The Forward Guidance Puzzle

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Disclaimer: **The views expressed are mine and do NOT necessarily reflect those of the Federal Reserve Bank of New York or the Federal Reserve System**

Monetary Policy Pre-Great Recession

- Interest-rate: key instrument of policy
  - interest-rate rule captures systematic behavior of central bank (e.g. Taylor 1993,...)
  - Policy shocks capture unpredictable deviations from rule

- Monetary transmission
  - Extensively studied using both VAR models and DSGE models (Sims 1980, Christiano, Eichenbaum, Evans 1999, 2005) ...

Monetary Policy Post-Great Recession

- "New" policy tools
  - Forward guidance: announcements about future path of short-term policy rate
    - Used extensively since Dec. 2008 FOMC meeting
  - LSAP (quantitative easing)
    - changes in size or composition of CB balance sheet
- Goal: lower long-term bond yields $\longrightarrow$ stimulate aggregate expenditures
- But ... effects not well understood; harder to use existing empirical tools (VARs) to gather evidence

Forward Guidance in the US

- FOMC statements

- December 2008:
  - economic conditions "are likely to warrant exceptionally low levels of the FFR for some time"

- March 2009 June 2011:
  - "exceptionally low levels of the FFR would likely be warranted for an extended period"

- August 2011:
  - economic conditions "are likely to warrant exceptionally low levels of the FFR at least through mid-2013"

- January 2012:
  - ... "exceptionally low levels of the FFR at least through late 2014"

- September 2012:
  - ... "highly accommodative stance of monetary policy will remain appropriate for a considerable time after the economic recovery strengthens.
  - ... exceptionally low levels for the FFR are likely to be warranted at least through mid-2015"

- December 2012 [thresholds]:
  - ... "exceptionally low range for the FFR will be appropriate at least as long as the unemployment rate remains above 6-1/2 percent, inflation between one and two years ahead is projected to be no more than a half percentage point above the Committees 2 percent longer-run goal"

Analyzing the Effects of Forward Guidance – The Challenge

- Campbell, Evans, Fisher, Justiniano 2012, Woodford 2012
- Announcement by CB that will maintain FFR at ZLB for longer can have two effects:
  - Reveals bad news about state of economy (**Delphic**) $\longrightarrow$ lower projected activity, lower inflation
  - More monetary stimulus (**Odyssean**/Commitment á la Eggertsson and Woodford 2003) $\longrightarrow$ stimulates economic activity, higher inflation
- Interpretation by market depends in very subtle ways on FOMC communication

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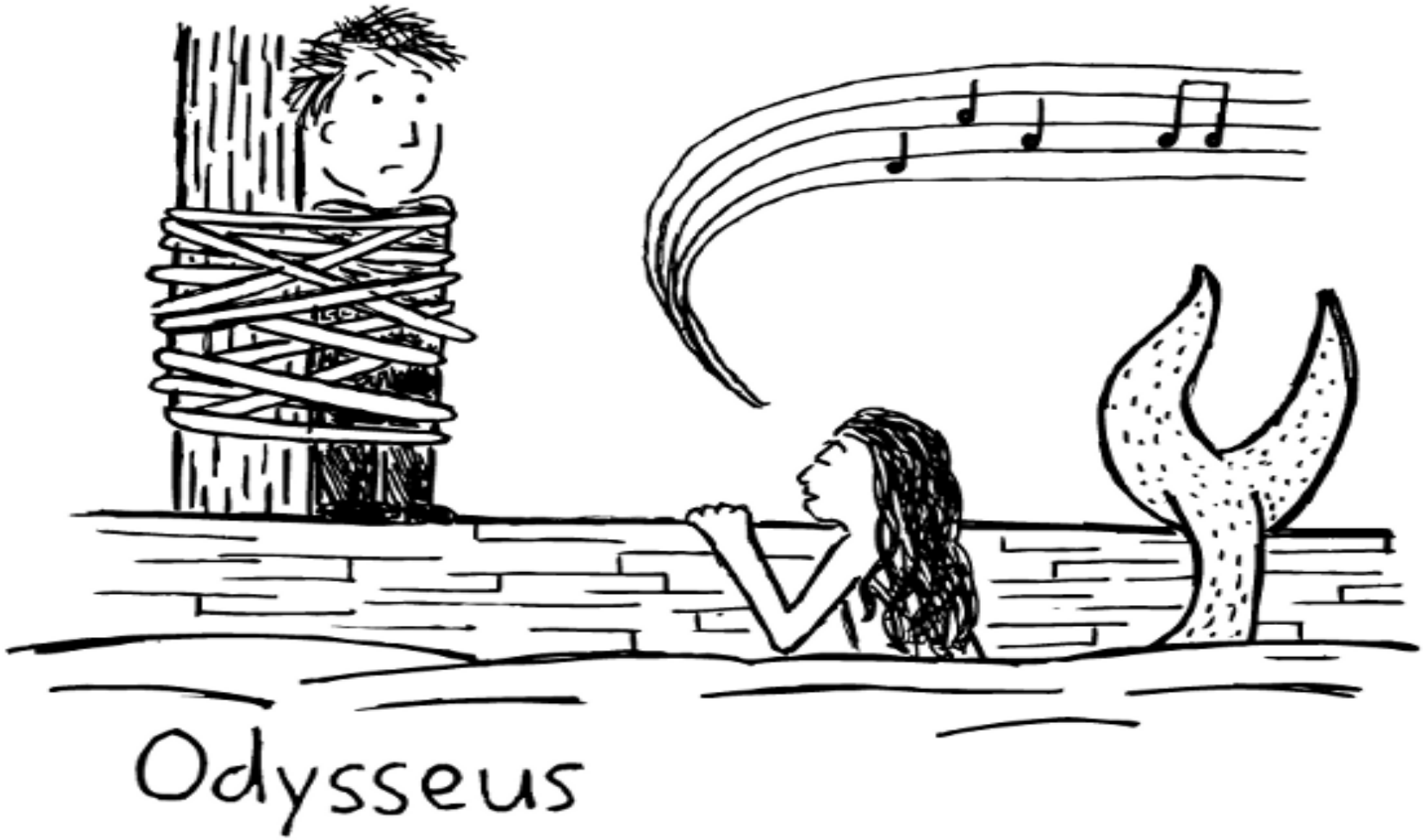

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DSGEs and Forward Guidance

- Medium-scale New Keynesian DSGE models "fit data well": reasonable forecasting performance relative to VARs, private sector forecasts, or Greenbook (Smets & Wouters 2007; Del Negro & Schorfheide 2013; ...)
- Variants with financial frictions also "fit data reasonably well" in the aftermath of the Great Recession – Del Negro, Giannoni, & Schorfheide (forthcoming)

$\longrightarrow$ these models are *in principle* well suited to:

1. perform counterfactual experiments, e.g., "What if we extend fwd guidance by another 2 quarters/lower the unemployment threshold to x% ..."
2. investigate the effects of past forward guidance (Milani & Treadwell 2010, Campbell, Fisher, Justiniano 2011)

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Modeling Forward Guidance: Anticipated Policy Shocks

- We modify this rule to allow for forward guidance following Laseen & Svensson 2009:

$$\hat{R}_t = \rho_R \hat{R}_{t-1} + (1-\rho_R)(\psi_\pi \sum_{j=0}^{3} \hat{\pi}_{t-j} + \psi_y \sum_{j=0}^{3} (\hat{y}_{t-j} - \hat{y}_{t-j-1} + \hat{z}_{t-j})) + \epsilon_t^R + \sum_{k=1}^{K} \epsilon_{k,t-k}^R$$

  where $\epsilon_{k,t-k}^R$ is a policy shock that is known to agents at time $t-k$, but affects the policy rule k periods later, that is, at time t.

- Anticipated policy shocks are a simple way of capturing anticipated deviations from the standard reaction function

- Note: Even in the model, *not* commitment to a *path*: **conditionality** is still there!

