

# The Forward Guidance Puzzle

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# Forward Guidance

- Announcements about future interest rate changes: key instrument of monetary policy at least since 2008 (also before – see Campbell et al. 2012)
- ① What are the effects of forward guidance?
  - On financial markets
  - On expectations – Evidence from Blue Chip surveys
- ② Can its effects be captured by standard medium-scale DSGE models? No!
  - ⇒ **Forward Guidance Puzzle:** Excessive response of output and inflation
    - The farther into the future is the change in FFR, the stronger the economy's response
- ③ A proposed resolution to the FG puzzle
  - Accounting for finite life: Blanchard-Yaari's perpetual youth in a medium-scale DSGE model

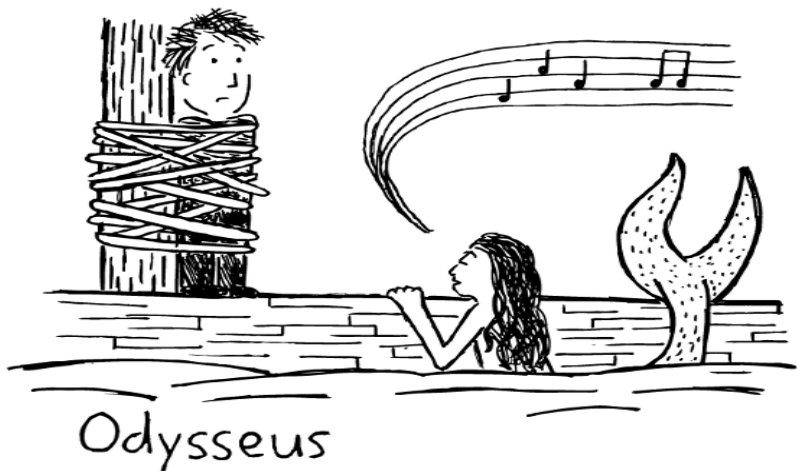
# Transmission of Monetary Policy

- Pre-Great Recession
  - Key instrument of policy: short-term interest rate
  - Monetary transmission well understood (extensively studied using both VAR models and DSGE models)
- Post-Great Recession
  - “New” policy tools: Forward guidance (FG), LSAPs
  - Goal at ZLB: lower long-term bond yields  
→ stimulate aggregate expenditures
  - But ... effects not well understood; harder to quantify using existing empirical tools (e.g. VARs)

# Analyzing the Effects of Forward Guidance – The Challenge

- Announcement by CB that will maintain FFR at ZLB for longer can have two effects (Campbell, Evans, Fisher, Justiniano 2012; Woodford 2012):
  - ① More monetary stimulus (**Odyssean**/Commitment a la Eggertsson and Woodford 2003) → stimulates economic activity, higher inflation
  - ② Reveals bad news about state of economy (**Delphic**) → lower projected activity, lower inflation
- Interpretation by market depends in very subtle ways on FOMC communication

# Analyzing the Effects of Forward Guidance – The Challenge



- Like Odysseus, central bank commits to keeping FFR low despite temptation to raise FFR once the economy is recovering

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# Analyzing the Effects of Forward Guidance – The Challenge



- Like the Oracle of Delphi, central bank announces a low forecast for FFR, given its forecast of weak economic conditions

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# DSGE Models Suited to Analyze Forward Guidance?

- Medium-scale New Keynesian DSGE models “fit data well”
- Models are “structural” → *in principle* well suited to perform counterfactual experiments
- Problem: Model-implied response to FG much larger than observed → “Forward Guidance Puzzle”!

