

The Limitations of Forward Guidance

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Coauthors and Disclaimer

This is a joint work with

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The ideas in this paper are those of the authors and do not necessarily reflect official views of the Federal Reserve Bank of St. Louis, the Board of Governors of the Federal Reserve System, or anyone else in the Federal Reserve System.

Two Types of Forward Guidance

- Campbell et al. (2012) differentiate between two types of forward guidance.
 1. *Delphic forward guidance* is a central bank's forecast of its own policy based on its own policy rule and its forecasts of inflation and output.
 2. *Odyssean forward guidance* is a central bank's commitment to deviate from its own policy rule at sometime in the future when the policy rate is normally expected to rise above zero.

Our Contribution

This paper examines forward guidance (FG) in a New Keynesian model where FG impacts the economy via news shocks to the monetary policy rule.

Key findings:

1. Conventional monetary policy is more stimulative than FG away from the ZLB.
2. If agents believe the economy will recover slowly, then the stimulative effect of FG is limited.
3. Longer FG horizons do not reverse the stimulative effect, but rather spread the effect across the entire horizon.

Key Features of Our New Keynesian Model

- Households:

1. Maximize utility from consumption and leisure.
2. No capital accumulation.
3. Stochastic discount factor shock:

$$\ln(\beta_t/\beta) = \rho_\beta \ln(\beta_{t-1}/\beta) + \varepsilon_{\beta,t},$$

where $0 \leq \rho_\beta < 1$ and $\varepsilon_{\beta,t} \sim N(0, \sigma_\beta)$.

- Firms:

1. Monopolistically competitive producers of differentiated goods.
2. Each firm faces a Rotemberg (1982) quadratic cost of adjusting its price, $P_{i,t}$:

$$\frac{\varphi}{2} \left(\frac{P_{i,t}}{\pi P_{i,t-1}} - 1 \right)^2 y_t.$$

Monetary Policy

- The central bank follows a nonlinear nominal interest rate rule:

$$r_t = \max\{1, r(\pi_t/\pi)^{\phi_\pi} \exp(x_t)\}$$

- The monetary policy parameter, x_t , is a function of an unexpected policy shock, $\varepsilon_{r,t}$, and previously announced “news” shocks, $\varepsilon_{r,t-j}$, in periods $t-1, \dots, t-q$:

$$x_t = \sum_{j=0}^q \alpha_j \varepsilon_{r,t-j}, \text{ such that } \sum_{j=0}^q \alpha_j^2 = 1.$$

- $\alpha_j \in [0, 1]$ is the intensity of new j periods in the future, q is the forward guidance horizon,
 $r = 1.015$, $\pi = 1.005$, $\sigma_\varepsilon = 0.0025$, and $\phi_\pi = 1.5$

Computational Procedure—Richter, Throckmorton and Walker (2013)

- We solve the nonlinear model using policy function iterations.
- This solution method discretizes the state space and uses time iteration to determine the updated decision rules.
- Expectations of future variables are approximated using piecewise linear interpolation.
- Advantages of this approach:
 1. The duration of ZLB events is stochastic.
 2. The probability of returning to the ZLB after exiting is nonzero.

Decision Rules: 1-Quarter Horizon

Key assumptions: Note that a hat indicates a % deviation from steady state

- In period t , the initial shadow interest rate, \tilde{r}_t^* , (the nominal interest rate without a ZLB constraint) is 0 ($\hat{\beta}_t = 1.15$).
- In the absence of any “news” shocks, agents expect $\hat{\beta}$ to gradually revert to its mean so that $E_t[r_{t+i}] > 1$ for all $i = 1, 2, \dots, \infty$.
- Three cases are examined:

1. No FG ($\alpha_0 = 1$)

$$x_t = \varepsilon_{r,t}.$$

2. 1-quarter FG ($\alpha_0 = 0$ and $\alpha_1 = 1$)