Estimating Forward Guidance

- Add Expected FFR to the measurement equations:

$$\begin{aligned} FFR^e_{t,t+k} &= 400\left(\boldsymbol{E}_t\widehat{R}_{t+k} + \ln R_*\right) \\ &= 400\left(\Psi_{R,2}(\theta)\Phi_1(\theta)^k s_t + \Psi_{R,1}(\theta)\right), \quad k = 1, .., K \end{aligned}$$

  where $FFR^e_{t,t+k}$ is measured using OIS rates (1 through 12 quarters ahead), and

$$s_t = \Phi_1(\theta)s_{t-1} + \Phi_\epsilon(\theta)\epsilon_t$$

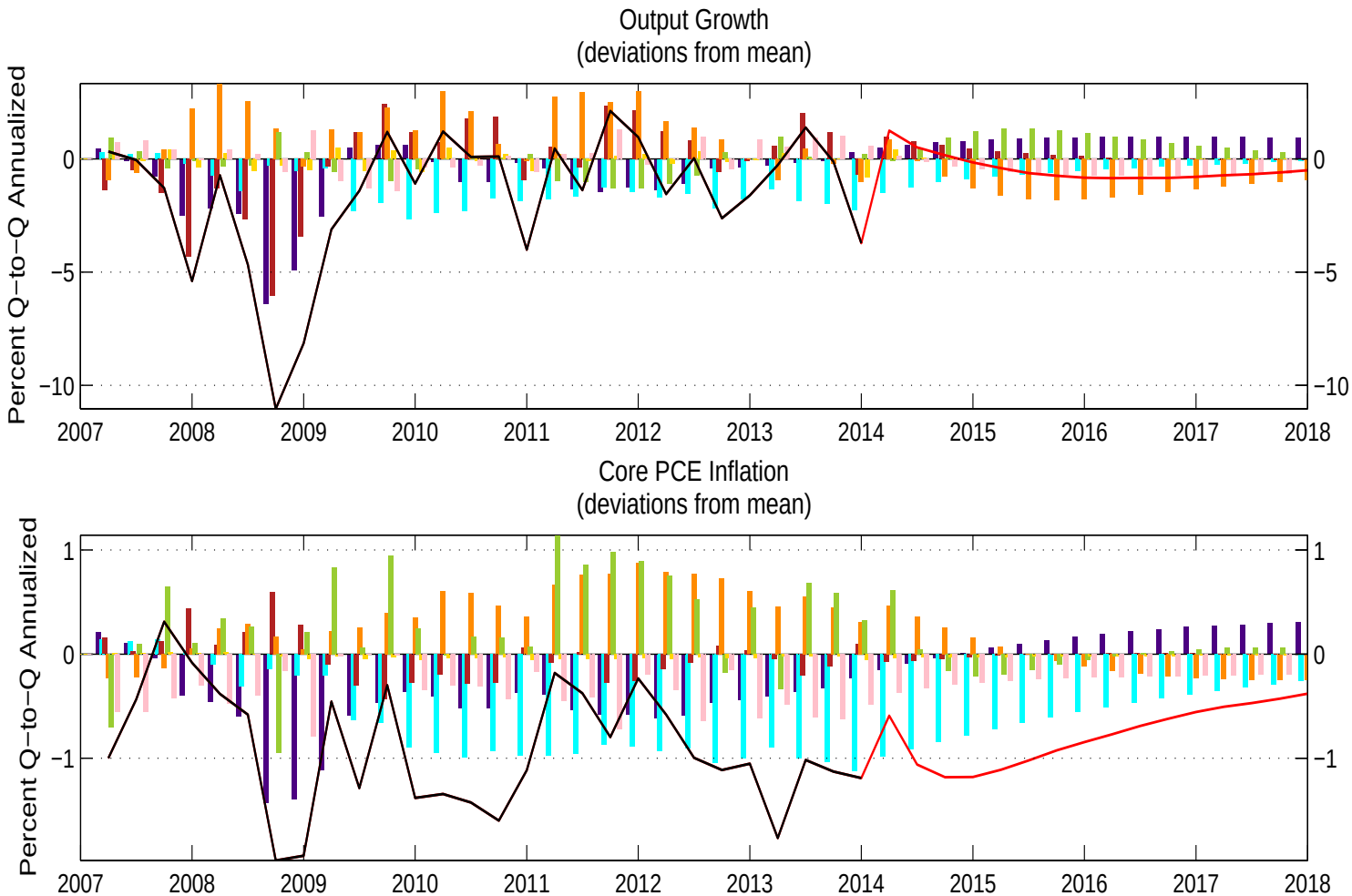
  is the transition equation, and

$$y_t = \Psi_1(\theta) + \Psi_2(\theta)s_t$$

  is the measurement equation

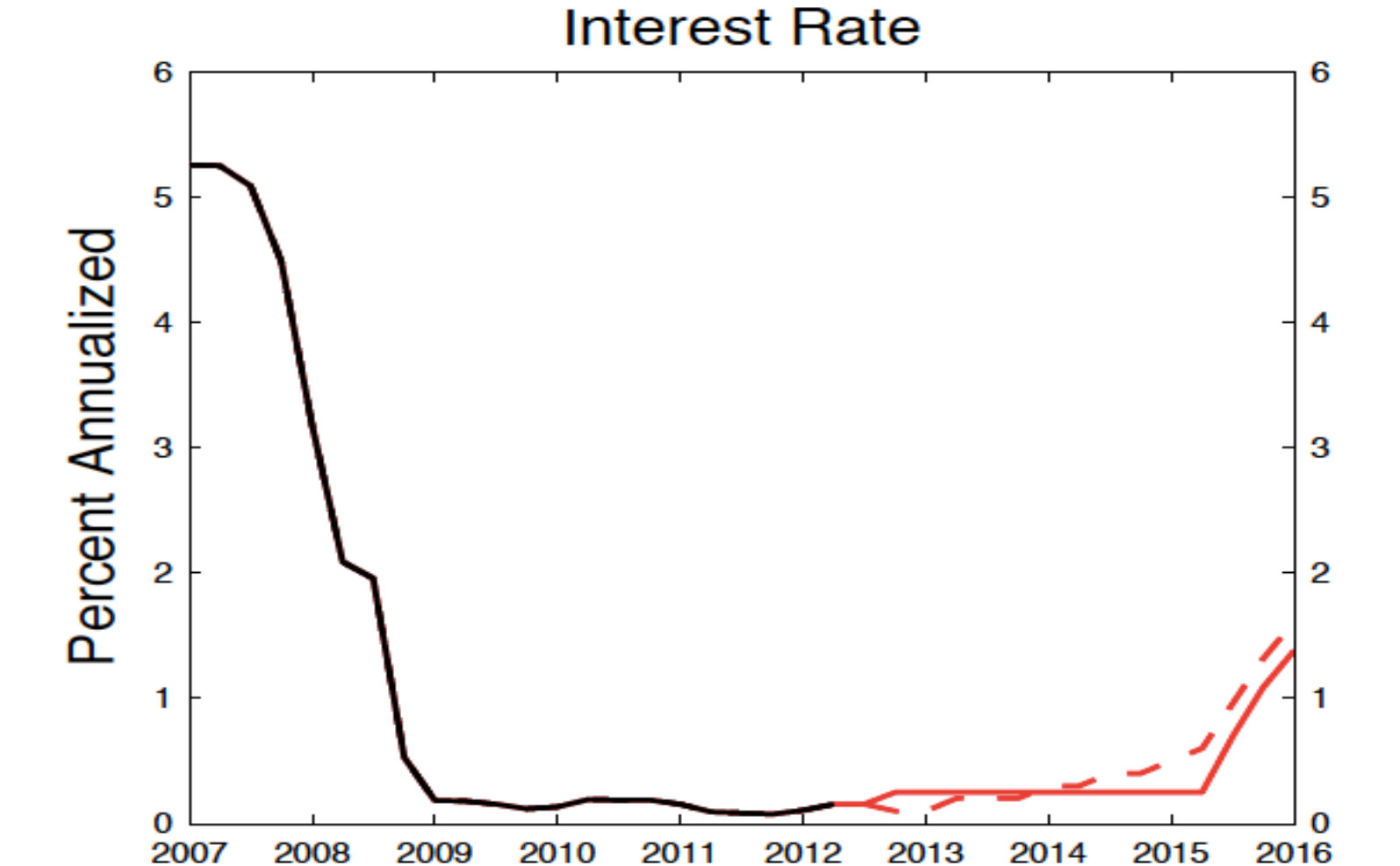
- Note: From the ex-post behavior of output and inflation the model should be able to tell whether the change in expected FFR is due to a policy shock or bad news

Historical Decomposition of Output and Inflation in the FRBNY DSGE Model



The Forward Guidance Puzzle

- Perform a "counterfactual" experiment in 2012Q2: Fed announces that FFR is 25 bp through 2015Q2