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## Evidence from Blue Chip Financial Forecasters

- Compute *change in forecasts* in a one-month window around the announcement
- ... controlling for:
  - all macro economic news (surprises)
  - asset price movements (ex event window)
- Panel regression for variable ( $k$ ), horizon ( $h$ ), forecaster ( $i$ ):

$$\Delta f(k, h)_{t,i} = \gamma_0 + \gamma'_1 \text{ Macro news} + \gamma'_2 \text{ Asset Price Changes} \\ + \gamma'_3 \text{ } i\text{-specific control} + \beta \text{ Announcement Dummy} + \epsilon_{i,t}$$

for  $t = 2008.06, \dots, 2015.02$

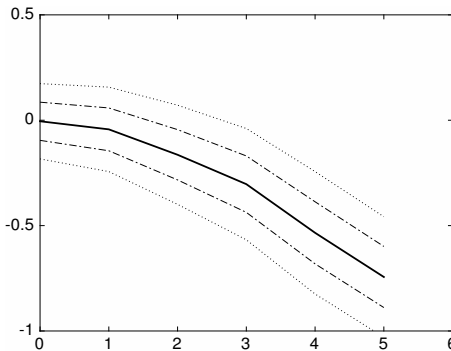
- Std errors corrected for correlation across  $i$ 's and heteroskedasticity

## August 2011

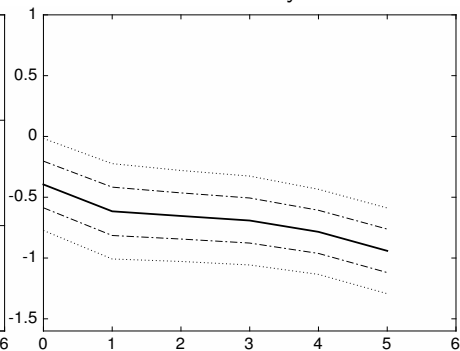
“ ... exceptionally low levels of the FFR **at least through mid-2013**”

- Projections for 3-month rates and 10-year yields decline
  - Change in forecasts of financial variables *in line with asset response in two-day window*
  - Forecasters *believe* the FOMC announcement

### 3-Month TBill

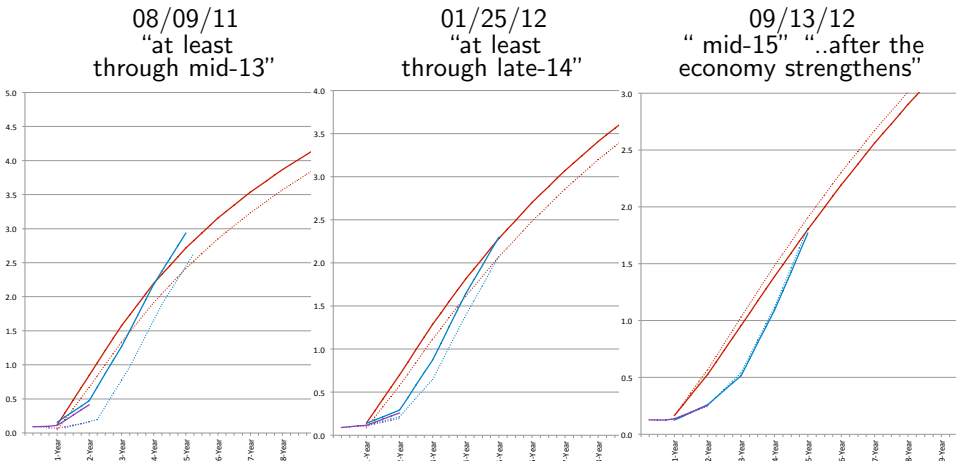


### 10 Treasury



# Evidence from Financial Markets: Forward Rates

- Pre-FOMC: solid; post-FOMC: dashed
- FF fut. (purple); Eurodol. fut. (blue); Fwd rates from yield curve (red)



## Evidence from Financial Markets

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

### Changes in bond yields in 2-day following FOMC meeting

Maturity (years)	Treasury Yields (constant maturity)					Agency Yields (Fannie/Freddie)				MBS Yields	
	30	10	5	3	1	30	10	5	3	30	15
8/9/2011	-14	-23	-18	-12	-3	-19	-23	-27	-25	-24	-26
1/25/2012	-5	-12	-15	-8	0	-10	-13	-18	-14	-16	-18
9/13/2012	17	11	2	2	0	10	5	0	1	-13	-11

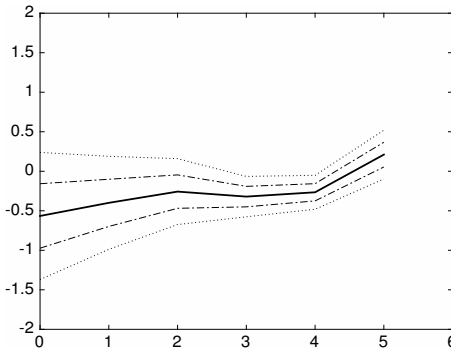
Notes: All figures are in basis points unless otherwise noted.