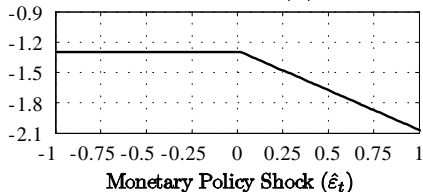
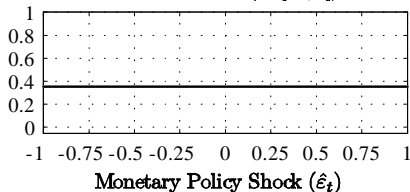
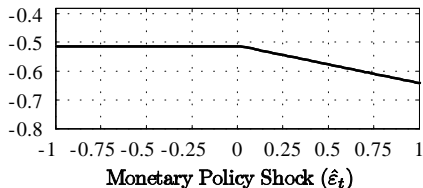
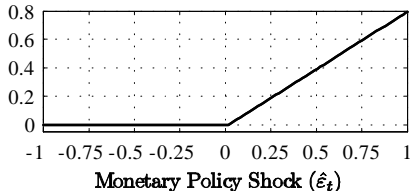
$$x_t = \varepsilon_{r,t-1}.$$

3. 1-quarter equal FG ($\alpha_0 = \alpha_1 = \sqrt{1/2}$)

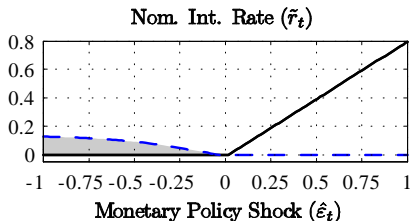
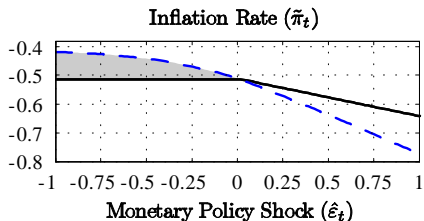
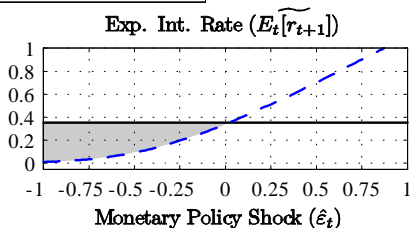
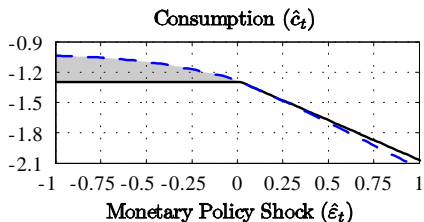
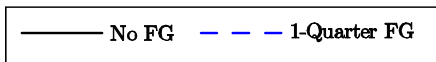
$$x_t = \sqrt{1/2}(\varepsilon_{r,t} + \varepsilon_{r,t-1}).$$

Decision Rules: Unanticipated Policy Shock

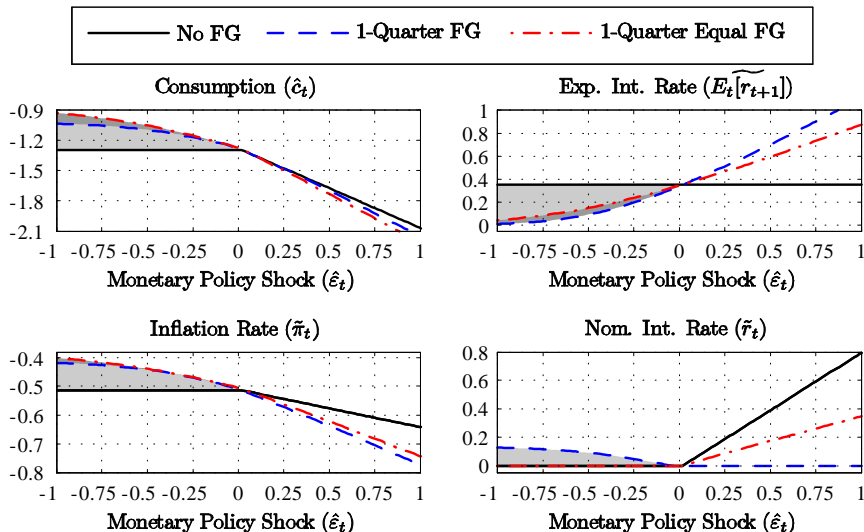
— No FG

Consumption (\hat{c}_t)Exp. Int. Rate ($E_t[\widetilde{r}_{t+1}]$)Inflation Rate ($\widetilde{\pi}_t$)Nom. Int. Rate (\widetilde{r}_t)

