Empirical and Policy Performance of a Forward-Looking Monetary Model

Alexei Onatski and Noah Williams

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Comments by Jeff Fuhrer
FRB Boston
The authors are to be applauded and I mean that

- For moving beyond “toy” models
  - Incorporating recent advances in consumption, investment for monetary models
- For taking the data seriously
  - Empirical performance is a success criterion in this paper
- For using rigorous empirical standards
  - Serious estimation
  - Serious diagnostics (Impulse responses, covariance functions, etc.)
The result: A Sophisticated Model-About-Town

Start with canonical model

$$\pi_t = E_t \pi_{t+1} + \gamma y_t + \varepsilon_t^p$$

$$c_t = E_t c_{t+1} + \varepsilon_t^b$$

$$i_t = \rho i_{t-1} + (1-\rho)[a(\pi_t - \bar{\pi}_t) + b(y_t - y_t^*)] + \varepsilon_t^r$$

- Add habits, indexing in wages and prices, higher-order adjustment costs in investment
- Add autocorrelated errors (\(\rho=.9,.95,.98\))
- And voila! The model really works!
This model really works!

Response to inflation target shock

Nice, hump-shaped responses, fairly data-consistent
But what are the relative contributions of shocks, frictions, and deep structure to dynamics?

- Run impulse responses with
  - Full model
  - Model with all $\rho$’s set to zero
  - Model with all $\rho$’s set to zero, “frictions” set to zero: habits, indexing, policy smoothing ($h=0$, $\gamma_w=0$, $\gamma_p=0$, $\rho=0$)
  - Nice accounting of where the action is coming from in the model
This model really works: ALMOST
Response to preference shock, with and without AC errors, frictions

It’s all in the shocks (for preference shock)
This model really works: ALMOST
Response to inflation target, with and without AC errors, frictions

A lot's in the shocks; everything is in shocks + frictions
Why am I whining about shocks?

• I AM NOT OPPOSED TO AUTOCORRELATED SHOCKS

• But the shocks and ad hoc frictions shouldn’t explain too much!

• Because if they do, then what does the welfare function mean?
  – Applies only to steady-state or unconditional welfare
  – But then we’re choosing optimal inflation rates, not transition paths (i.e. monetary policies)

• And what about the Lucas critique?
  – We may have found deep behavioral parameters, but
  – Much of the dynamics come from $\rho_a$, $\rho_b$, etc.
  – Why would these be “deep?”
That said, the estimated contribution from “frictions” in O-W is somewhat small

- **Habits**
  - Note that with $h = .4$, the weight on past consumption $(h/(1+h))$ is 0.29
  - This is well below other estimates that often place weight on past consumption well above 0.5
  - Micro concerns: Little evidence of habits in micro data

- **Indexing**
  - Similarly, weight on lagged inflation from indexing $(\gamma_p/(1+\beta \gamma_p))$ is 0.24
  - Again, well below many estimates which are often well above 0.5
  - For wage indexing, preferred estimate has lagged inflation contribution at zero
Stronger frictions might imply a smaller role for shocks

- Like difference between autocorrelated errors

\[ y_t = \beta x_t + \frac{\varepsilon_t}{1 - \rho L} \rightarrow y_t = \rho y_{t-1} + \beta x_t - \rho \beta x_{t-1} + \varepsilon_t \]

- And lagged dependent variables (habits, adj. costs, indexing)

\[ y_t = \rho y_{t-1} + \beta x_t + \varepsilon_t \]

- Common factor restriction, but for small \( \beta \), as is typical in these models, may not be important