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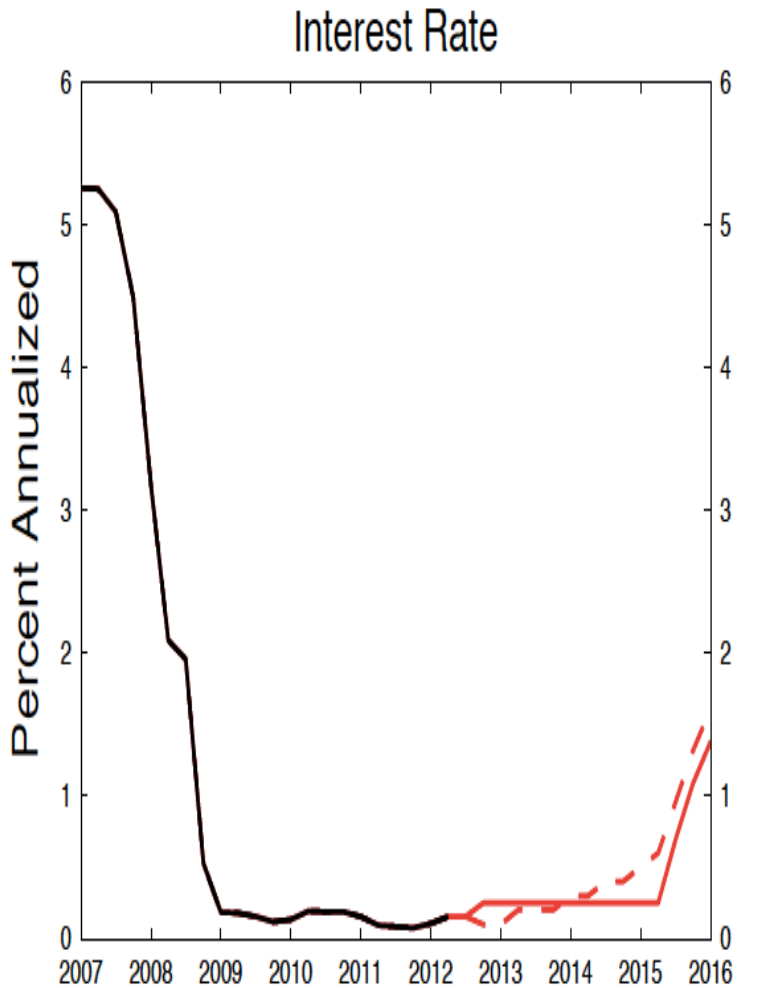

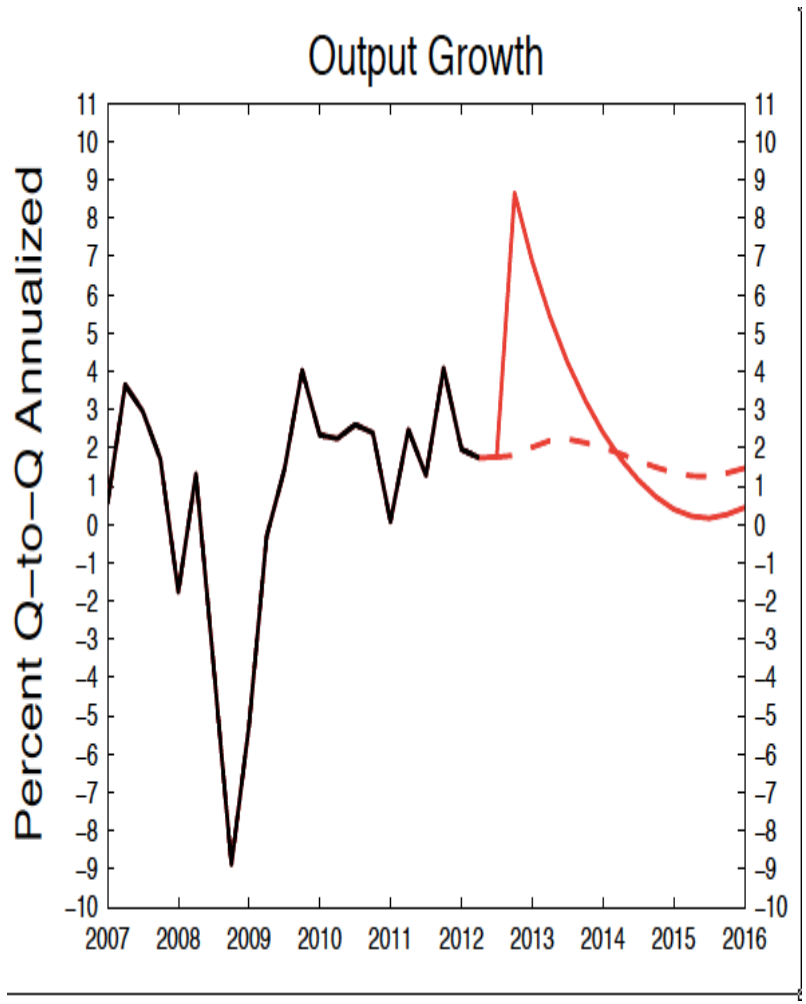

Excessive response of activity/inflation to fixing the policy rate is also discussed in Laseen & Svensson 2009 and Carlstrom, Fuerst, & Paustian 2012

Forward Guidance in NK DSGE 101

- Take a 3-equations NK model
- Modify the policy rule so to introduce anticipated policy shocks:

$$\hat{R}_t = \psi_\pi \hat{\pi}_t + \epsilon_t^R + \sum_{k=1}^{K} \epsilon_{k,t-k}^R$$

- Are these policy news shocks more or less powerful than contemporaneous (usual) policy shocks?

Forward Guidance in NK DSGE 101

Step 1: Consumption depends on the (real) long rate:

From the Euler eq. $\hat{c}_t = -\boldsymbol{E}_t[\hat{R}_t - \hat{\pi}_{t+1} + \hat{c}_{t+1}] \longrightarrow$

$$\hat{c}_t = -\underbrace{\sum_{j=0}^{\infty} \boldsymbol{E}_t[\hat{R}_{t+j} - \hat{\pi}_{t+1+j}]}_{\widehat{LR}_t}$$

Step 2: Anticipated shocks move consumption tomorrow and today $\longrightarrow$ stronger effect on inflation:

- (Assume for now the price level is fixed $\rightarrow$ the CB pegs the real rate)
- Contemporaneous shock: $\hat{R}_t = -\Delta,\ \hat{R}_{t+1} = 0,\ \hat{R}_{t+2} = 0... \longrightarrow$ $\widehat{LR}_t = -\Delta,\ \widehat{LR}_{t+1} = 0, ... \longrightarrow \hat{c}_t = \Delta,\ \hat{c}_{t+1} = 0, ...$
- Anticipated shock: $\hat{R}_t = 0,\ \hat{R}_{t+1} = -\Delta,\ \hat{R}_{t+2} = 0... \longrightarrow$ $\widehat{\mathbf{LR}}_\mathbf{t} = -\boldsymbol{\Delta},\ \widehat{LR}_{t+1} = -\Delta, ... \longrightarrow \hat{\mathbf{c}}_\mathbf{t} = \boldsymbol{\Delta},\ \hat{c}_{t+1} = \Delta,\ \hat{c}_{t+2} = 0, ...$

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Step 3: Now let π move. In the NK model inflation is the PDV of future expected output gaps

$$\hat{\pi}_t = \kappa \sum_{j=0}^{\infty} \beta^j \boldsymbol{E}_t[\hat{c}_{t+j}]$$

- Anticipated shock: more prolonged output increase $\hat{c}_t = \hat{c}_{t+1} = \Delta$ $\longrightarrow$ $\hat{\pi}_t$ rises more $\longrightarrow$ *real* rate drops today.

