Rational Sunspots

By Ascari, Bonomolo, and Lopes

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This Paper

- A nice and well-written paper from which I learned a lot

- The paper carries out an interesting and sensible exercise

- My discussion:

  1. I will review the method proposed by the authors
  2. Some remarks on the empirical results of the paper
  3. Role of demand shocks in the 1970s: a reassessment

Blanchard and Kahn (ECMA, 1980)

- LRE models:

$$\left[\begin{array}{c} X_{t+1} \\ E_t P_{t+1} \end{array} \right] = A \left[\begin{array}{c} X_t \\ P_t \end{array} \right] + \gamma Z_t$$

  - X_t collects the n predetermined variables
  - P_t collects the m non-predetermined variables
  - $Z_t \backsim N(0, \Sigma)$

- There exist ∞^m solutions to the system

- How many of these solutions are stable?

$\Longrightarrow$ Blanchard and Kahn conditions

How Many Stable Solutions?

- Stability requires computing the eigenvalues of the matrix A

- Denote the number of eigenvalues that lie outside the unit circle with $r \leq m$

- Blanchard and Kahn showed that

  1. If $r = m$ (*determinacy*), there exists only one stable solution (i.e., path consistent with REE)

  2. If $r < m$ (*indeterminacy*), there exist $\infty^{(m-r)}$ stable solutions

The Proposed Approach

- This paper complains that macroeconomists are obsessed with stable solutions

  1. Most of modern macro analysis has studied RE models under determinacy

  2. A few papers (e.g., Lubik and Schorfheide AER 2004) have studied the properties of RE models under indeterminacy

     - Sunspots to capture jumps to stable paths

- This paper argues that allowing jumps to *unstable* paths (rational sunspots) can improve the fit of our models

My Take

- Rational agents are assumed to know the model equations, the parameter values, and how other agents think

- I do not have trouble thinking that such superheroes can coordinate their beliefs so as to select a stable solution

- Is this restrictive? yes

- Is this a *too* restrictive? Maybe. Restricting to stable solutions

  - Sharpens the predictions of RE models

  - But can also alter model selection and models' predictions in an undesirable way

- So what the authors are doing makes sense

Lubik and Schorfheide (AER 2004) Model

- Three-equation New Keynesian DSGE model:

$$
\begin{aligned}
x_t &= E_t x_{t+1} - \tau \left(R_t - E_t \pi_{t+1} \right) + g_t \\
\pi_t &= \beta E_t \pi_{t+1} + \kappa \left(x_t - z_t \right) \\
R_t &= \rho_R R_{t-1} + \left(1 - \rho_R \right) \left(\psi_1 \pi_t + \psi_2 \left(x_t - z_t \right) \right) + \varepsilon_{R,t}
\end{aligned}
$$

- with exogenous processes:

$$
\begin{aligned}
g_t &= \rho_g g_{t-1} + \varepsilon_{g,t}, \quad \varepsilon_{g,t} \backsim N \left(0, \sigma_g \right) \\
z_t &= \rho_z z_{t-1} + \varepsilon_{z,t}, \quad \varepsilon_{z,t} \backsim N \left(0, \sigma_z \right)
\end{aligned}
$$

- $\varepsilon_{R,t} \backsim N \left(0, \sigma_R \right)$.

- Stability of the system:

  - Number of non-predetermined variables $m = 2$
  - If $\psi_1 > 1 - \frac{1-\beta}{\kappa} \psi_2$ (Taylor Principle), number of explosive eigenvalues $r = 2$ (*determinacy*)
  - Else, number of explosive eigenvalues $r = 1$ (*indeterminacy*)

Two Models to Study the 1970s

- **STABLE MODEL**
  1. If the Taylor principle is satisfied, the unique stable solution is selected
  2. If the Taylor principle is not satisfied, all solutions are stable and sunspots shocks select a REE path (similarly but not exactly as in LS)

- **UNSTABLE MODEL**
  1. The stability restriction is never imposed
  2. Since there is always an explosive eigenvalue, all the solutions are unstable independently of Fed's policies
  3. Exogenous jumps to these infinitely many unstable paths

