

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
- $corr(\text{bond supply, yield}) > 0$
 - d'Amico, English, Lopez-Salido and Nelson (2012), Krishnamurthy and Vissing-Jorgensen (2011), Greenwood, Hanson and Vayanos (2015), d'Amico and King (2013), ...
- 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

- 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)

- \Rightarrow *Data*: study debt of different maturities outstanding (\approx central bank balance sheet size)
- \Rightarrow *Model*: explicit, rich structure for government debt maturity policy

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

- \Rightarrow *Model*: DSGE enables accounting for anticipation
 - Not just in interest rate policy (Forward Guidance)
 - Also in 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 $F\left(\frac{b_t^S}{b_t^L}\right)$

Financial block: implications (1)

- Term spread

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

- 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)

Fiscal block

- Debt accumulation equation: long and short bonds
- Debt maturity:

$$\underbrace{\hat{\bar{b}}_t^L - \hat{b}_t^S}_{\text{maturity composition}} = \underbrace{f(\Omega_t)}_{\text{endogenous maturity policy}} + \underbrace{\sum_{j=0}^M \varepsilon_{t-j}^{MATj}}_{\text{maturity policy shocks}} + \underbrace{v\varepsilon_t^{TD}}_{\text{debt issue}}$$

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)

- De Graeve, Emiris and Wouters (2009): adds a term structure of interest rates (EH) to Smets and Wouters (2007)
- 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

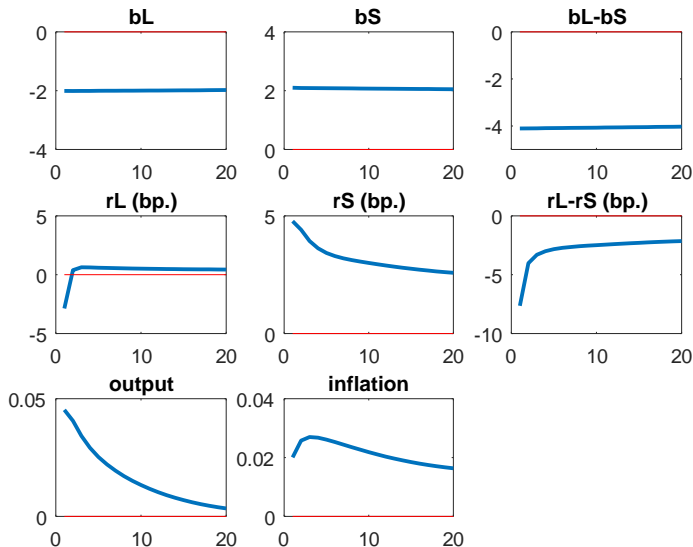
Key overall finding

- Joint empirical model of $\left\{ \begin{array}{l} \text{macroeconomy} \\ \text{term structure of interest rates} \\ \text{term structure of govt. debt} \end{array} \right.$
- *Is* compatible with data
- Why key?
 - Earlier research finds dichotomy (Chen, Cúrdia & Ferrero, 2012)
 - \implies QE irrelevant

Importance of various model components?

	ML	χ
Benchmark	-1699	5.16
No endogenous maturity policy	-1699	5.46
No anticipation in QE	-1703	4.53
Static adj.	-1722	0.00
Long bond exogenous/short residual	-1759	4.61
No infl. target changes + TP shock	-1740	4.97
No infl. target changes	-1977	6.74

