Discussion of Wu and Zhang

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Chicago Fed DSGE Conference
Major challenge: In 2020, how are we going to estimate our models with data covering 2009-2015?

- Continuous regime with ZLB?
- New regime with new tools? (Balance sheet, forward guidance, ...)

Either way, take regime change and/or occasionally-binding constraints seriously when solving/estimating models.

This paper: Take your favorite DSGE model, replace FFR that is subject to the ZLB constraint with the shadow rate and solve the model linearly. All will be well. (need to accept some assumptions)

All “problems” due to the inability of the central bank to react: multiplicity of equilibria, large multipliers, strange responses, and the model solves in an instant.

Let’s confront these assumptions with U.S. data. (ultimate goal is to estimate this model)
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Shadow rate reacts to events (e.g. to output and inflation deviations) just the way FFR does.
Assumption 1: Shadow rate reacts to events like FFR

<table>
<thead>
<tr>
<th></th>
<th>Change in Policy (monthly, in bp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Claims Surprises (lagged, std)</td>
<td>-10.9 (**)</td>
</tr>
<tr>
<td>Initial Claims Surprises × ZLB</td>
<td></td>
</tr>
</tbody>
</table>

-10.9 (**)
-11.1 (**)
-0.5
Assumptions and U.S. Data

- Shadow rate reacts to events (e.g. to output and inflation deviations) just the way FFR does.
  - Shadow rate shows a muted response to news.
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Shadow rate is a good description of Fed’s unconventional policies.
Assumption 2: Shadow Rate Captures UMP
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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

B. Aruoba

Wu-Zhang Discussion
Assumptions and U.S. Data

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- Risk premium / term premium is constant away from ZLB and is linear in the shadow rate at ZLB.
Assumption 3: Risk/Term Premium at and away from ZLB

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Wu-Zhang Discussion
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corr(GZ, shadow) = 0.75

corr(TP, shadow) = 0.34
Assumption 3: Risk/Term Premium at and away from ZLB

Estimate \( \text{spread}_t = \alpha + \beta_T s_t + \epsilon_t \) for \( t = 1, \ldots, T \) recursively and plot \( \beta_T \).
Assumptions and U.S. Data

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Risk premium / term premium is constant away from ZLB and is linear in the shadow rate at ZLB.

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Bond holdings of the public is constant away from ZLB and it is linear in the shadow rate at ZLB (i.e. it falls as \( s_t \) falls below zero)
Assumption 4: Government Bonds at and away from ZLB

Supply and Demand for U.S. Government Bonds (% of GDP)

Households
Firms
Rest of the World
Government
Federal Reserve
Supply (Right)

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3. **Risk premium / term premium is constant away from ZLB and is linear in the shadow rate at ZLB.**
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4. **Bond holdings of the public is constant away from ZLB and it is linear in the shadow rate at ZLB (i.e. it falls as \( s_t \) falls below zero)**
   - Fiscal response to crisis / flight to quality increases both supply and holdings of government bonds by the public. Fed's share (still) small.
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5. Key variables such as output and inflation behave at ZLB just like they do away from ZLB, i.e. they do not inherit the ZLB kink.
### Assumption 5: Key Variables at and Away from ZLB

<table>
<thead>
<tr>
<th></th>
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</tr>
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<tbody>
<tr>
<td>$corr(\pi_t, \pi_{t-1})$</td>
<td>0.48</td>
<td>0.40</td>
</tr>
<tr>
<td>$corr(y_t, y_{t-1})$</td>
<td>0.34</td>
<td>0.08</td>
</tr>
<tr>
<td>$corr(y_t, \pi_t)$</td>
<td>-0.17</td>
<td>0.24</td>
</tr>
<tr>
<td>$corr(R_t, y_t)$</td>
<td>0.06</td>
<td>-0.42</td>
</tr>
<tr>
<td>$corr(R_t, \pi_t)$</td>
<td>0.18</td>
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5. Key variables such as output and inflation behave at ZLB just like they do away from ZLB, i.e. they do not inherit the ZLB kink.
   - Some key correlations seems to change signs.
Conclusion

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- This approach is not (yet) ready for prime-time.
  - If we were to estimate it using U.S. data covering 2009-2015, it would not do well.

- Looking forward to the next iteration.