Decision Rules: 1-Quarter Horizon News Shock



Decision Rules: 1-Quarter Horizon Equal News Shock

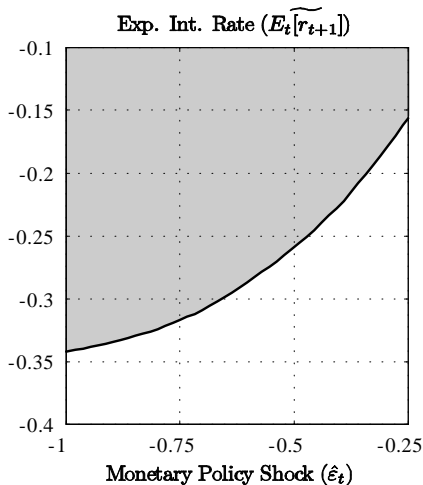
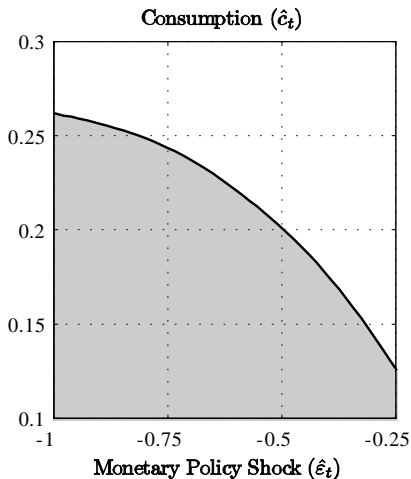


Expectations about the Economic Recovery Matter

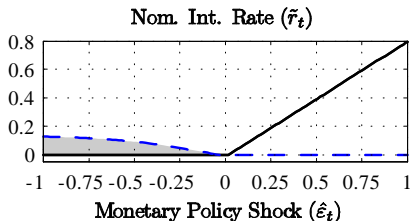
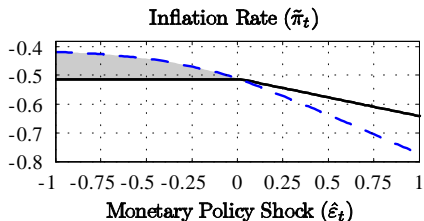
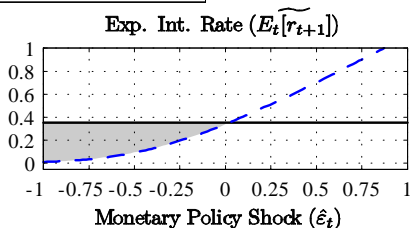
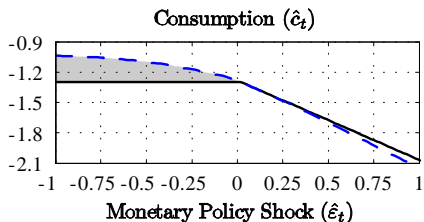
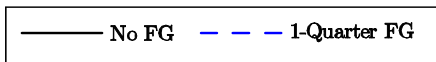
- The amount of persistence in the discount factor determines the strength of expectations about future consumption and interest rates
- A lower value of ρ_β means that β_t reverts to its steady state faster. (i.e., agents expect a more robust recovery.)
- Same assumptions apply as in the decision rules graphs.
- Our comparative measure is the difference between 1-quarter FG and no FG.

Baseline Result with 1-Quarter Horizon

— Slower Recovery ($\rho_\beta = 0.80$)

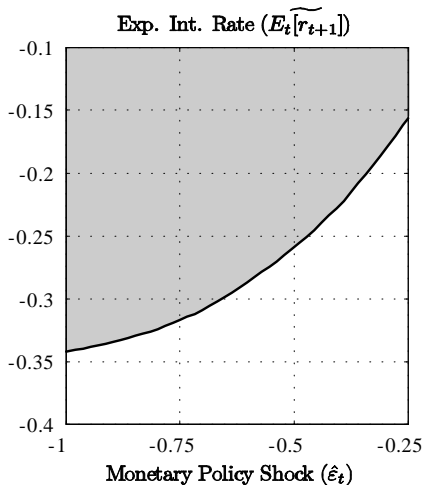
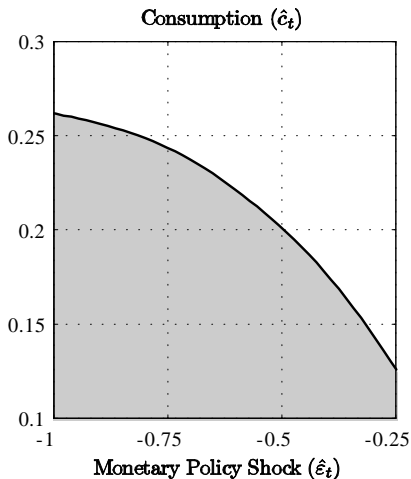