- How “deep” are adjustment costs?
  - “Higher-order” adj. costs smacks of adding lags without much restriction (FRB-US?)
For example, my parameter estimates on Smets-Wouters (detrended) data:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>O-W Estimate</th>
<th>My estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>$h$</td>
<td>0.4</td>
<td>0.99</td>
</tr>
<tr>
<td>$\gamma_p$</td>
<td>0.32</td>
<td>0.99</td>
</tr>
<tr>
<td>$\gamma_w$</td>
<td>0</td>
<td>0.99</td>
</tr>
<tr>
<td>$\rho_b$</td>
<td>0.88</td>
<td>0.001</td>
</tr>
<tr>
<td>$\rho_I$</td>
<td>0.94</td>
<td>0.07</td>
</tr>
<tr>
<td>$\rho_\pi$</td>
<td>0.58</td>
<td>0.88</td>
</tr>
<tr>
<td>$\xi_p$</td>
<td>0.93</td>
<td>0.985</td>
</tr>
<tr>
<td>$\xi_w$</td>
<td>0.704</td>
<td>0.918</td>
</tr>
</tbody>
</table>

Likelihood: 1.57e03
Likelihood, O-W parameters: 22.07
A Larger Concern

- Are we adding “epicycles” to a dead model?
  - Habits help, but no compelling evidence that they’re present in micro data
  - Indexing in wages and prices (basically adding lags) is a bit ad hoc, no?
  - Higher-order adjustment costs are also subject to suspicion
  - Big “rho’s” on shocks make me nervous

- In a way, this takes us back to the very old models
  - With decent long-run, theory-grounded properties
  - But dynamics from a-theoretic sources

- If so, don’t push the model’s implications too far
  - “Optimal” policy may be more than we can ask
On Optimal Policy

• O-W Results
  – Optimal utility-based policy reduces loss by a factor of 50 relative to estimated rule
  – Rule which implements optimal policy looks like figure 16, with lagged interest rate coefficients like:
    \[ \text{One root of polynomial inside unit circle, hence “super-inertial” in a generalized sense} \]
In the rule which implements optimal policy, inflation gets essentially no weight (from figures 17-18)
Robustness: With Smets and Wouters’ parameters, the rule looks somewhat different

- Although many of the qualitative properties are preserved
- Lagged interest rate coefficients about the same
- Output coefficients still much larger than inflation
- This latter result holds for the “simple rule” that approximates the optimal
Simple Rules in the O-W model

• They find a nice simple rule that captures most of the 50x reduction in losses:
  \[ i_t = i_{t-1} + 0.4(Y_t - Y_t^*) \]
  
• Now *that’s* something the Fed can really work with!

• **No response to inflation necessary**; difference specification

• The “nominal anchor” is lagged inflation?
  – This really *shouldn’t* work
  – Does it work in other models?
Look at the nominal anchor issue in a simple model

• “Hybrid” model, similar to O-W but simpler

\[ \pi_t = \omega \pi_{t-1} + (1-\omega) E_t \pi_{t+1} + \gamma y_t \]

\[ y_t = \omega y_{t-1} + (1-\omega) E_t y_{t+1} - \sigma (i_t - E_t \pi_{t+1}) \]

\[ i_t = i_{t-1} + \alpha \pi_t + b y_t \]

• For all values of 0\leq\omega\leq1, if a=0, no value of b will stabilize the system

• System requires a true nominal anchor
  – Anchor works because CB moves \( i_t \) to attain its inflation target
  – Nothing else in system pins down long-run value of inflation.
  – CB attains inflation goal by moving real rates to influence \( y \)
  – It can move real rates because it can move \( i \) faster than \( \pi \)

• Another non-robust result
What to take away from the paper

- Big models are complicated and hard to understand!
- Optimal policy conclusions from these models can be quite counter-intuitive, seldom robust, not practical (O-W would agree)—super-inertia, nominal anchors
- The dependence on many *ad hoc* “frictions” and time series shock processes is worrisome
- But to match the data for this class of models, we need these epicycles
- Could other avenues be explored to improve models?
  - Heterogeneity: not hard to document, may be important
  - Aggregation: disaggregated time series often don’t look like aggregates—micro foundations?
  - Learning: as some others at this conference are exploring
  - “Behavioral” explanations