [Gylfason(1999)]
  - **Agent-Based Computational Economics** (ACE): computational models of many interacting agents with 'realistic' behaviour; e.g., *reinforcement learning* where agents develop a reputation for good or bad service [LeBaron and Tesfatsion(2008)], [Schuster(2009)]

Early Keynesian Economics

- 1960s-70s econometric models were based on
  - Equation-by-equation estimation of behavioural equations often reduced form without explicit expectations
  - Construct large model by combining these with identities
- Lucas Critique
- Incoherence
- Move towards micro-founded models with systems estimation

DSGE

- Main Features
  - RBC Core plus a Nominal Rigidities and other frictions
  - Expected Utility Maximizing Representative Agent
  - Rational Expectations under complete information
  - Bayesian-Maximum Likelihood Estimation – see DYNARE
- Widely used especially by central banks and an "impressive achievement" [Blanchard(2008)]
- But there are **shortcomings**:
  - Well-established problems with rationality and Expected Utility Maximization (EUM)
  - DSGE models examine fluctuations about an exogenous balanced growth path – no role for endogenous growth
  - Empirical concerns – identification, ability to match VARS, too many shocks required, too little attention to priors
  - Heterogeneity and Aggregation

Expected Utility Maximization

- An alternative is **Prospect Theory** which takes into account people behave as if extremely improbable events are impossible and extremely probable events are certain.;
- Can explain phenomena such as the equity premium puzzle
- BUT difficult in incorporate into GE and "EUM can be a workhorse for some sensible research" (Shiller, 1999)

Rationality

- Experiments using people and ACE models suggest agents can **learn to be rational**
- **Statistical Learning** in theoretical macro-models **converge to rational expectations equilibria**, [Evans and Honkapohja(2001)]
- **Darwinian selection** helps rational firms (profit-maximizing) to succeed in competition
- **Myerson criterion**: The design of social institutions and policy rules should not depend on irrationality for their success [Myerson(1999)]

Heterogeneous Agents and Aggregation

- ACE models tackle this but should central banks go down this path?
- To quote LeBaron and Tesfatsion (2008) they "raise some practical complications for the applied econometrician... computational methods such a method of moments might be too computationally costly to undertake ... Researchers at central banks might never decide to fit giant ACE macro models to data."
- Aggregation matters! [An *et al.*(2008)]
- Difficult Problem! Not like atoms in physics - economic agents are conscious and calculating!

Robustness: Related Methodological Literature

- All these modelling alternatives highlight the need for *robustness* in policy design

- Unstructured Uncertainty Approach of [Hansen and Sargent(2008)]
  - Game against malign Nature; mini-max approach
  - HS pursue optimal policy, not optimized simple rules

- Why the Structured Uncertainty Approach? [Sims(2001)], [Levine and Pearlman(2008)]
  - Unconventional Taylor Rules which must respond to Nature
  - For monetary policy we do have information on uncertainty: *Use it*! HS is a Counsel of Despair!
  - Recent research: [Levin *et al.*(2003)], [Levin *et al.*(2006)], [Levine *et al.*(2008)]

A Robust Operational Procedure [Levine *et al.*(2008)]

- Estimate a number of rival DSGE models based on [Smets and Wouters(2003)]
- By Bayesian estimation obtain **estimated** model probabilities and parameter joint distributions for each model. These represent our 'quantified risks'
- Design interest rate rules to incorporate **increasing degrees of robustness**:
  - **Model-variant and parameter robustness** by maximizing expected welfare across the rival models and across estimated parameter distributions within each model
  - First assume **model-consistent expectations**: private sector and central bank believe in the same model and parameter combination.
  - Then allow for **model-inconsistent perception**.

Brief Summary

- We propose a **general methodology** for designing robust simple monetary rules
- Robustness is over a narrow range of modelling alternatives, but can be applied to a greater diversity of models
- **Qualified Support for the Brainard Result** – model uncertainty call a more cautious policy response to shocks
- **Forward-looking inflation targeting rules perform badly** – problem of indeterminacy
- Current inflation targeting rule perform well BUT **Current wage inflation rule** is best of all! Robust Design not even essential.
- Best wage inflation rule: change in interest rate responds to wage inflation $\Rightarrow$ a **nominal wage level rule**

Future Research

- **Better Models given Expectations Formation**
  - Labour Markets with Unemployment and the Informal Economy [Batini *et al.*(2009)]
  - Financial Frictions [Bernanke *et al.*(1999)]
  - Banking Sector [Goodfriend and McCallum(2007)]
  - More disaggregated models

- **Robustness with respect to Expectations Formation**
  - Move away from perfect information [Levine *et al.*(2007)]
  - Rational Inattention [Sims(2005)]
  - Statistical Learning
  - Animal Spirits? [Akerlof and Shiller(2009)]

- **The Way Forward?** Robust Policy Design within the DSGE paradigm

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