Decision Rules: 1-Quarter Horizon News Shock

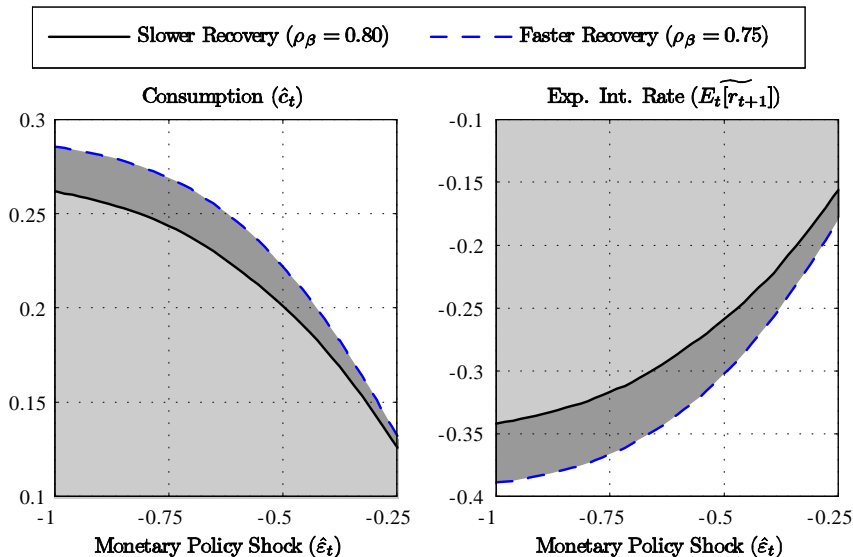


Baseline Result with 1-Quarter Horizon

— Slower Recovery ($\rho_\beta = 0.80$)



Persistence Matters—Lower value means faster recovery

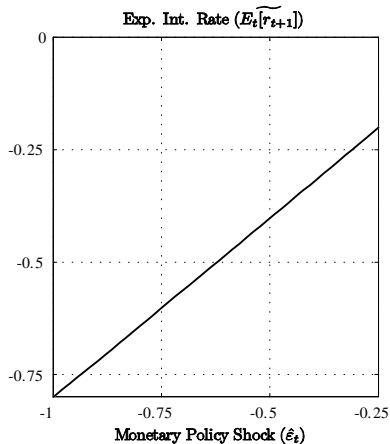
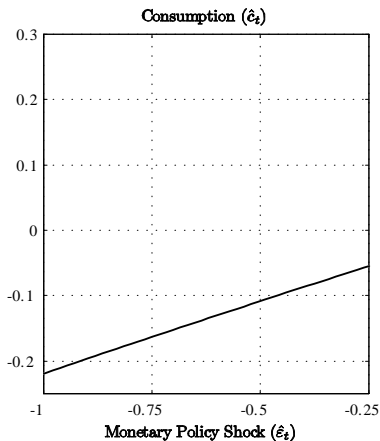


Forward Guidance at and above the ZLB

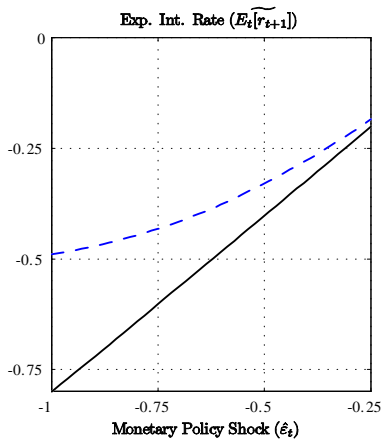
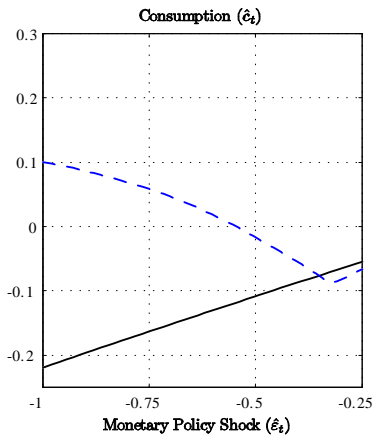
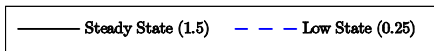
- Same assumptions apply as in the original decision rules graphs.
- We focus on the impact of four different initial shadow interest rates:
 1. The economy is at its steady state ($\tilde{r}_t^* = 1.5$).
 2. The economy is below trend but above its ZLB ($\tilde{r}_t^* = 0.25$).
 3. The economy is in a large enough recession so that the ZLB just binds ($\tilde{r}_t^* = 0$).
 4. The economy is in a deep recession ($\tilde{r}_t^* = -0.5$).
- Our comparative measure is the difference between 1-quarter FG and no FG.