- However, as $\hat{\pi}_t$ increases, $\hat{R}_t$ also increases and this mitigates the effect of the shock

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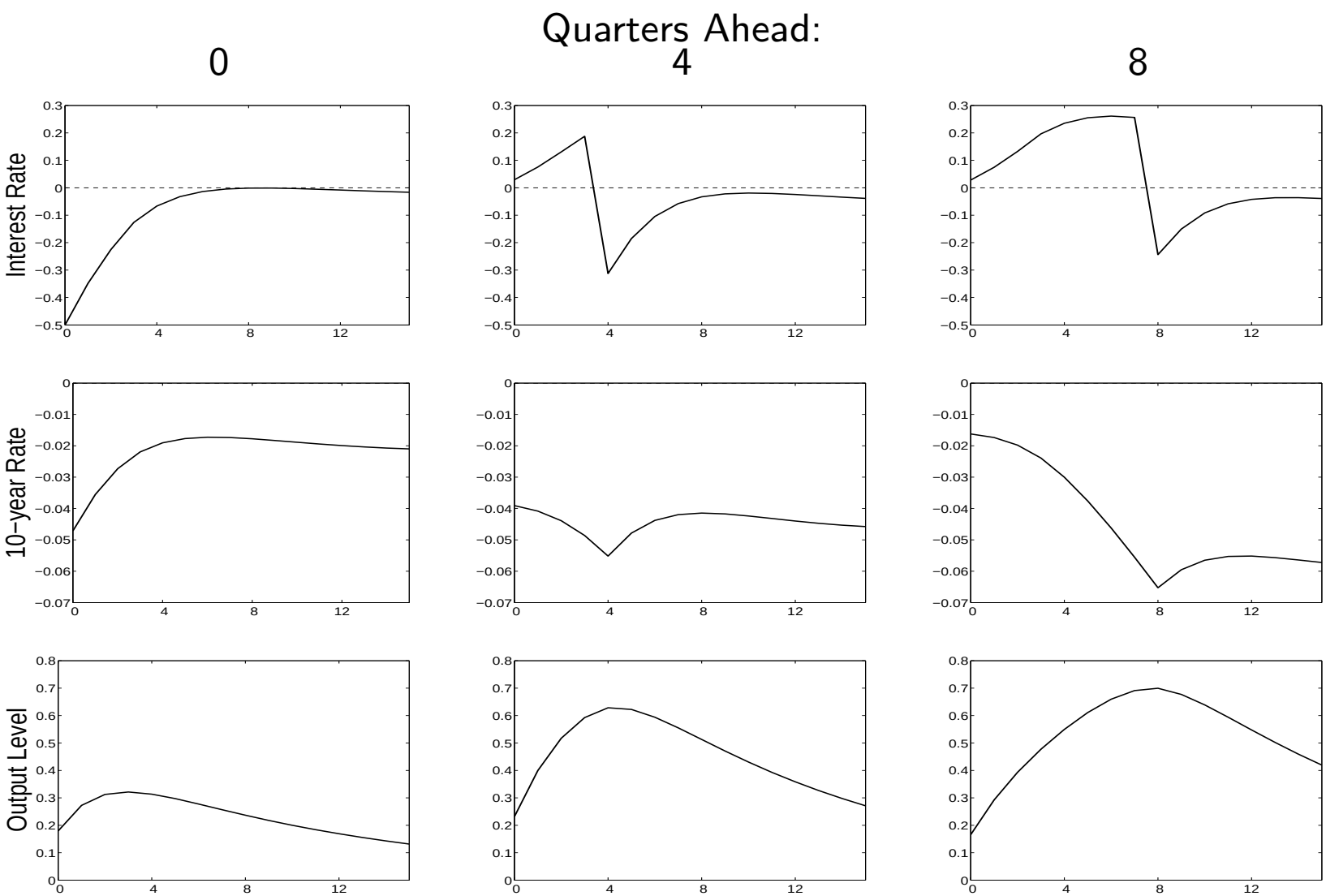
Impulse Responses to Anticipated Shocks in an Estimated (FRBNY) DSGE Model



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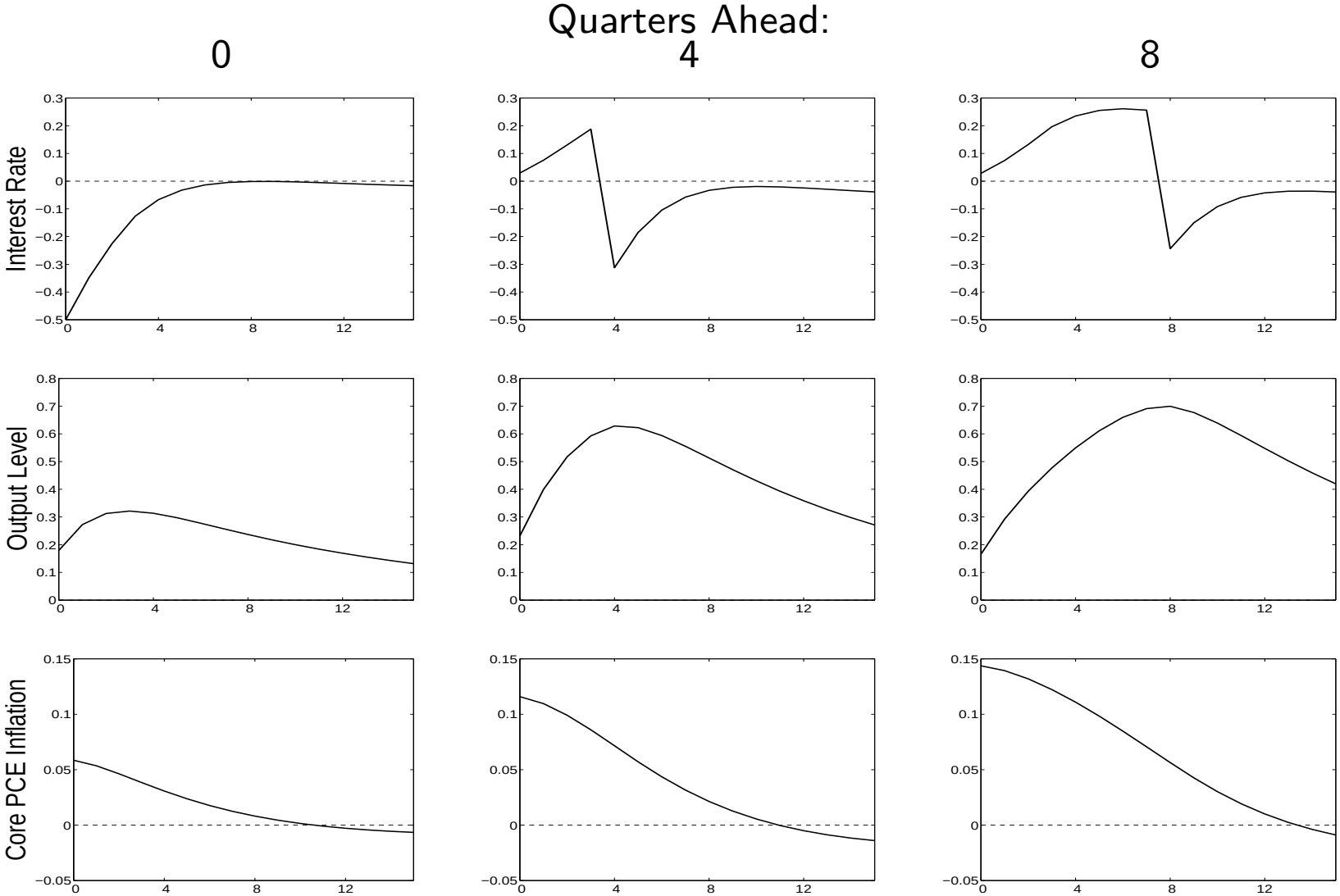

Evidence from Campbell et al. (BPEA 11)

Table 8. Regressions Estimating Asset Price Responses to Forward Guidance Shocks Identified from an Interest Rate Rule, 1996Q1–2007Q2[a]

		Shock					*Adjusted*
Asset	*Constant*	$\nu_{t,0}$	$\nu_{t,1}$	$\nu_{t,2}$	$\nu_{t,3}$	$\nu_{t,4}$	R_2
Treasuries							
2 years to maturity	5.90	1.08***	1.98***	1.56***	0.70*	0.89*	0.77
	(4.47)	(0.37)	(0.22)	(0.33)	(0.42)	(0.50)	
5 years to maturity	3.46	0.61*	1.83***	1.91***	1.43***	1.25**	0.78
	(4.31)	(0.36)	(0.21)	(0.32)	(0.40)	(0.49)	
10 years to maturity	1.57	0.38	1.48***	1.60***	1.41***	1.29***	0.70
	(4.44)	(0.37)	(0.22)	(0.33)	(0.42)	(0.50)	
Corporate bonds[b]							
Aaa/AAA-rated	0.60	0.19	0.65***	0.75**	0.86**	0.17	0.33
	(4.63)	(0.38)	(0.23)	(0.34)	(0.43)	(0.52)	
Baa/BBB-rated	0.57	0.13	0.69***	0.71**	1.00***	0.37	0.42
	(4.01)	(0.33)	(0.20)	(0.30)	(0.38)	(0.45)	

Evidence from Campbell et al. (BPEA 11)

Table 9. Regressions Estimating Forecast Revisions in Response to Forward Guidance Identified from an Interest Rate Rule, 1996Q1–2007Q2[a]