- Bond yields fall in Aug. 2011 and Jan. 2012; increase in Sept. 2012
- Fed announcements affect yields:
  - Hard to reconcile with lack of credibility story

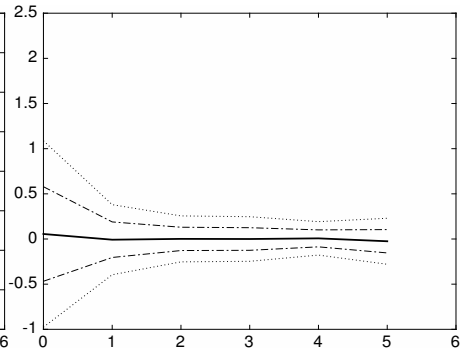
## August 2011

“... economic growth so far this year has been considerably slower than ... expected. ...The Committee now **expects a somewhat slower pace of recovery** over coming quarters ... **economic conditions ... are likely to warrant** exceptionally low levels of the FFR at least through mid-2013”

### GDP Growth



### CPI Inflation

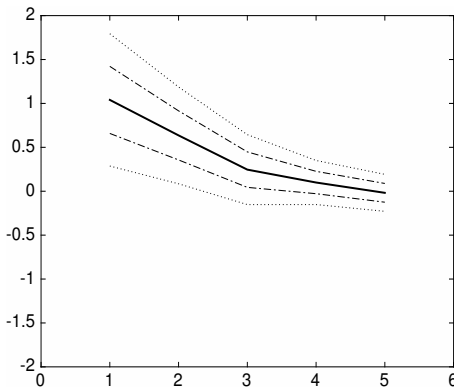


- Possible example of **Delphic** forward guidance: bad news about the economy

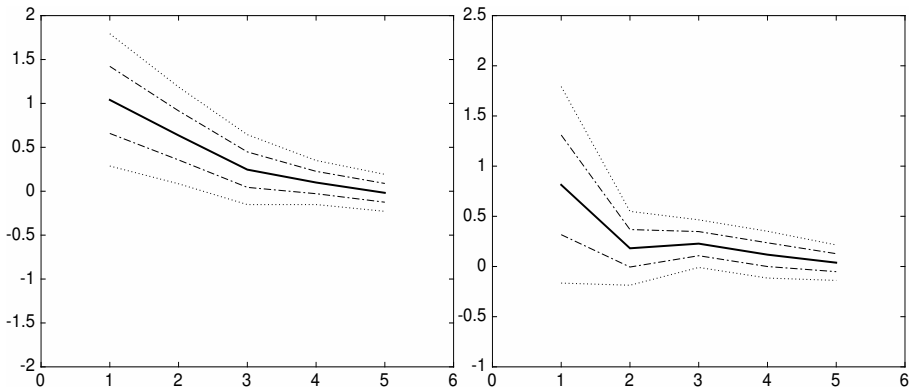
## September 2012

- ... “highly accommodative stance ... will remain appropriate for a considerable time after the economic recovery strengthens. ... at least through mid-2015”

### GDP Growth



### CPI Inflation



- **Odyssean:** significant increase in forecasts for real activity and inflation



## Evidence from Financial Markets

Maturity (years)	TIPS (constant maturity)					Implied Vol.	SP 500 (% change)	DJ IA (% change)	FX USD/EUR (% change)
	30	20	10	7	5				
8/9/2011	-26	-16	-33	-52	-39	-8.11	0.12	-0.83	-0.01
1/25/2012	-8	-11	-15	-18	-20	-4.21	0.29	0.46	0.56
9/13/2012	-9	-8	-15	-19	-25	-1.13	2.03	1.95	1.78

Notes: All figures are in basis points unless otherwise noted.