Initial State Matters

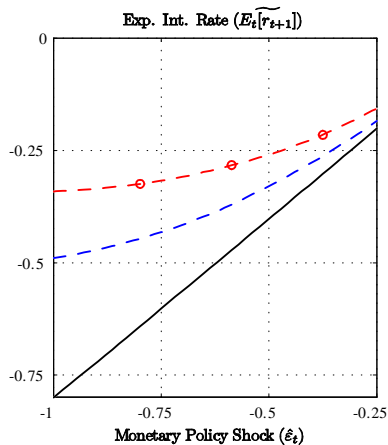
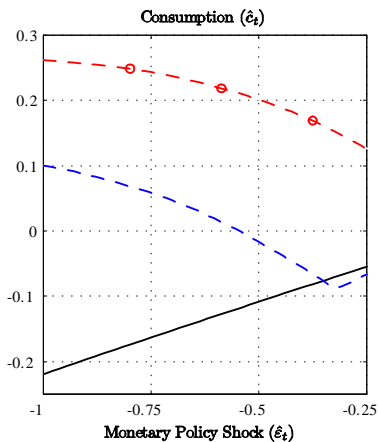
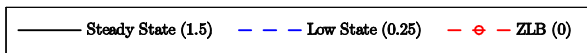
— Steady State (1.5)



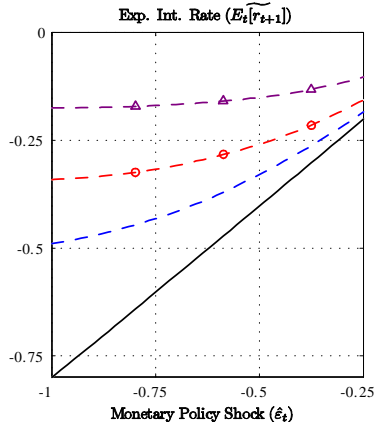
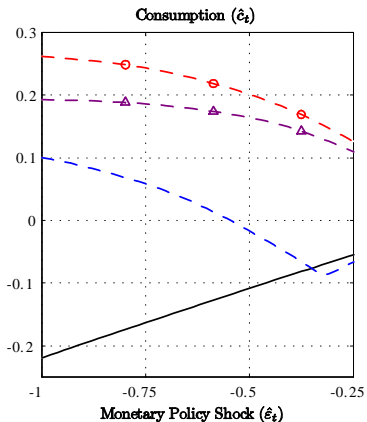
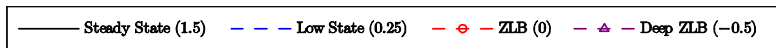
Initial State Matters



Initial State Matters



Initial State Matters

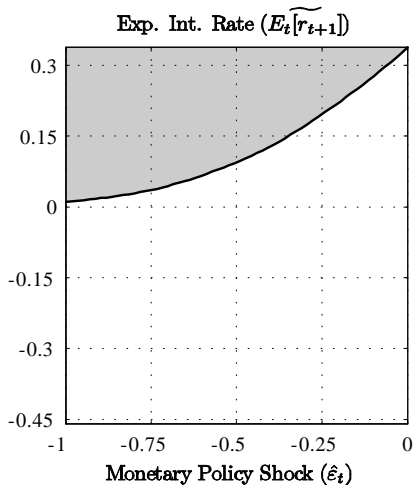
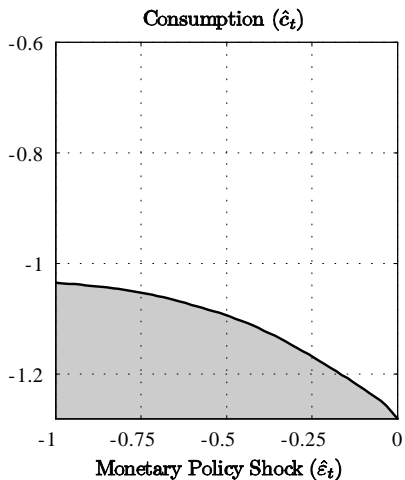