		Shock					Adjusted
Change in forecast[b]	*Constant*	$\nu_{t,0}$	$\nu_{t,1}$	$\nu_{t,2}$	$\nu_{t,3}$	$\nu_{t,4}$	R_2
Unemployment rate							
$u_t^{-1} - u_t^0$	–6.82***	–0.37*	–0.20	–0.13	–0.38	0.46	0.28
	(2.47)	(0.20)	(0.12)	(0.18)	(0.23)	(0.28)	
$u_{t+1}^0 - u_{t+1}^1$	–4.02	–0.34	–0.30**	–0.05	–0.27	0.54	0.27
	(2.92)	(0.24)	(0.14)	(0.22)	(0.27)	(0.33)	
$u_{t+2}^1 - u_{t+2}^2$	–3.39	–0.46*	–0.47***	–0.02	–0.20	0.30	0.34
	(2.93)	(0.24)	(0.14)	(0.22)	(0.27)	(0.33)	
$u_{t+3}^2 - u_{t+3}^3$	–2.86	–0.31	–0.47***	–0.00	–0.07	0.26	0.34
	(2.65)	(0.22)	(0.13)	(0.20)	(0.25)	(0.30)	
Inflation							
$\pi_t^{-1} - \pi_t^0$	1.83	–0.35	0.23	–0.08	–0.61	–0.09	0.05
	(5.55)	(0.46)	(0.27)	(0.41)	(0.52)	(0.63)	
$\pi_{t+1}^0 - \pi_{t+1}^1$	–5.20*	–0.18	0.17	0.05	–0.44	0.07	0.10
	(2.91)	(0.24)	(0.14)	(0.21)	(0.27)	(0.33)	
$\pi_{t+2}^1 - \pi_{t+2}^2$	–7.55***	–0.05	0.15	0.11	0.35	–0.02	0.10
	(2.69)	(0.22)	(0.13)	(0.20)	(0.25)	(0.30)	
$\pi_{t+3}^2 - \pi_{t+3}^3$	–5.32**	–0.25	0.18*	–0.07	0.09	–0.04	0.14
	(2.11)	(0.18)	(0.10)	(0.16)	(0.20)	(0.24)	

What is the "Excessive" Response Due To?

1. The **NKPC** (Kiley et al. NBER Macroannual 2014, Carlstrom et al.)
2. The **Euler equation**: long-term rate $\longrightarrow$ activity
3. **Excess propagation**: too strong a response of long-term rate to news shocks?

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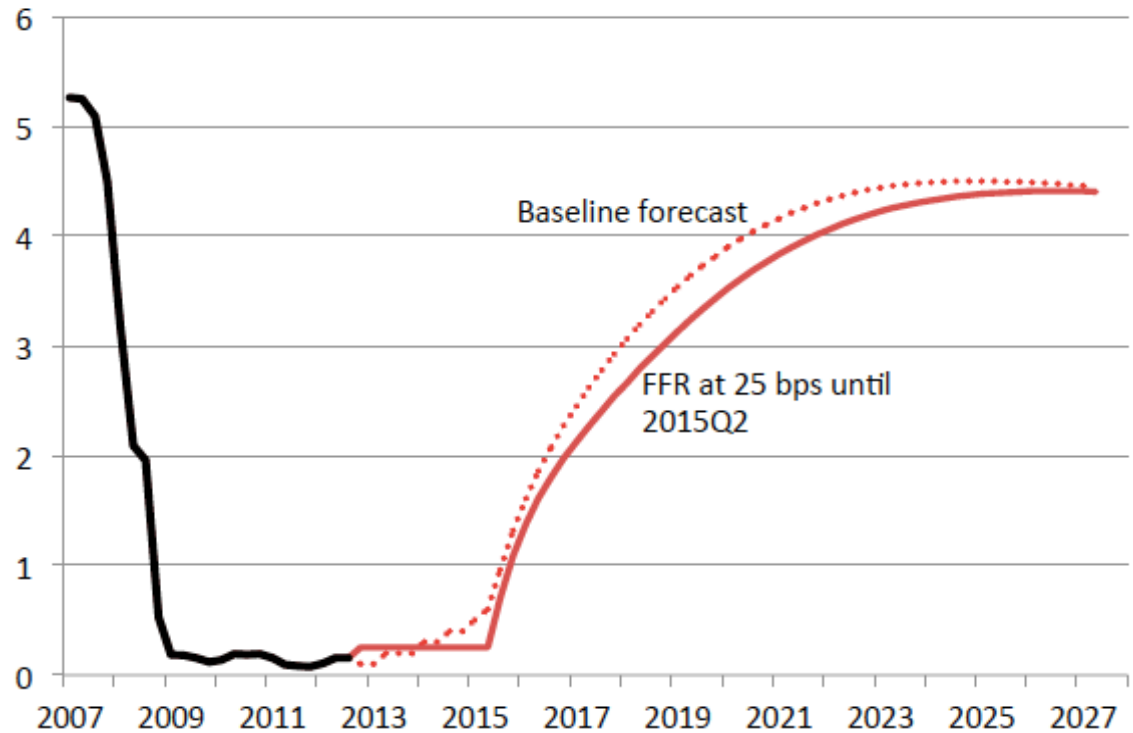


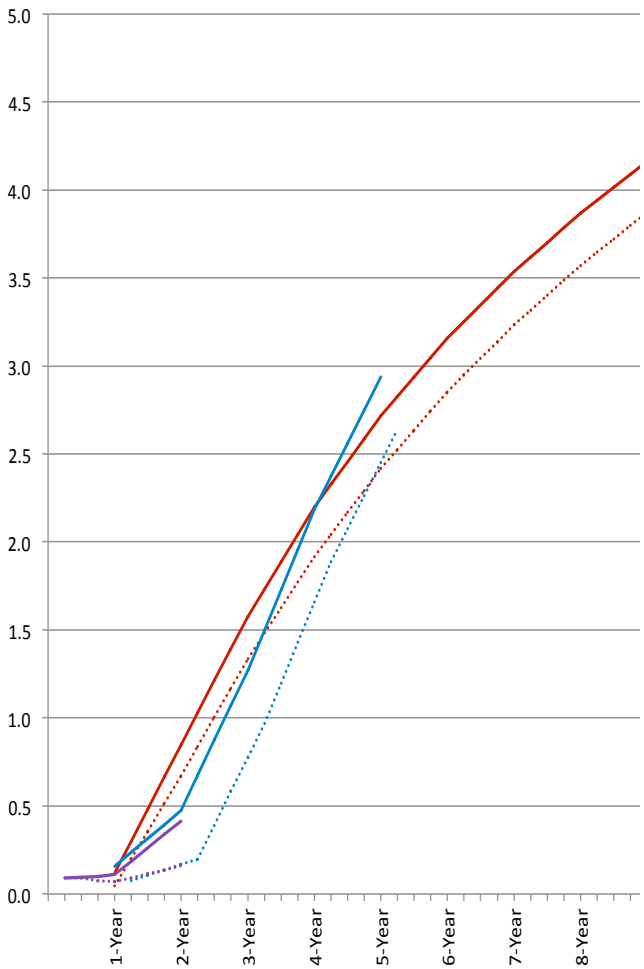
What Did Actually Happen Following the Anncouncements? – Treasury Yield Curve

Treasury Yields (constant maturity) - Treasury					
Date	30-Year	10-Year	5-Year	3-Year	1-Year
8/9/2011	-14	-23	-18	-12	-3
9/21/2011	-42	-23	-6	4	1
1/25/2012	-5	-12	-15	-8	0
6/20/2012	-5	-1	2	2	1
9/13/2012	17	11	2	2	0

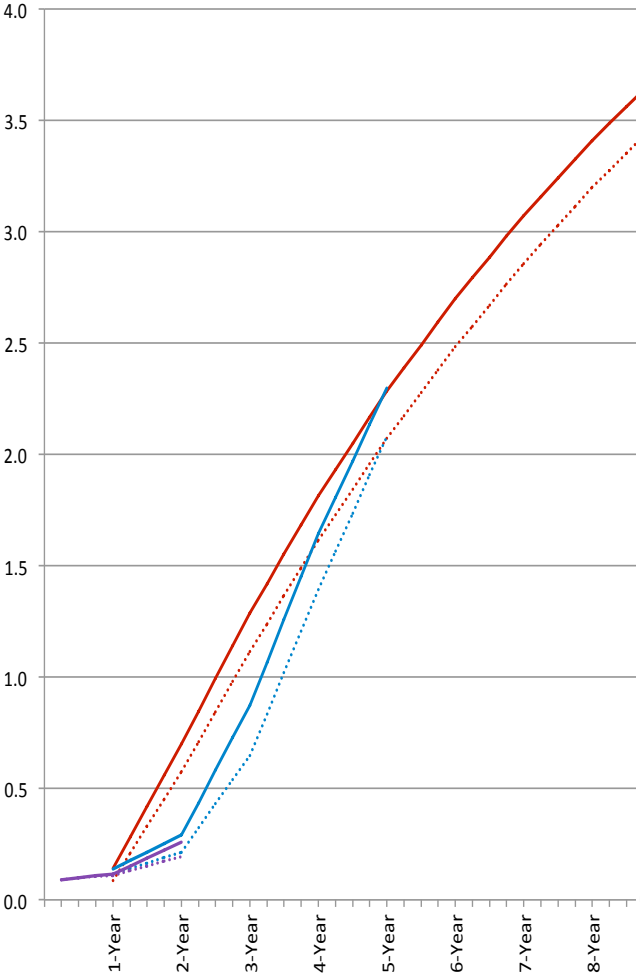
- Follow KVJ (11) approach: look at cross-section of financial markets data. Existing literature: Femia et al. 2013, Raskin 2013, Filardo and Hoffman 2014, Moessner 2013,...