- Real rates fall
- Stocks prices: modest changes in Aug. 2011 and Jan. 2012; larger increases in Sept. 2012

Maturity (years)	Breakevens			Inflation Swaps					Liquidity Premium		
	20	10	5	30	20	10	5	1	20	10	5
8/9/2011	-7	10	21	8	9	14	13	-3	16	4	-8
1/25/2012	3	3	5	3	3	4	8	12	0	1	3
9/13/2012	24	26	27	26	27	21	28	23	3	-5	1

Notes: All figures are in basis points unless otherwise noted.

- Inflation breakeven and Inflation swaps increase especially in Sept. 2012
- Little variation in liquidity premium (TIPS-Treasury spread, Fleckenstein et al.)

	Corporate Yields											
	Intermediate term						Long term					
	Aaa	Aa	A	Baa	Ba	B	Aaa	Aa	A	Baa	Ba	B
8/9/2011	-8	-6	-8	-8	2	16	-11	-9	-5	-5	26	33
1/25/2012	-10	-13	-11	-16	-9	-13	-12	-15	-17	-13	-16	-10
9/13/2012	11	10	7	-2	-8	-15	0	-1	-1	5	-12	-18

Notes: All figures are in basis points unless otherwise noted.

- While high-grade yields decrease in August 2011 in line with Treasuries, low-grade corporate yields increase (safety premium ↑)
- Low-grade corporate yields fall in Sept 2012 (safety premium ↓)

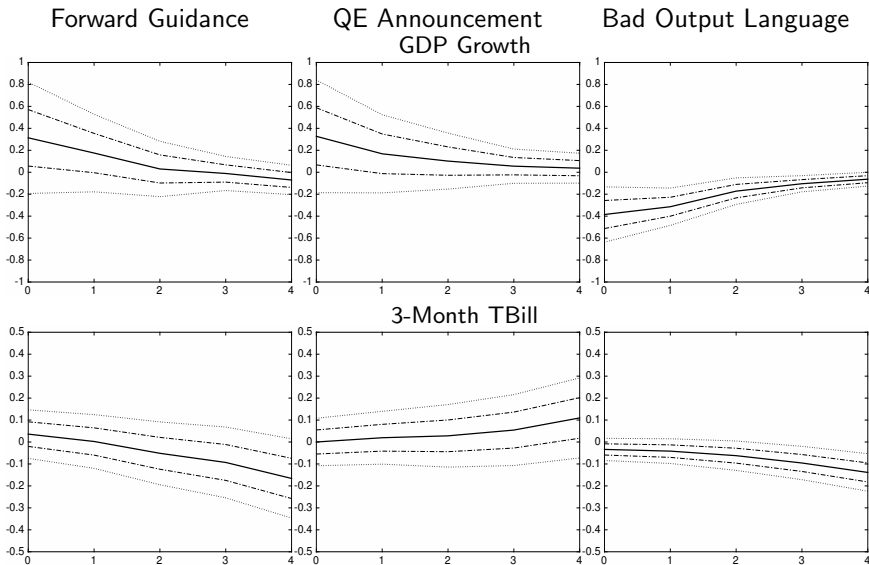
## Evidence from Financial Markets

- August 2011:
  - Bond yields and real rates fall; little change in stocks prices
  - Inflation breakeven and inflation swaps increase slightly
- January 2012:
  - Financial market response similar to that of August 2011, but more modest
- September 2012: Different response
  - Real yields fall
  - But bond yields rise with inflation breakeven and inflation swaps; stock market rises
- Sept. 2012: Could be consistent with Odyssean forward guidance: monetary policy more accommodative than expected and provides more stimulus
  - ... “highly accommodative stance of monetary policy will remain appropriate for a considerable time after the economic recovery strengthens”.
  - What happened to output forecasts?

