Forward Guidance, Quantitative Easing, or both?

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Broad Research Question

- Unconventional monetary policy
  - Foward 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* (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 $\Longrightarrow$ 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* (bond supply, yield) > 0
- The **real effects** of QE through a portfolio channel appear absent
  - *corr* (bond supply, GDP) ≈ 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 ($\propto$ central bank balance sheet size)
- $\Rightarrow$ *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 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 block

- 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 $F(\frac{b_t^S}{b_t^L})$

Financial block: implications (1)

- Term spread

$$E_t \hat{R}^L_{t+1} - \hat{r}^S_t = \frac{1+\delta}{\delta}\chi\left(\hat{\bar{b}}^L_t - \hat{b}^S_t - \rho_\chi\left[\hat{\bar{b}}^L_{t-1} - \hat{b}^S_{t-1}\right]\right)$$

- 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:

$$\underbrace{\hat{\bar{b}}_t^L - \hat{b}_t^S}_{\substack{\textit{maturity} \\ \textit{composition}}} = \underbrace{f\left(\Omega_t\right)}_{\substack{\textit{endogenous} \\ \textit{maturity} \\ \textit{policy}}} + \underbrace{\sum_{j=0}^{M} \varepsilon_{t-j}^{MAT,j}}_{\substack{\textit{maturity} \\ \textit{policy} \\ \textit{shocks}}} + \underbrace{\nu \varepsilon_t^{TD}}_{\substack{\textit{debt} \\ \textit{issue}}}$$

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

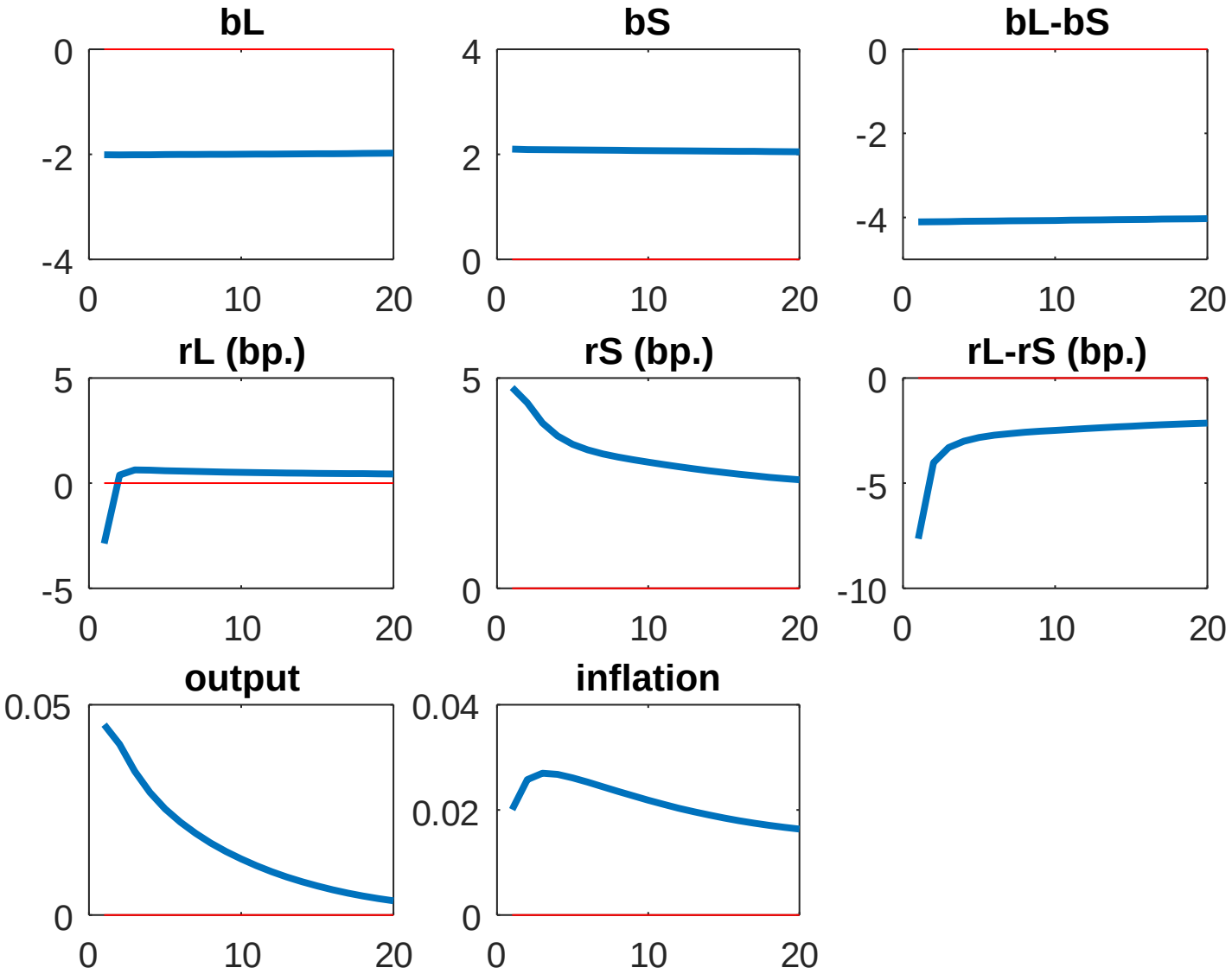
- Joint empirical model of $\left\{ \begin{array}{c} \text{macroeconomy} \\ \text{term structure of interest rates} \\ \text{term structure of govt. debt} \end{array} \right.$
- *Is* compatible with data