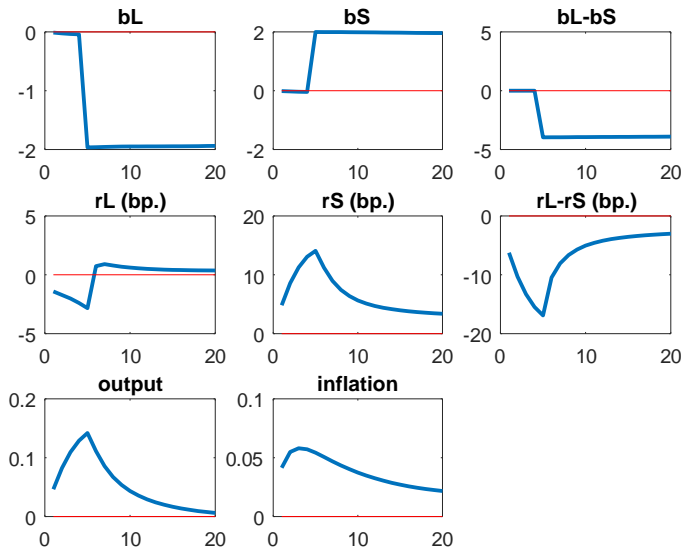
Maturity shocks: no anticipation



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



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

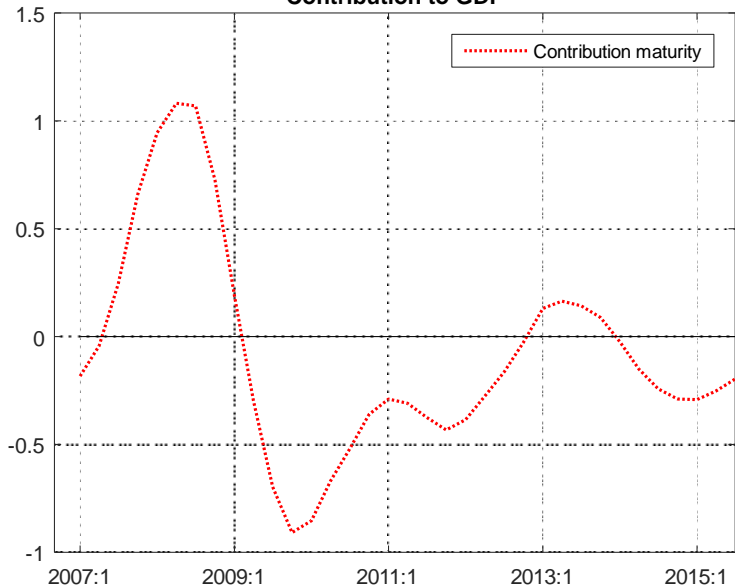
- Whether QE works through stock or flow effects has important implications (e.g. tapering, or reversing QE)
- Unclear which is relevant in the data: stock vs. flow?
- Persistence of interest rate effects hard to study in event-study setting
- Model suggests: jump on announcement day, remains low throughout 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)
- \implies unconditional maturity contribution is not the best measure to assess unconventional *Fed* policy

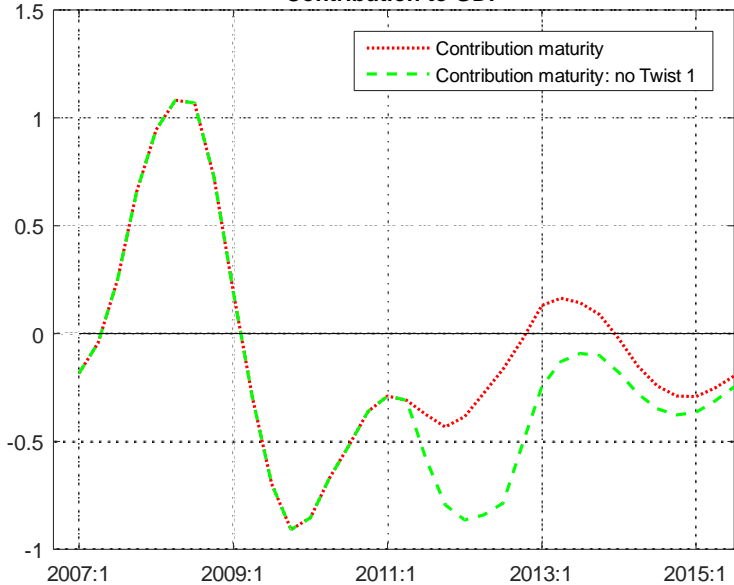
Contribution to GDP



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



Policy evaluation I: Quantitative Easing

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

Study	Program: size	Peak GDP	Only FG	Only QE
CCF	QE2: \$600 bn	+0.3%	$\approx 0.3\%$	$\approx 0\%$
DT	Twist: \$400 bn	+1.2%	$\approx 0.6\%$	$\approx 0.6\%$

CCF: Chen, Cúrdia and Ferrero (2012)

DT: De Graeve and Theodoridis

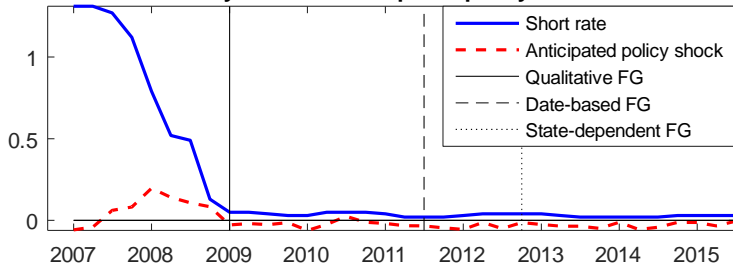
Policy evaluation II: Forward Guidance

- Forward Guidance \sim Anticipated interest rate shocks

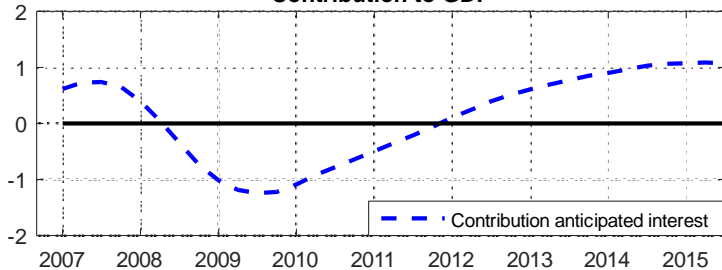
$$\hat{r}_t = r(\Omega_t) + \varepsilon_t^{r,0} + \sum_{j=1}^M \varepsilon_{t-j}^{r,j}$$

- Pre 2009: policy constrained by the ZLB
 - Positive anticipated shocks
 - \Rightarrow Actual policy rate $>$ 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



Contribution to GDP



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