# Effect of Different Aspects of the FOMC Statement

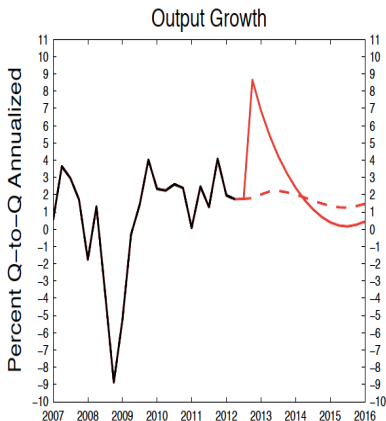
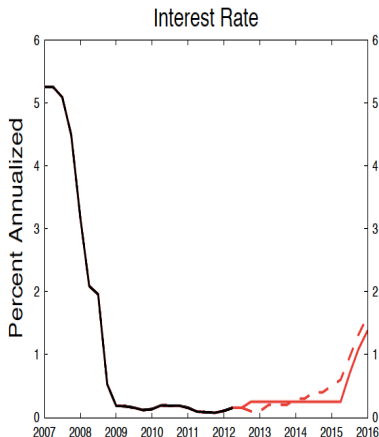
- Add dummies for announcements of:
  - Forward guidance episode
  - QE
  - Continuation of QE
  - Output conditions
  - Inflation conditions

# Effect of Different Aspects of the FOMC Statement



## The Forward Guidance Puzzle

- Medium-scale DSGE – Good forecasting performance
  - *In principle* well suited for counterfactual experiments
- 2012Q2 “experiment”: FFR kept at ZLB through 2015Q2



See also Carlstrom et al. 2012

# The Two Legs of the Forward Guidance Puzzle

1: Consumption depends on the expected future short-term real rates:

$$\hat{c}_t = -E_t[\hat{R}_t - \hat{\pi}_{t+1} + \hat{c}_{t+1}] \implies \hat{c}_t = -\sum_{j=0}^{\infty} E_t \underbrace{[\hat{R}_{t+j} - \hat{\pi}_{t+1+j}]}_{\hat{r}_{t+j}}$$

- **Contemporaneous** shock:  $\hat{r}_t \downarrow \implies \hat{c}_t \uparrow, \hat{c}_{t+1} = 0, \dots$
- **Anticipated** shock:  $\hat{r}_{t+H} \downarrow \implies \hat{c}_t \uparrow, \hat{c}_{t+1} \uparrow, \dots, \hat{c}_{t+H} \uparrow$
- The farther the rate drop, the longer does consumption boom last (McKay, Nakamura, Steinsson, 2015)

2: Now let  $\pi$  move. NK Phillips curve implies

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

- **Anticipated** shock: more prolonged consumption boom  
 $\implies \hat{\pi}_t, \hat{\pi}_{t+1}, \dots$  rises more  $\implies$  *real* rate drops even more today  
 $\implies$  consumption increase amplified



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# Possible Resolutions

## ① The **Euler equation?**

- McKay, Nakamura, Steinsson (2015), Caballero and Fahri (2014)
- **Here:** Discounting in the Euler equation coming from overlapping generations
- Werning (2015)

## ② The **NKPC?**

- Kiley et al. 2014, Carlstrom et al. 2012

## ③ **Lack of credibility?**

- At odds with surveys and financial markets responses

## ④ **Deviations from rational expectations?**

- Gabaix (2015), Garcia-Schmidt, Woodford (2015)

## A Proposed Resolution: Finite Life (Blanchard-Yaari)

- Agents face probability  $p$  of “dying”

$$\sum_{s=0}^{\infty} (\beta(1-p))^s \log(C_{j,t+s})$$

- Life-insurance companies offer an annuity contract  $\rightarrow$  individual wealth accumulates at  $R/(1-p)$

$$S_{j,t+1} = \frac{R_t}{1-p} (S_{j,t} + Y_t - C_{j,t})$$

- Individual EE for each cohort  $j$ :

$$C_{j,t+1} = \beta R_t C_{j,t} \Rightarrow C_{j,t} = \frac{(S_{j,t} + H_t)}{1 - \beta(1-p)}$$

where  $H_t = \sum_{s=0}^{\infty} \frac{Y_{t+s}}{\prod_{l=0}^{s-1} (R_{t+l}/(1-p))}$