- Why key?
  - Earlier research finds dichotomy (Chen, Cúrdia & Ferrero, 2012)
  - $\Longrightarrow$ 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

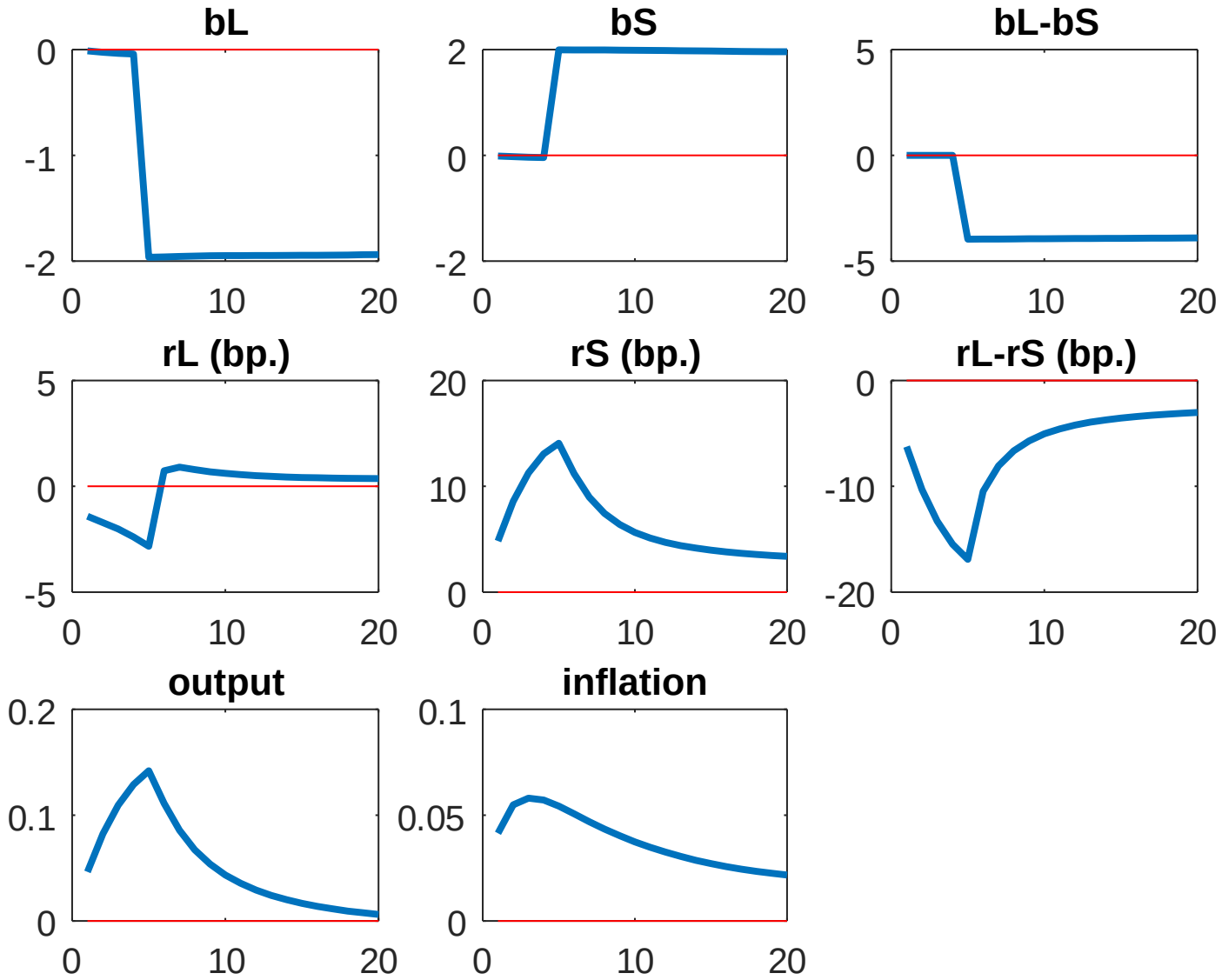
Maturity shocks: no anticipation



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)