Forward Rates

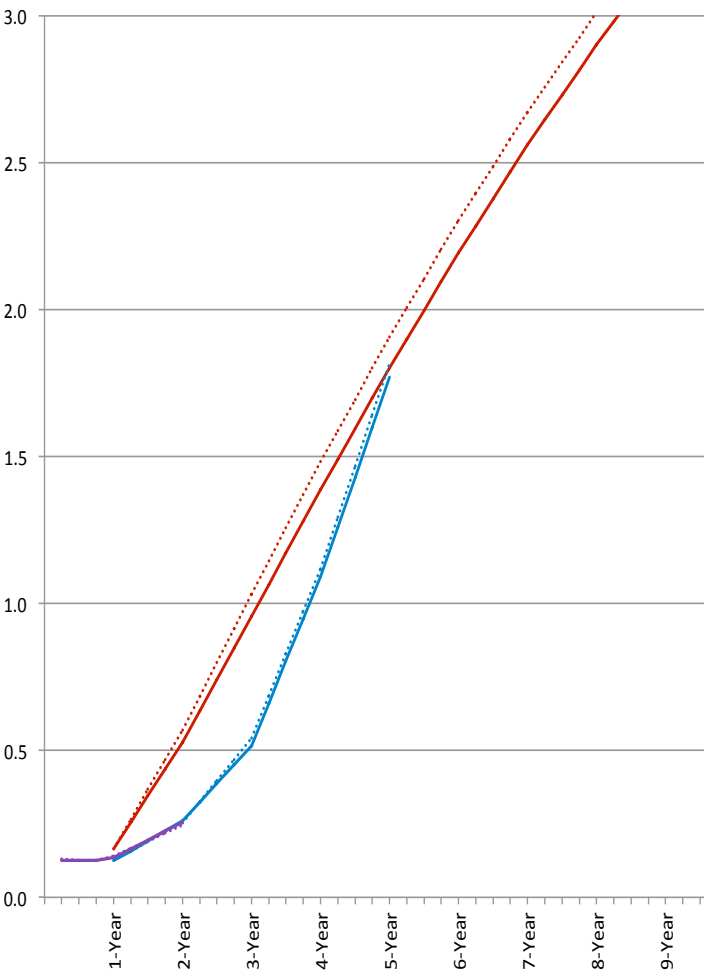
08/09/11
"at least
through mid-13"



01/25/12
" mid-14"



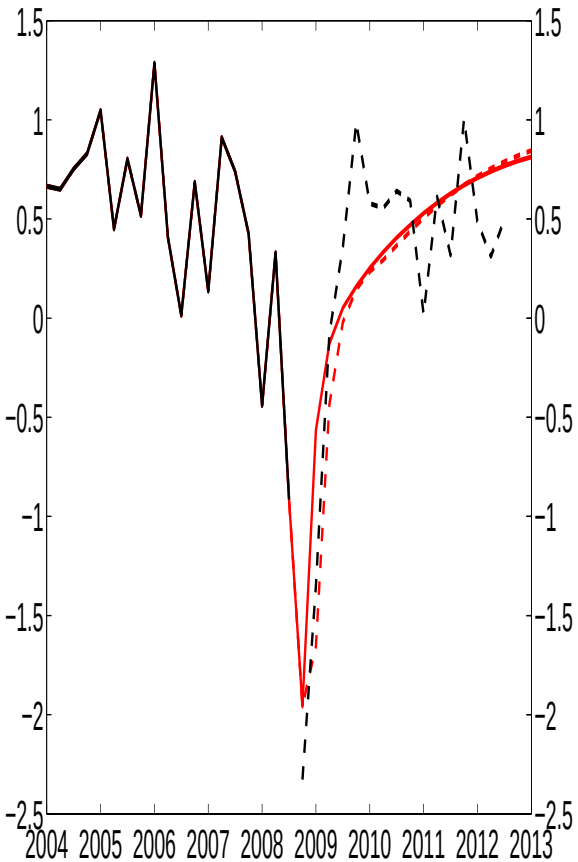
09/13/12
" mid-15 " "..after the
economy strenthens"



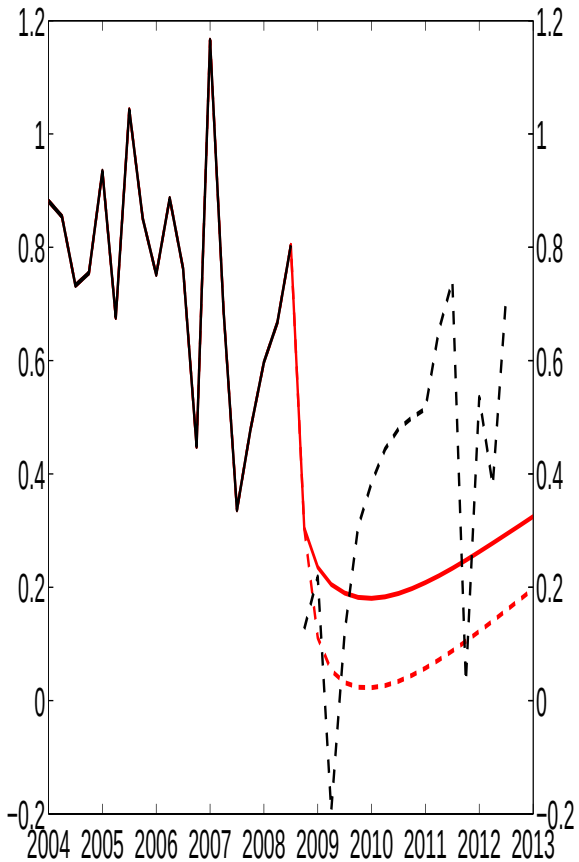
The Policy Reaction Function and the FFR Path

- How can we explain what happened to nominal rates on 9/13/12?
- A different policy experiment (with the opposite sign) to show that nominal rates can ↑ in equilibrium following an announcement about the reaction function