- Aggregate EE:

$$C_{t+1} = R_t \beta C_t - \frac{p(1 - \beta(1-p))}{(1-p)} S_{t+1}$$

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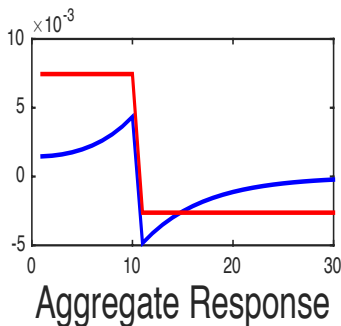
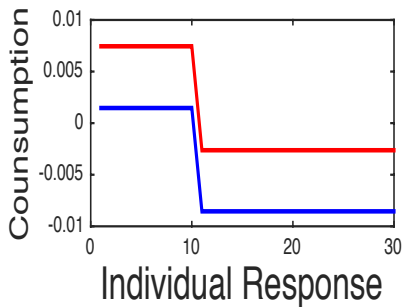
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## A Proposed Resolution: Finite Life (Blanchard-Yaari)

- Announced future drop in  $R$ . "Death" probability:  $p = 0$ ,  $p > 0$



- Individuals*: consumption  $\uparrow$ , wealth  $\downarrow$  (standard Euler eq)
- But **unborn cohorts cannot react to the announcement**
- In the *aggregate*,  $C$  increases as it gets closer to drop in  $R$  (as newborn cohorts react)

# Smets-Wouters Model with Blanchard-Yaari Households

- Aggregate consumption Euler equation (simplified):

$$\hat{c}_t = - \left( \hat{R}_t - E_t[\hat{\pi}_{t+1}] \right) + (1 - \eta) E_t[\hat{s}_{t+1}] + \eta E_t[\hat{c}_{t+1}]$$

where  $\eta < 1$  when  $\rho > 0$

- Evolution of wealth  $\hat{s}_t$  and fiscal policy
- All other equations are the same as in SW (with  $\tilde{\beta} = \eta\beta$ ), e.g. NK Phillips Curve:

$$\pi_t = E_t \sum_{j=0}^{\infty} \tilde{\beta}^j \kappa m_{c_{t+j}}$$

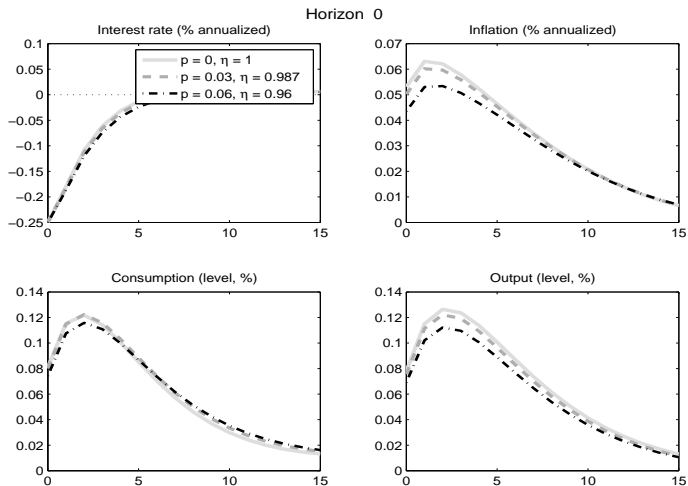
- SWBY: Tractable medium scale DSGE

## Does it Matter Quantitatively?

- Calibration of  $p$ :
  - Average death prob. (Soc. Sec.) per quarter: 0.4% to 0.8%
  - In addition, can loosely think of  $p$  as the probability of entering/exiting hand-to-mouth status (e.g. bankruptcy,..., from Kaplan, Violante, Wieder 2014: 2.3%)
  - Baseline:  $p = 3\%$ ; alternative:  $p = 6\%$
- All other parameters taken from Smets and Wouters