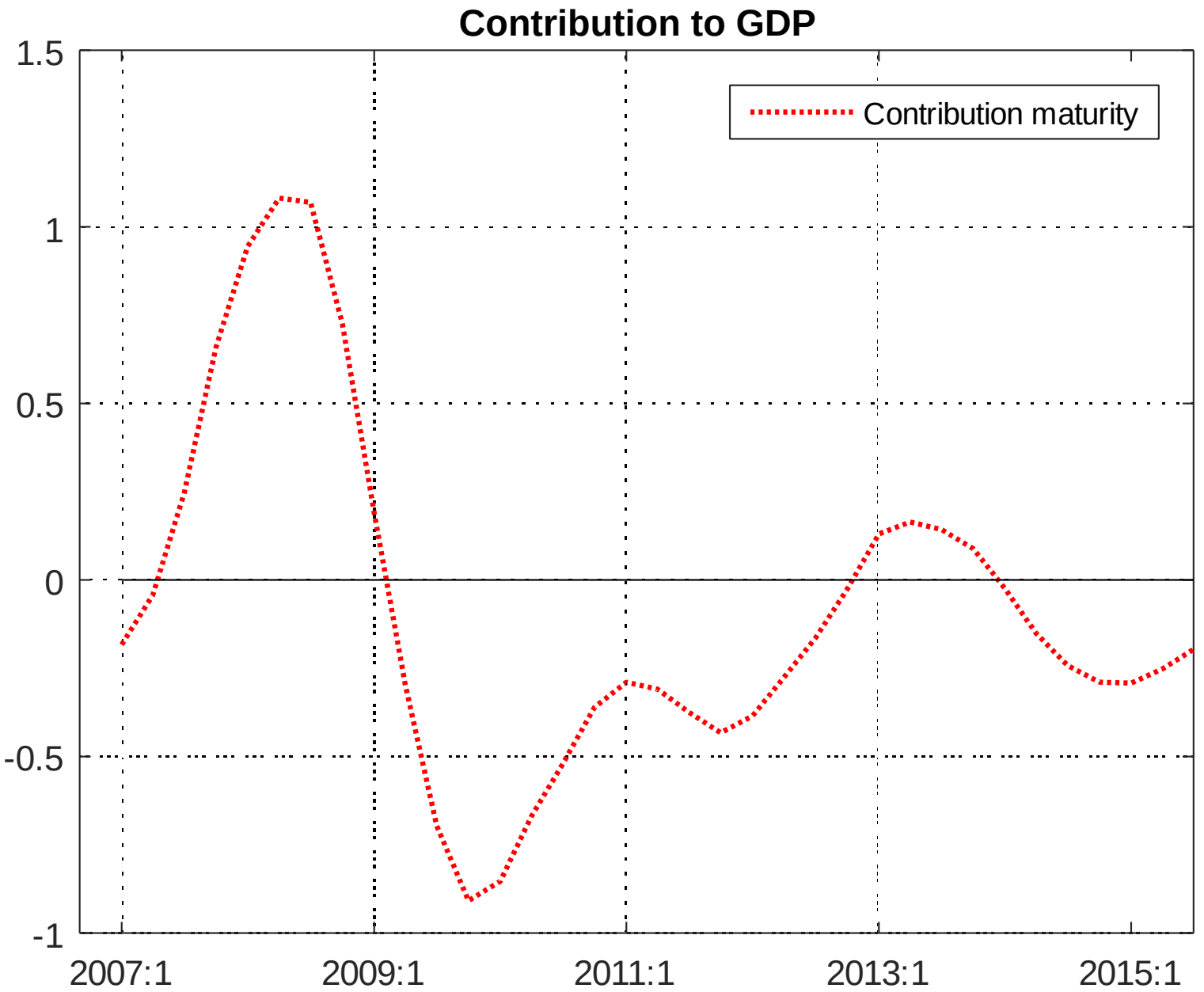
Stock and flow effects of QE

- 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

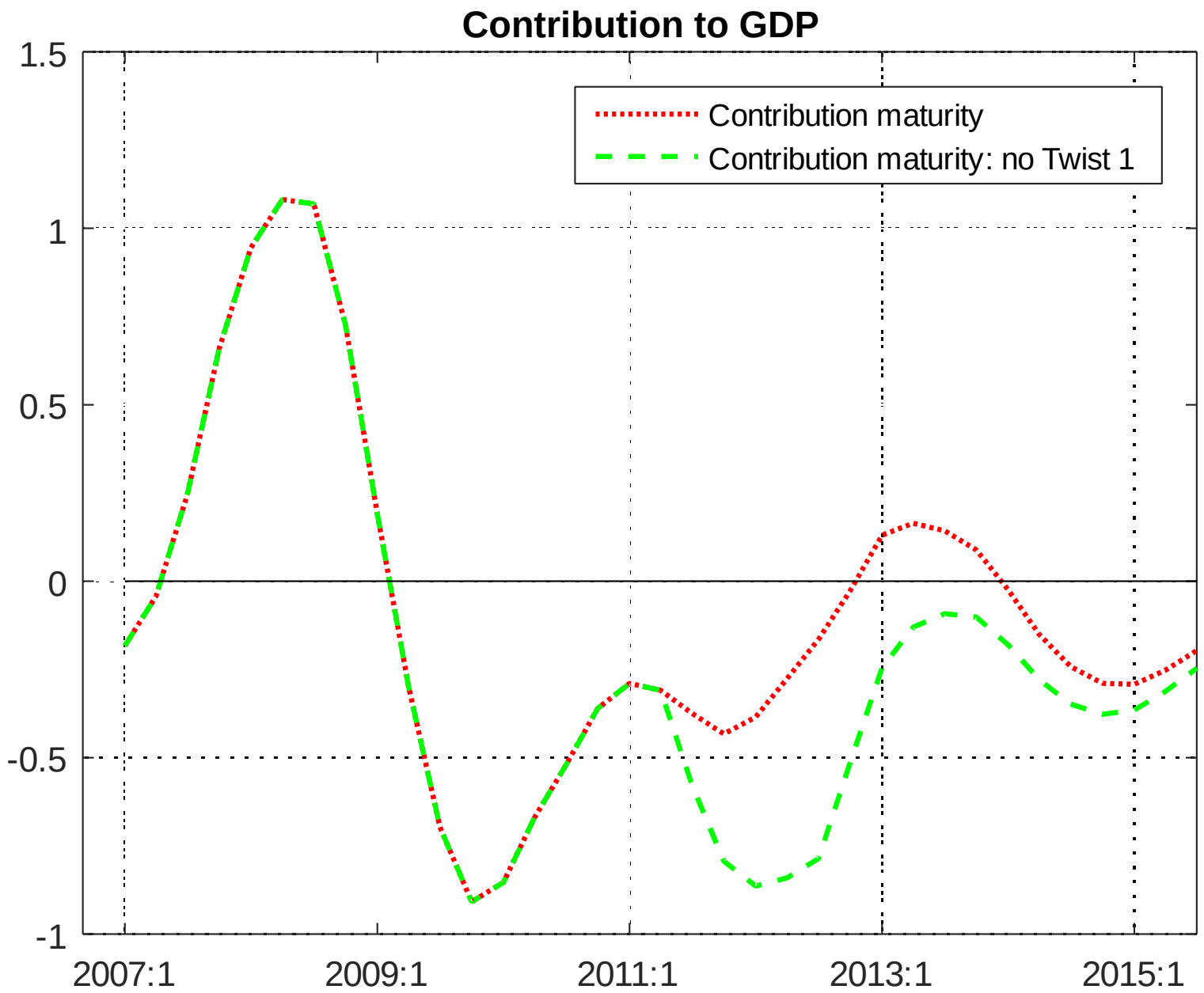
The (unconditional) role of maturity

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


Contribution to GDP
Contribution maturity
1.5
1
0.5
0
-0.5
-1
2007:1
2009:1
2011:1
2013:1
2015:1

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
1.5
1
0.5
0
-0.5
-1
2007:1
2009:1
2011:1
2013:1
2015:1

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	$+1.2\%$	$\approx 0.6\%$	$\approx 0.6\%$