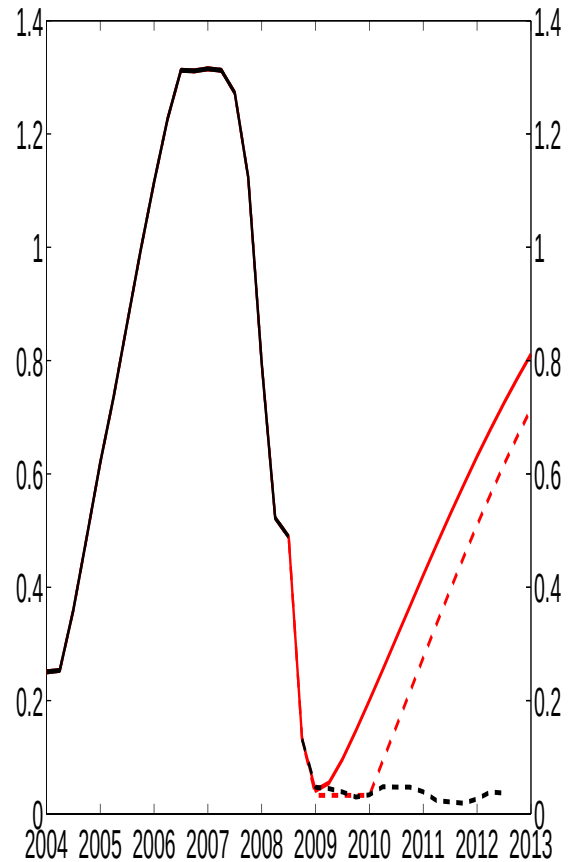
Output



Inflation

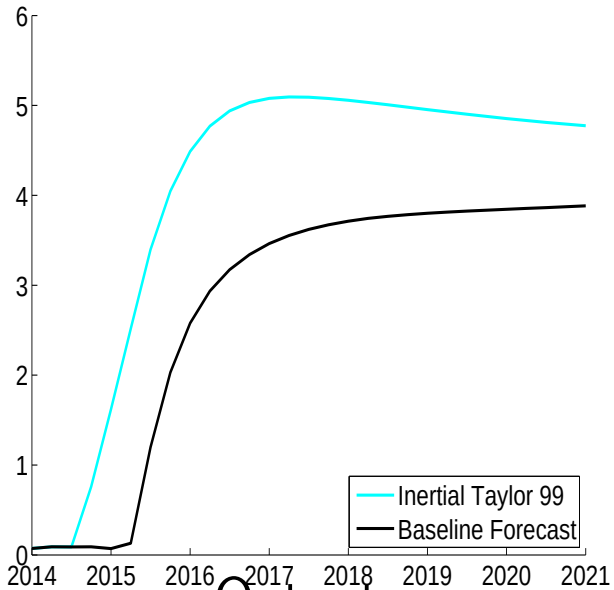


Interest Rates

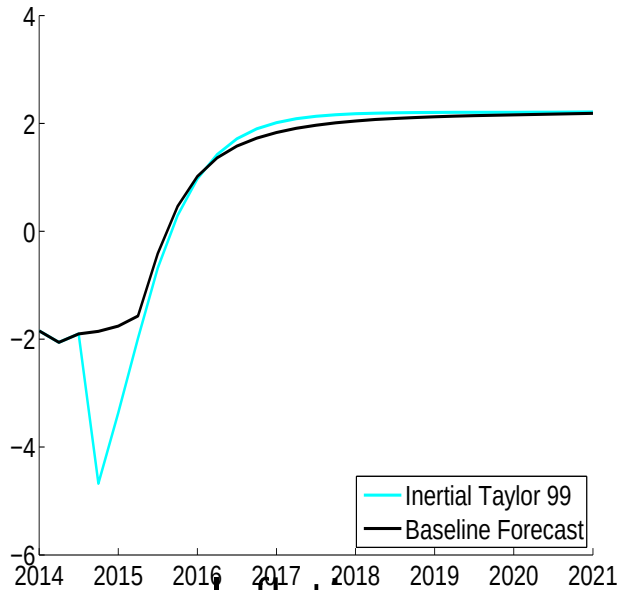


- A different experiment that makes the same point ...

Nominal Rates



Real Rates



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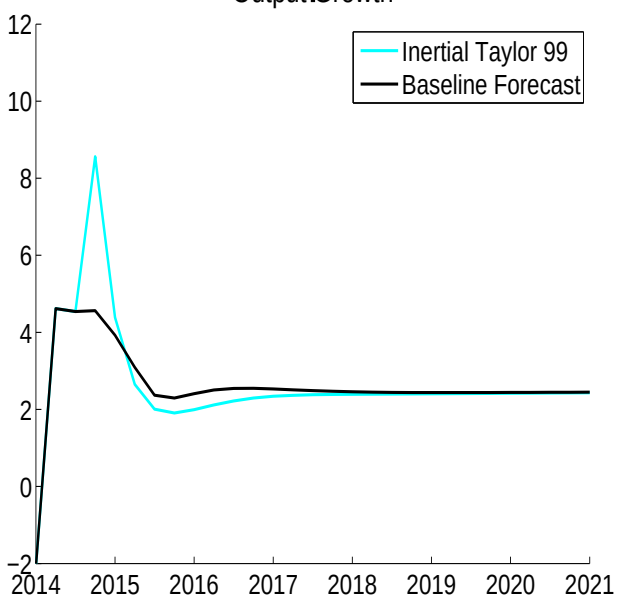
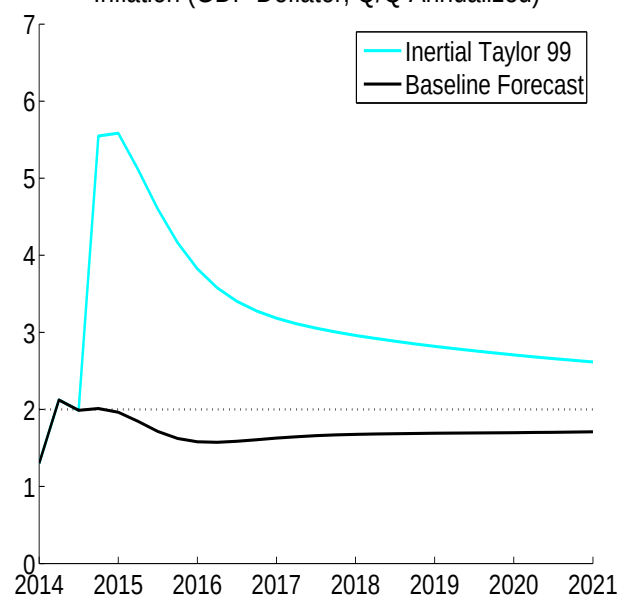


Inflation



Real Rates ↓

TIPS (constant maturity)					
Date	30-Year	20-Year	10-Year	7-Year	5-Year
8/9/2011	-26	-16	-33	-52	-39
9/21/2011	-16	-12	-3	6	12
1/25/2012	-8	-11	-15	-18	-20
6/20/2012	1	3	6	10	12
9/13/2012	-9	-8	-15	-19	-25

Breakeven and Inflation Swaps ↑

Breakeven

Breakeven (Basis Points)			
Date	**20-Year**	**10-Year**	**5-Year**
8/9/2011	-7	10	21
9/21/2011	-22	-20	-18
1/25/2012	3	3	5
6/20/2012	-6	-7	-10
9/13/2012	24	26	27

Inflation Swaps

Breakeven (Basis Points)			
Date	**20-Year**	**10-Year**	**5-Year**
8/9/2011	-7	10	21
9/21/2011	-22	-20	-18
1/25/2012	3	3	5
6/20/2012	-6	-7	-10
9/13/2012	24	26	27

- In all three periods, financial markets reaction is consistent with Odyssean forward guidance