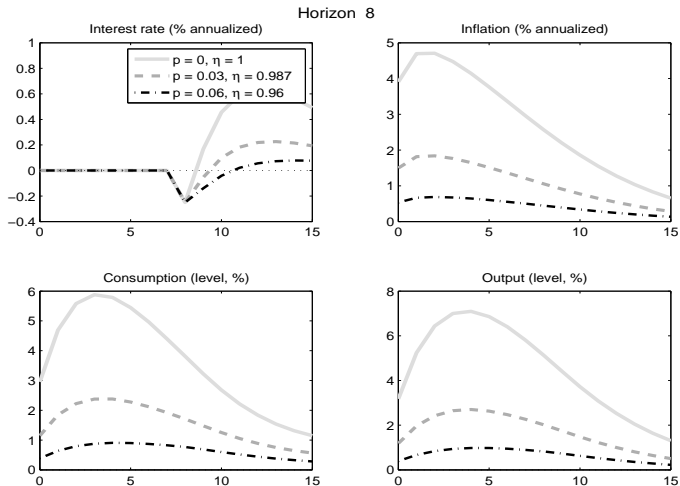
# Contemporaneous drop in FFR

- Response to contemporaneous shock similar for  $\rho = 0, 3\%$  or  $6\%$



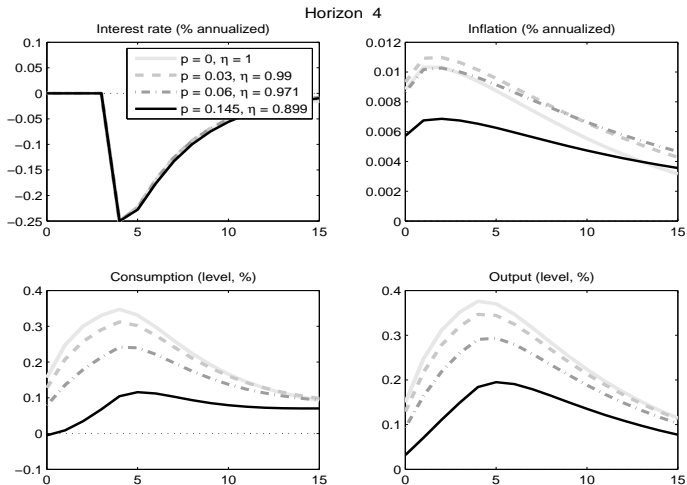


# Announcement of FFR drop in 8 quarters



- With  $p = 0$ : FG causes huge changes in output and inflation
- With  $p = 3\%$ , response of output and inflation cut by 2/3

# Estimated Model



- $r_* = 1/\tilde{\beta}$  is fixed across simulations
- Very preliminary results!

# Conclusions

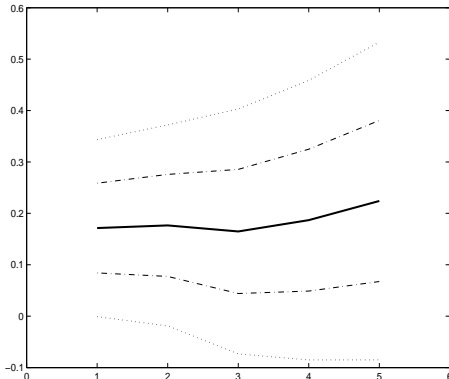
- ① What are the effects of forward guidance?
  - **Stimulative, non-trivial, but not huge**
- ② Can its effects be captured by standard medium-scale DSGE models?
  - No! Estimated DSGE model delivers **implausibly large responses to forward guidance**
- ③ A proposed resolution to the forward guidance puzzle
  - **Blanchard-Yaari**
  - Compositional effects imply **discounting in the Euler equation**  $\implies$  mitigate aggregate response

# Reference Slides

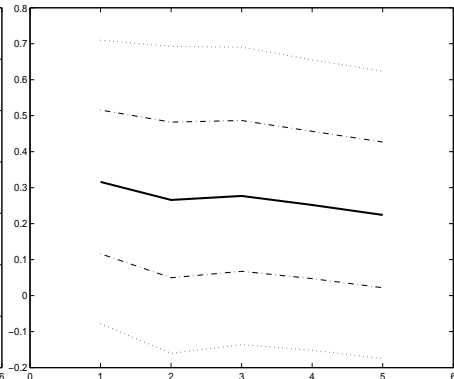
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- ... “highly accommodative stance ... will remain appropriate for a considerable time after the economic recovery strengthens. ... exceptionally low levels for the FFR are likely to be warranted at least through mid-2015”

### 3-Month TBill



### 10-Year Treasury



- Long term-rates increase (in line with market reaction)

# Fwd Guidance Puzzle and Effects of Changes in the Reaction Function

- “Excessive” response of output and inflation as well
- Note: Nominal rates can  $\uparrow$  in equilibrium following an announcement about the reaction function (consistent with 9/13/12)