Empirical Analysis

- Models are estimated over two samples: 1960:Q1-1979:Q2 and 1982:Q4-1997:Q4

- Solutions to the unstable model are characterized by stochastic volatilities (multiplicative sunspots)

$\implies$ Can't use the Kalman filter to estimate these models

- MCMC filtering required

- So estimation is more challenging than that in LS

Estimation Results: Comments

1. The estimated values for the parameters of the unstable model are quite stable across samples

   - The parameters of that model look really structural

2. The slope of the Phillips curve is tiny in the unstable model

   $\implies$ Inflation is mainly explained by rational sunspots (exogenous jumps to unstable paths)

   - More discussion about this result is warranted

3. The data like the unstable model better than the stable model

   - The authors have to work harder to convince me on this one

4. The likelihood seems to use rational sunspots to affect the propagation of shocks

   - Additional "supply shocks" to explain stagflation

Stability or Instability in the 70s?

- Is imposing stability on RE paths too restrictive?
- Let the data speak about this:
  - Sequential Bayes factors favor the unstable model to explain the 70s
- Sequential Bayes factors are based on one-quarter-ahead predictive likelihood
- Caveat: the unstable model seems to have a lot of flexibility to explain the data
  - Useful for forecasting at short horizons
  - Less useful for fitting out of sample at 1Y, 3Y, or 5Y horizons
- Suggestions:
  - Assess how the two models forecast at longer horizons
  - Use expectation data to put discipline on unstable REE paths that can be selected

# Propagation of Shocks in the Unstable Model

- An important finding is that monetary policy shocks move output and inflation in opposite directions

- These shocks propagate as they were "supply shocks"

- This result is also in LS

- My ReStud paper about signaling effects of monetary policy finds a similar result

- Arguably, the likelihood alters the transmission of monetary shocks so as to explain the stagflation in the '70s

- What is the relative role of shocks in the '70s according to the unstable model?

Signaling Effects of Monetary Policy

- Develop a structural GE model in which
    1. price-setting firms have dispersed information
    2. the central bank imperfectly measures inflation and the output gap
    3. the interest rate set by the central bank is perfectly observable

- The policy rate conveys information about the central bank's view on inflation and the output gap

- Estimation using
    - **Survey of Professional Forecasters** as a measure of firms' inflation expectations
    - **Greenbook data** as a measure of the central bank's view about output gap and inflation

- I show that signaling effects largely contributed to the run-up of inflation and inflation expectations observed in the '70s
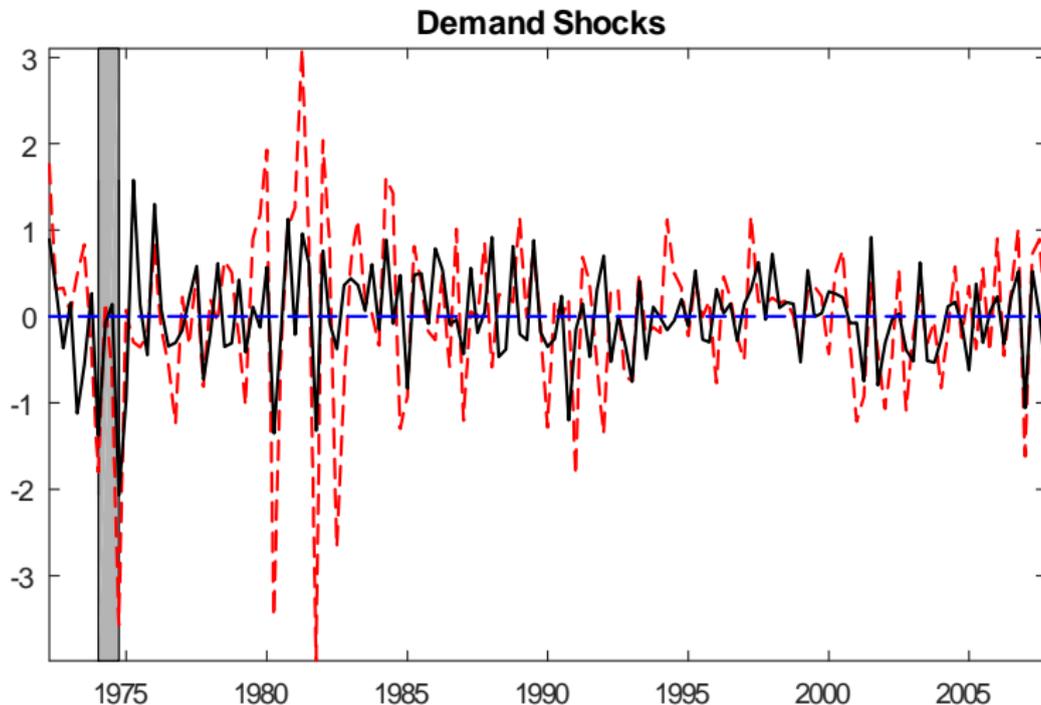
Demand Shocks