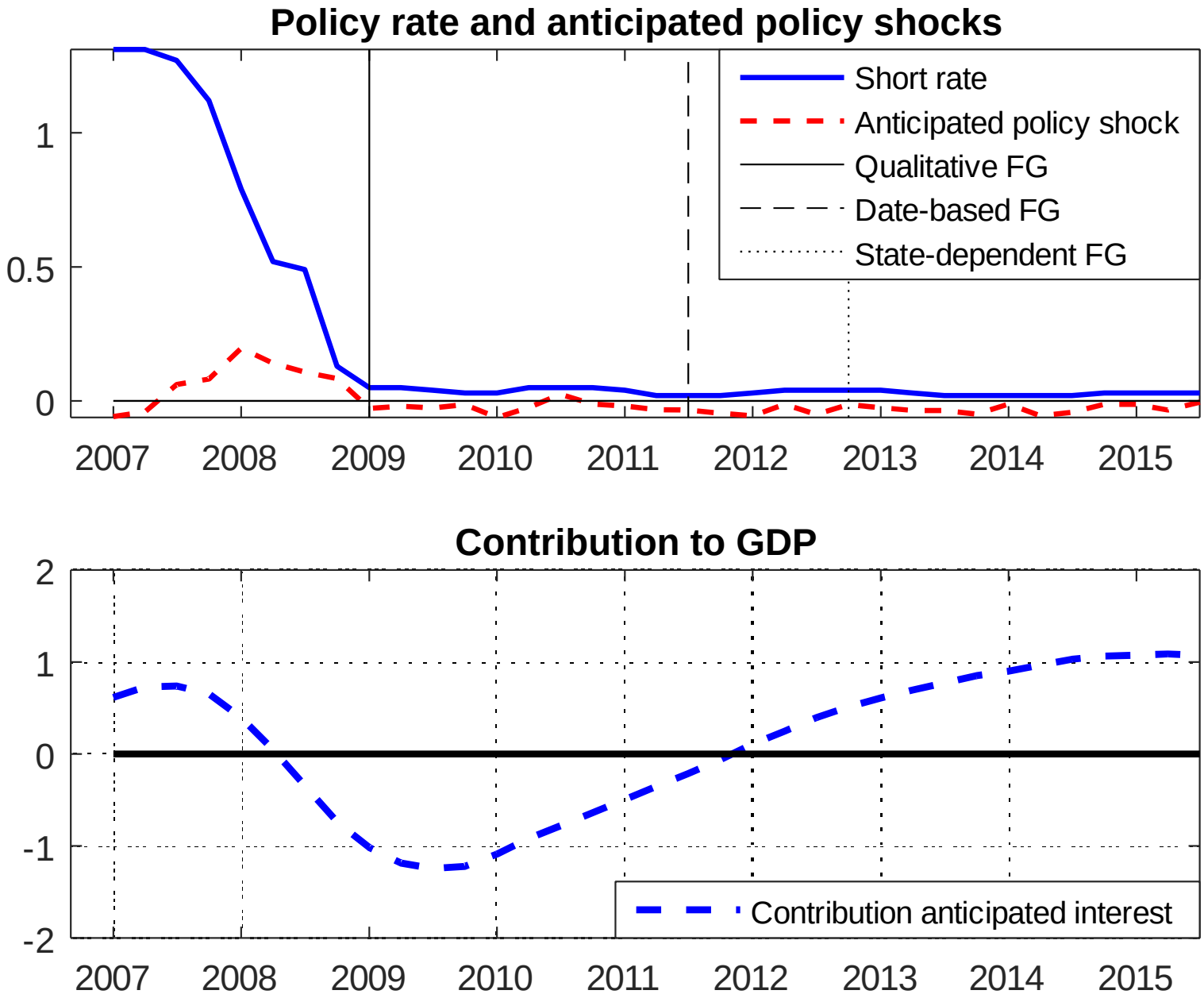
CCF: Chen, Cúrdia and Ferrero (2012)
DT: De Graeve and Theodoridis

Policy evaluation II: Forward Guidance

- Forward Guidance $\sim$ Anticipated interest rate shocks

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

- Pre 2009: policy constrained by the ZLB
  - Positive anticipated shocks
  - $\Rightarrow$ Actual policy rate $>$ rule-implied rate $r\left(\Omega_t\right)$
- 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
1
0.5
0
2007
2008
2009
2010
2011
2012
2013
2014
2015
Contribution to GDP
2
1
0
-1
-2
Contribution anticipated interest
2007
2008
2009
2010
2011
2012
2013
2014
2015

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