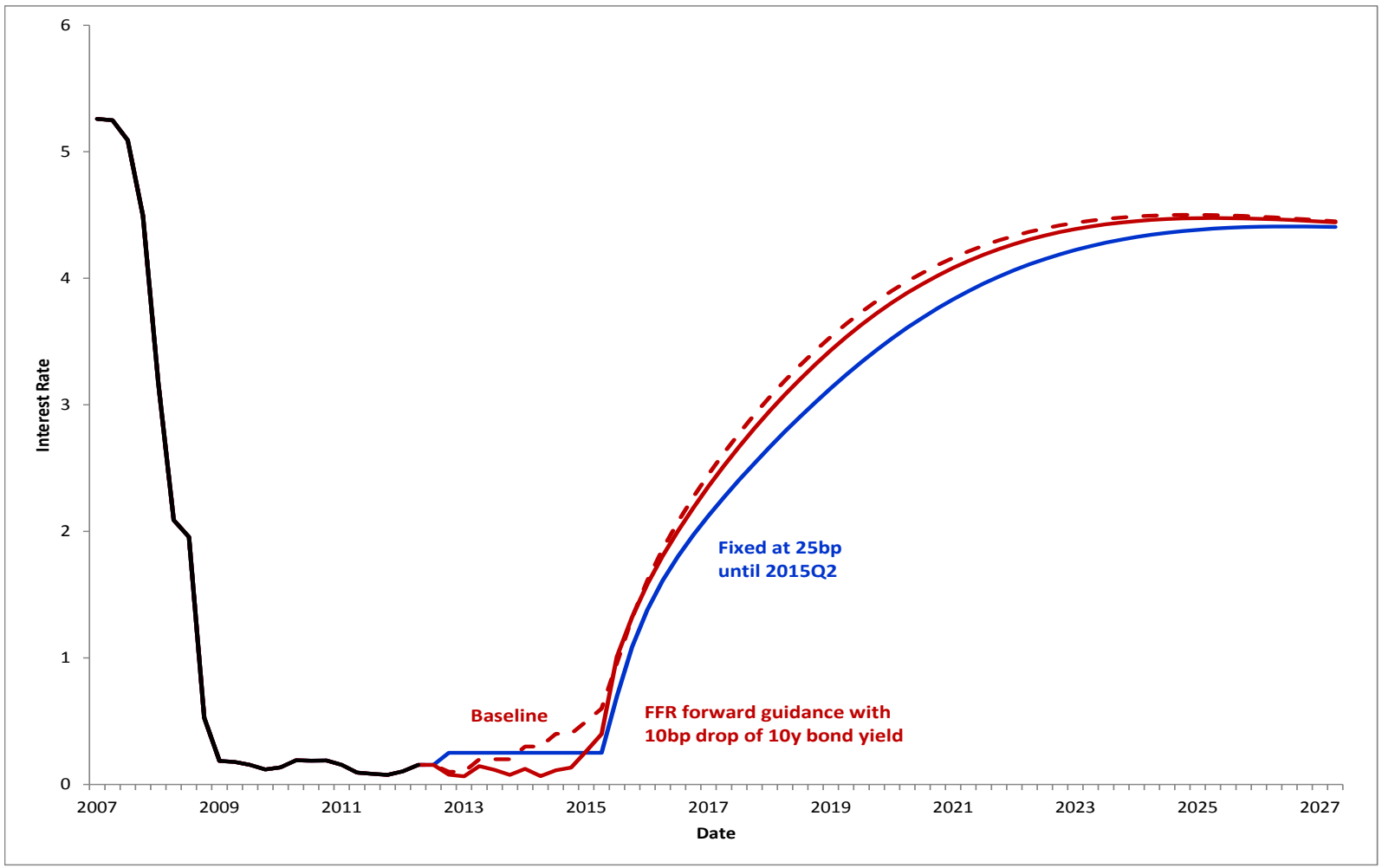
... Not Driven by Illiquidity

TIPS-Teasury Spread (Fleckenstein, Longstaff, Lustig JF)

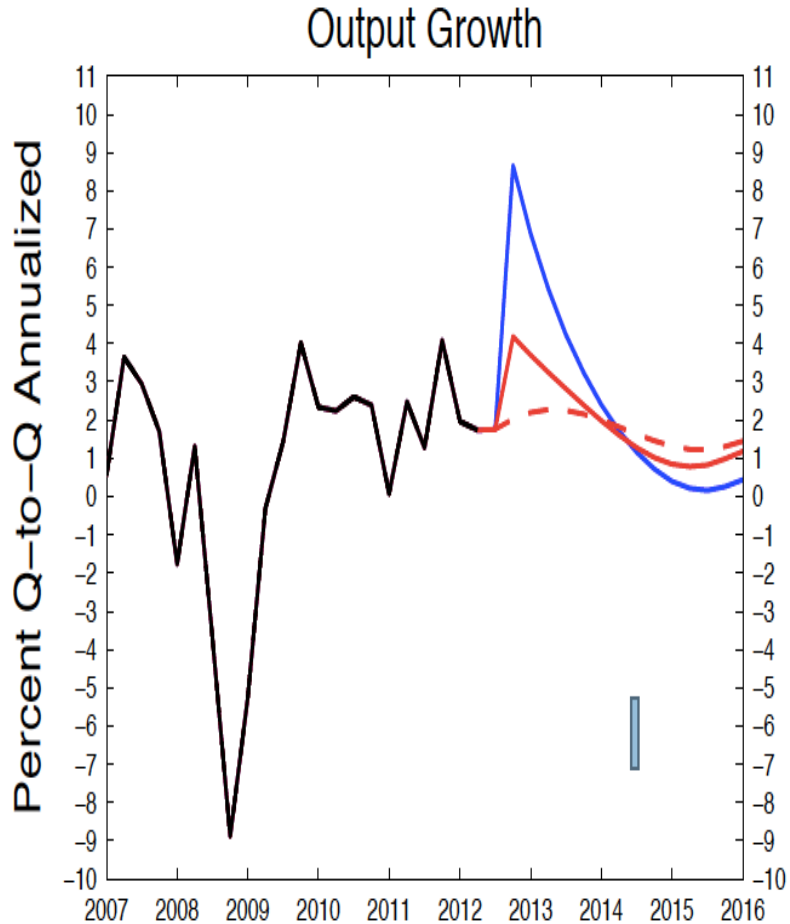
TIPS Spread: [TIPS + inflation swap - treasury note] (Basis Points)				
Date	20-Year	10-Year	7-Year	5-Year
11/25/2008	-17	-13	-21	0
12/1/2008	13	18	-146	-204
12/16/2008	10	13	-12	-33
1/28/2009	-2	-7	0	-21
3/18/2009	2	4	20	17
8/9/2011	16	4	-15	-8
9/21/2011	2	5	9	3
1/25/2012	0	1	1	3
6/20/2012	0	-4	5	-4
9/13/2012	3	-5	-4	1
12/12/2012	-2	-1	-1	-4
6/19/2013	4	1	-2	3
12/18/2013	4	-1	-15	-3

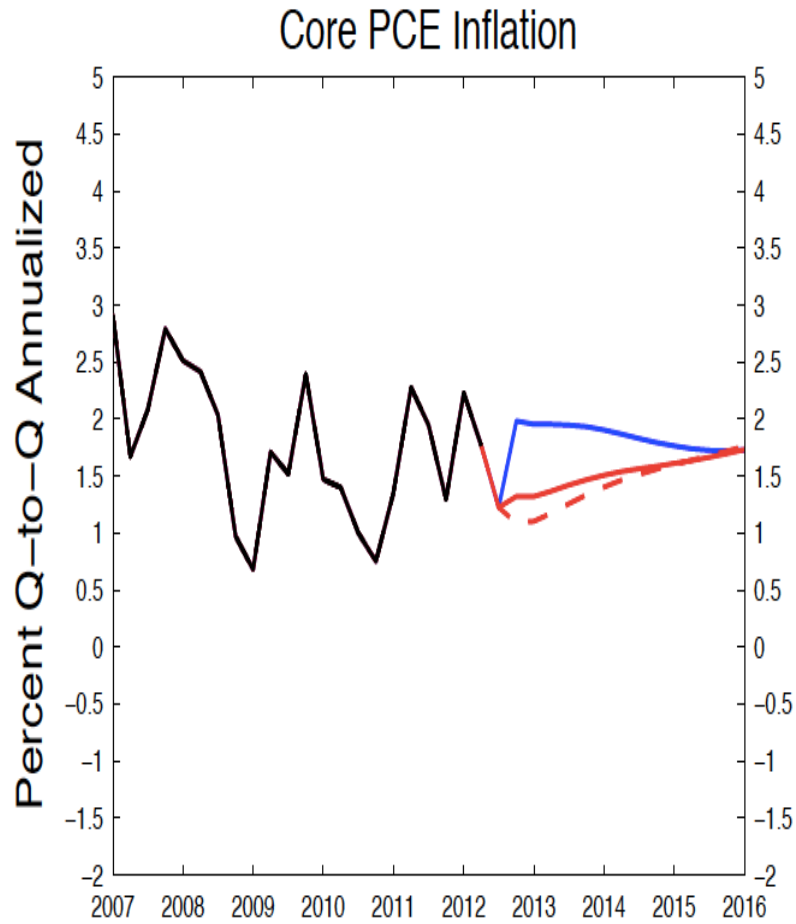
What If We Constrain the Long Rates Response?

- Choose anticipated shocks so to i) minimize the weighted deviations from baseline path, ii) subject to causing a given drop in a long-term rate (say 10 bps of 10-year yield)



- We obtain "reasonable" effects on output and inflation





- The problem seems to be in the mapping *forward guidance* $\longrightarrow$ *long rate* and not so much in *long rate* $\longrightarrow$ *activity*

Conclusions

- What is the forward guidance puzzle?
- A model that is almost "designed" to capture well the responses to a *contemporaneous* policy shocks fails to adequately describe the impact of *anticipated* shocks:

  It arguably delivers implausibly large responses to forward guidance.
- ... and this is the case in part because the model over-predicts the impact of forward guidance on long term rates – a model that one may a priori expect to have too little persistence, has in fact *too much*

- Lots to do:
  - Better understand the sources of the excessive response of long-term rates
  - Estimating the model with the "right" observables may deliver more reasonable responses to forward guidance

Conclusions

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  - Better understand the sources of the excessive response of long-term rates
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Risk-neutral Forward Rates

Date	10-Year	5-Year	3-Year	1-Year
8/9/2011	-7	-9	-8	2
9/21/2011	-10	-12	-7	12
1/25/2012	-5	-7	-5	1
6/20/2012	0	0	0	2
9/13/2012	3	4	3	-2