Forward Guidance, Quantitative Easing, or both?

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Broad Research Question

- Unconventional monetary policy
  - Forward Guidance (FG)
  - Quantitative Easing (QE)

- Both were pursued, hoping at least one would work
- Did they?

Our analysis boils down in large part to novel empirical evaluation of the real effects of QE
  - (QE - here: not credit easing)
Evidence and rationale for QE

- Recent evidence supports the scope for portfolio balance / preferred habitat effects on interest rates
- $\text{corr} (\text{bond supply, yield}) > 0$

Importance?

- Standard NK DSGE models $\implies$ QE irrelevant
- However, if bond quantities outstanding determine yields
- Then a central bank faced with the ZLB
- Can reduce long term interest rates
- By lengthening maturity of its balance sheet
QE: Evidence

- While the **interest rate** evidence is there
  - $corr(\text{bond supply, yield}) > 0$

- The **real effects** of QE through a portfolio channel appear absent
  - $corr(\text{bond supply, GDP}) \approx 0$
  - Chen, Cúrdia & Ferrero (CCF, 2012)

- Bernanke puzzle: “*The problem with QE is it works in practice, but it doesn’t work in theory.*”
Estimating real effects of QE fraught with difficulty

- Multiple challenges
- ... and how we address them
Estimating real effects of QE

Challenge 1

- QE = central bank steering maturity of debt outstanding
- Central bank is not the only one affecting maturity
- Primarily: Treasury
- US: Data suggests Treasury and Fed worked in opposite directions during Great Recession (Greenwood, Hanson, Rudolph and Summers, 2015)

⇒ Data: study debt of different maturities outstanding (∼ central bank balance sheet size)
⇒ Model: explicit, rich structure for government debt maturity policy
Estimating real effects of QE

- **Challenge 2**
  - Announcement ahead of implementation is an important feature of actual policy
  - Difficult to account for in (S)VAR-analysis

  \[ \Rightarrow Model: \ DSGE \text{ enables accounting for anticipation} \]
  - Not just in interest rate policy (Forward Guidance)
  - Also in QE
Estimating real effects of QE

- Challenge 3
  - FG and QE implemented simultaneously
  - Evaluating one policy in isolation may pick up the real effect of the other implemented (but unmodelled) unconventional policy

- \(\Rightarrow\) Model: encompass both FG and QE
Contribution & preview of findings

- Provide structural empirical framework which embeds
  - Maturity supply: explicit policy rule
  - Maturity demand: preferred habit(at), portfolio balance channel
  - Anticipation in both interest rate and maturity policy

**Key finding**: Fluctuations in maturity *do matter* for yield curve and macroeconomy

**Implication**: QE has significant expansionary real effects
Approach

- Start from “standard” DSGE model for US economy (Smets and Wouters, 2007)
- Add financial block
- Add fiscal block incl. maturity
- Add anticipation (both FG and QE)
- Estimate and evaluate
Financial intermediary

- Risk-neutral
- Maximizes profits
- Invests in two assets: short ($b^S$) and long-term ($b^L$) bonds
- Faces a cost in adjusting portfolio composition $F\left(\frac{b^S_t}{b^L_t}\right)$
Financial block: implications (1)

- Term spread

\[
E_t \hat{R}_{t+1}^L - \hat{r}_t^S = \frac{1 + \delta}{\delta} \chi \left( \hat{b}_t^L - \hat{b}_t^S - \rho \chi \left[ \hat{b}_{t-1}^L - \hat{b}_{t-1}^S \right] \right)
\]

- Non-standard in DSGE (but present in CCF):
  - Financial sector demand for different maturity bonds, function of balance sheet composition
  - **Novel**: Preferred habit(at): preferred maturity structure, desired maturity can change
    - Not just stock, also dynamics
    - Debate on stock vs. flow effects of QE, persistence of QE
Financial block: implications (2)

- Household rate

\[ \hat{r}_t^h = \frac{\delta}{1 + \delta} E_t \hat{R}_{t+1}^L + \frac{1}{1 + \delta} \hat{r}_t^S + \hat{\varepsilon}_t^b \]

- Non-standard in DSGE (but present in CCF):
  - Fluctuations in outstanding quantities matter for term structure (and real decisions)
Debt accumulation equation: long and short bonds

Debt maturity:

\[ \hat{b}_t^L - \hat{b}_t^S = f(\Omega_t) + \sum_{j=0}^{M} \varepsilon_{t-j}^{\text{MAT},j} + \nu \varepsilon_t^{TD} \]

- maturity composition
- endogenous maturity policy
- maturity policy shocks
- debt issue
Confronting the new blocks with the data (1)

- Embed in broader structural (DSGE) empirical framework:
- Smets and Wouters (2007): macro-fluctuations
Confronting the new blocks with the data (2)

- Important here since:
  - While portfolio balance effects may exist, need not require them to explain *all* long-term interest rate movements
Confronting the new blocks with the data (3)

- Embed in broader structural (DSGE) empirical framework:
- Smets and Wouters (2007): macro-fluctuations
- De Graeve, Emiris and Wouters (2009): term structure of interest rates (EH)

+ Blocks: term structure (EH+PH), financial & fiscal

- Observables: SW + Term structure of interest rates \((r^L, r^S)\) and debt \((b^L, b^S)\)
- Estimation on US data 1975-2015
Key overall finding

- Joint empirical model of
  - macaoneconomy
  - term structure of interest rates
  - term structure of govt. debt
- Is compatible with data

Why key?
- Earlier research finds dichotomy (Chen, Cúrdia & Ferrero, 2012)
  - $\Rightarrow$ QE irrelevant
## Importance of various model components?

