Discussion of Wu and Xia

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Summary

- Start with a standard Gaussian Affine Term Structure model, except 
  \[ r_t = \max(r, s_t) \]
  and \( s_t \) is an affine function of states, not \( r_t \).

- Use an approximation for the forward rate using \( g(z) \).
  - Faster than alternatives, not much loss in accuracy.

- Use extended Kalman filter (approximate the nonlinear state space model with a linear one) to estimate.
  - Data: One-month forward rates for maturities of 3-month, 6-month, 1-year, 2-year, 5-year, 7-year and 10-year.

- Obtain an estimate of \( s_t \), the shadow rate.
  - Use it in a FAVAR as a measure of monetary policy.
  - Impulse responses
  - Link between unconventional policies and shadow rate
Is the Shadow Rate “Unconstrained”?  

Swanson and Williams (2015, AER)

(a) 3-Month Treasury Yield Sensitivity to News
### Is the Shadow Rate “Unconstrained”?  

<table>
<thead>
<tr>
<th></th>
<th>Pre-ZLB</th>
<th>Full</th>
<th>ZLB</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Constant</strong></td>
<td>-3.8</td>
<td>-3.8</td>
<td>-4.2 (**)</td>
</tr>
<tr>
<td><strong>ZLB</strong></td>
<td></td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td><strong>Initial Claims Surprises</strong></td>
<td>-10.9 (**)</td>
<td>-11.1 (**)</td>
<td>-0.5</td>
</tr>
<tr>
<td><strong>Initial Claims Surprises \times ZLB</strong></td>
<td></td>
<td>10.0 (**)</td>
<td></td>
</tr>
<tr>
<td><strong>$R^2$</strong></td>
<td>0.05</td>
<td>0.05</td>
<td>0.00</td>
</tr>
</tbody>
</table>

- Perhaps more work needed with more surprises and a daily frequency.
- This suggests the shadow rate has muted response to news.
- Remember: the shadow rate is the short rate of the yield curve.
“The natural question is whether the shadow rate could be used in place of the fed funds rate to describe the stance and effects of monetary policy under the ZLB.”

- They test (simplifying notation) if $\rho_1 = \rho_3$ in

$$x_t = \mu + \rho_x x_{t-1} + 1(t < \text{December 2007})\rho_1 s_{t-1} + 1(\text{December 2007} \leq t \leq \text{June 2009})\rho_2 s_{t-1} + 1(t > \text{June 2009})\rho_3 s_{t-1} + \epsilon_t$$

- Issues:
  - Why expect equality? A major structural change is occurring in the economy.
    - End of Great Moderation
    - New policy regime? (figure)
    - New shocks: financial, uncertainty, fiscal
Fernandez-Villaverde et al. (2010, St. Louis Fed Review)

Smoothed Path for the Taylor Rule Parameter on Inflation ±2 SDs
Does the shadow rate reflect the stance of monetary policy?

![Graph showing the Fed Balance Sheet and the Shadow Rate with shaded bars for QE1, QE2, Twist, and QE3. The x-axis represents years from 2009 to 2015, and the y-axis represents values from -5 to 2. The graph includes a blue line labeled "Fed Balance Sheet (Right)" and a red line labeled "Wu-Xia (Left)." The shaded bars indicate the periods of quantitative easing and the twist.]
Was the Fed policy not nearly expansionary as it should be in 2009-2010?

Comparison of Shadow Rate with Unconstrained Policy Rate from a DSGE Model

R* (Aruoba Cuba-Borda Schorfheide, 2015)

Wu-Xia

B. Aruoba

Wu-Xia Discussion
Promises replacing federal funds rate in one’s favorite empirical model (DSGE, VAR etc.)

Not clear if it is a sufficient description of Fed’s stance.

Lift-off? (End of September: −0.74%)
  - Is the Fed keeping the policy rate down by 100 basis points?

Major challenge: When looking back to the U.S. data in 2020, how are we going to estimate our models?
  - Continuous regime?
  - New regime with new tools? (Balance sheet)

Very useful step forward.