From Melosi "Signaling Effects of Monetary Policy"
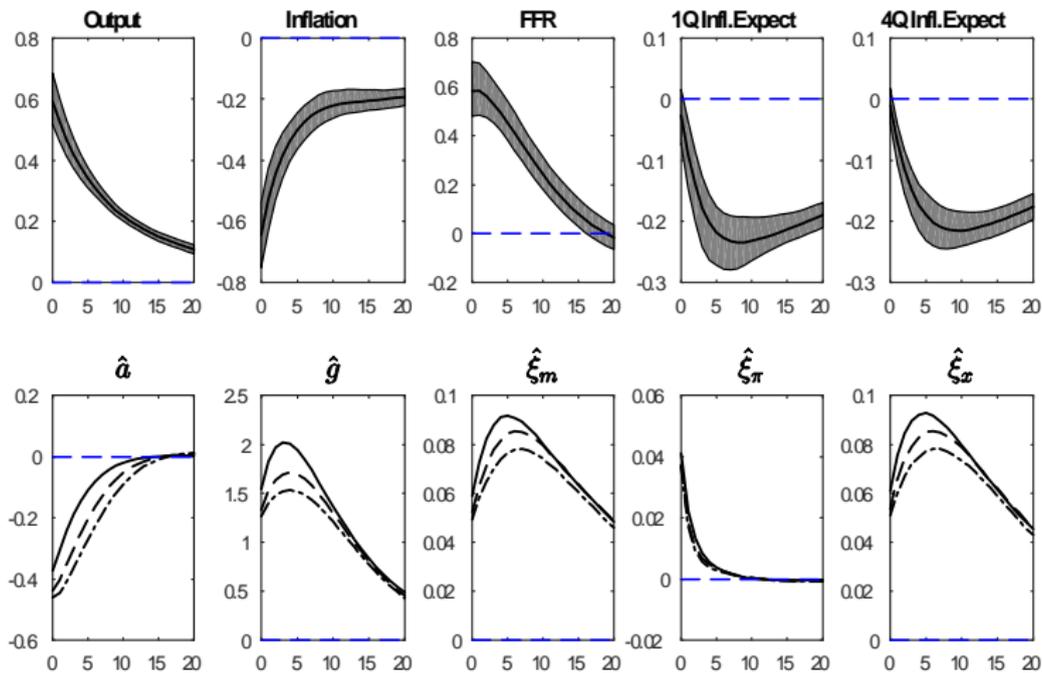
The Role of Demand Shocks in the 1970s?

From Melosi "Signaling Effects of Monetary Policy"

Demand Shocks

Wrap up

- This is a nice paper I have enjoyed reading it

- Some thoughts I hope they will help improve the paper a little:

    1. Inflation seems to be largely driven by exogenous sunspot shocks

    2. More work to convince me that considering unstable REE paths would improve the fit of our DSGE models

    3. Using expectation data on estimation would put discipline on rational sunspots

    4. The finding that monetary shocks propagate as supply shocks deserves more emphasis