<table>
<thead>
<tr>
<th>Component</th>
<th>ML</th>
<th>$\chi$</th>
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</thead>
<tbody>
<tr>
<td>Benchmark</td>
<td>-1699</td>
<td>5.16</td>
</tr>
<tr>
<td>No endogenous maturity policy</td>
<td>-1699</td>
<td>5.46</td>
</tr>
<tr>
<td>No anticipation in QE</td>
<td>-1703</td>
<td>4.53</td>
</tr>
<tr>
<td><strong>Static adj.</strong></td>
<td>-1722</td>
<td>0.00</td>
</tr>
<tr>
<td>Long bond exogenous/short residual</td>
<td>-1759</td>
<td>4.61</td>
</tr>
<tr>
<td>No infl. target changes + TP shock</td>
<td>-1740</td>
<td>4.97</td>
</tr>
<tr>
<td>No infl. target changes</td>
<td>-1977</td>
<td>6.74</td>
</tr>
</tbody>
</table>
Maturity shocks: no anticipation

- $bL$
- $bS$
- $bL-bS$
- $rL$ (bp.)
- $rS$ (bp.)
- $rL-rS$ (bp.)
- Output
- Inflation
Maturity shocks: no anticipation

- Permanent change in composition: lengthening of central bank balance sheet (or volume of long bonds outstanding falls)
- *Immediate & temporary* reduction in long term interest rate
- Boosts demand
- Short rate endogenously rises (conventional MP response), and long term rate reflects that (EH)
Maturity shocks: WITH anticipation

De Graeve & Theodoridis (KUL & BoE)
Maturity shocks: WITH anticipation

- Similarly sized permanent **announced** change in composition: lengthening of central bank balance sheet (or volume of long bonds outstanding falls)

- *Sustained* reduction in long term interest rate *throughout anticipation horizon*

- Boosts demand persistently

- Short rate endogenously rises (conventional MP response), and (post-announcement horizon) long term rate reflects that (EH)
Stock and flow effects of QE

- Whether QE works through stock or flow effects has important implications (e.g. tapering, or reversing QE)
- Unclear which is relevant in the data: stock vs. flow?
- Persistence of interest rate effects hard to study in event-study setting
- Model suggests: jump on announcement day, remains low throughout announcement horizon, vanishes after implementation

In structural terms:
- Static adjustment cost: same policy implies permanently lower long yield
- Dynamic/habit specification: yield effect can but need not persist. Estimates suggest dynamics are important
The (unconditional) role of maturity

- Uncoordinated maturity actions by Treasury and Fed during the Great Recession
- Dubious role of maturity fluctuations for GDP (Greenwood, Hanson, Rudolph and Summers, 2015)
- Unconditional maturity contribution is not the best measure to assess unconventional Fed policy
Contribution to GDP

Contribution maturity

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Maturity policy
Policy evaluation I: Quantitative Easing

- Cleaner policy counterfactual:
  - Suppose Fed did not implement QE
  - (but all other maturity fluctuations remained the same)
  - How would maturity have contributed to GDP?

- Evaluate one policy intervention: Operation Twist (Again)
  - On 21 September 2011, the Fed announced “... the Committee decided today to extend the average maturity of its holdings of securities. The Committee intends to purchase, by the end of June 2012, $400 billion of Treasury securities with remaining maturities of 6 years to 30 years and to sell an equal amount of Treasury securities with remaining maturities of 3 years or less”

- Model counterpart: Anticipated maturity shocks
Contribution to GDP

- Contribution maturity
- Contribution maturity: no Twist 1

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Comparison with literature:

- The policy we evaluate is smaller in size
- The real effect is much bigger
- Even without lower-for-longer

<table>
<thead>
<tr>
<th>Study</th>
<th>Program: size</th>
<th>Peak GDP</th>
<th>Only FG</th>
<th>Only QE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCF</td>
<td>QE2: $600 bn</td>
<td>+0.3%</td>
<td>≈ 0.3%</td>
<td>≈ 0%</td>
</tr>
<tr>
<td>DT</td>
<td>Twist: $400 bn</td>
<td>+1.2%</td>
<td>≈ 0.6%</td>
<td>≈ 0.6%</td>
</tr>
</tbody>
</table>

CCF: Chen, Cúrdia and Ferrero (2012)
DT: De Graeve and Theodoridis
Policy evaluation II: Forward Guidance

- Forward Guidance $\sim$ Anticipated interest rate shocks

$$\hat{r}_t = r(\Omega_t) + \varepsilon_t^r,0 + \sum_{j=1}^{M} \varepsilon_t^r,j$$

- Pre 2009: policy constrained by the ZLB
  - Positive anticipated shocks
  - $\Rightarrow$ Actual policy rate $> \text{rule-implied rate } r(\Omega_t)$

- Post 2009: effective FG
  - Negative anticipated shocks
  - $\Rightarrow$ Policy lower (for longer) than implied by rule

- Comparison with literature: similar effects
Policy rate and anticipated policy shocks

- Short rate
- Anticipated policy shock
- Qualitative FG
- Date-based FG
- State-dependent FG

Contribution to GDP

- Contribution anticipated interest

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Recovery contribution unconventional policy

- **Forward Guidance:**
  - +2%-points GDP over period 2009-2015
  - Coincides with timing of Fed’s forward communication
  - Quantitative effect similar to literature (e.g. FRB NY, FRB CHI)

- **Quantitative Easing:**
  - Operation Twist 1: +0.6%-points GDP
  - Conservative estimate, since:
    - Evaluation without lower-for-longer effect (main reason why literature finds any effect)
  - Twist < QE2
Conclusion

- Portfolio balance channel of QE is relevant

- Not just for yields
- Also for macro outcomes

- Not just in event studies, or VARs
- Also in structural evaluation