ZLB Constraint Matters

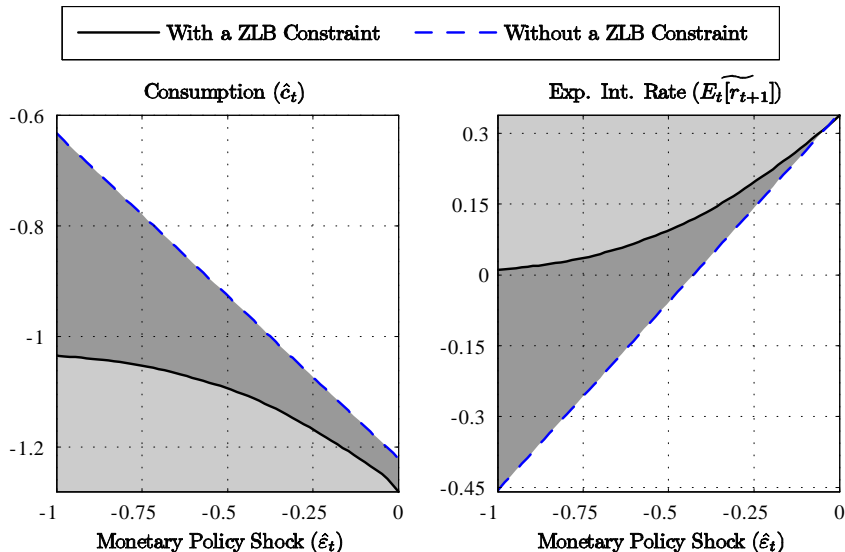
- One possible reason for a weak response to FG may be the initial state.
- If one computes the expected effect in a DSGE model without imposing the zero lower bound, then the model will overstate the expected effect.
- In the next experiment, the shadow rate is zero, so the ZLB is just binding and the nominal rate is expected to rise in the next period.

ZLB Constraint Matters

— With a ZLB Constraint



Without the ZLB Constraint Negative Rates Stimulate

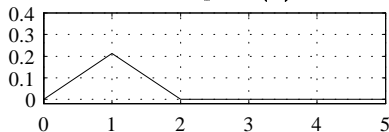
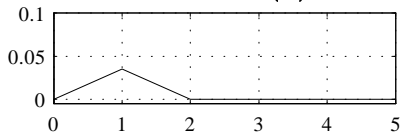
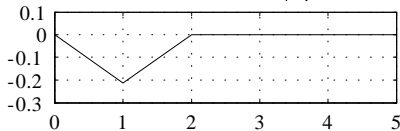
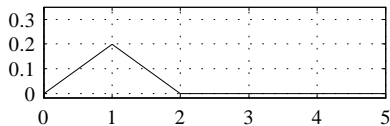
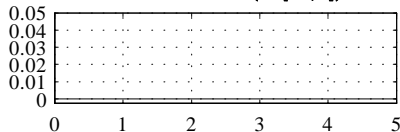
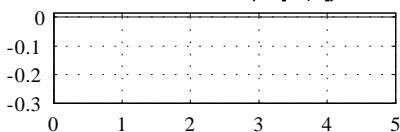


Generalized Impulse Responses to a Policy Shock

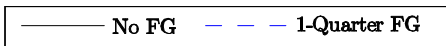
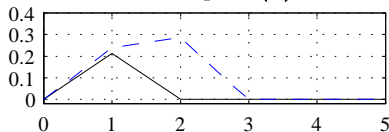
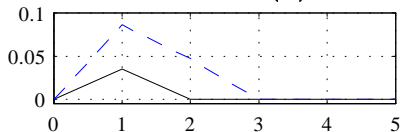
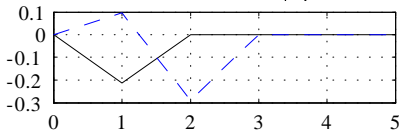
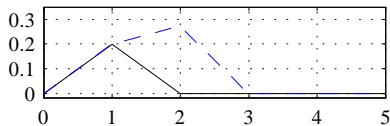
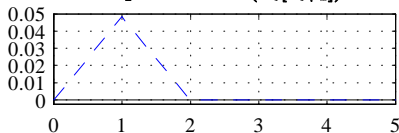
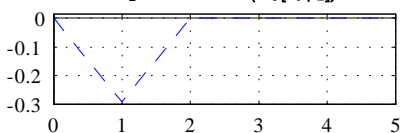
- The initial shadow interest rate, \tilde{r}_t^* , is set to -0.24 which is its average value conditional on the ZLB binding in a 500,000 quarter simulation.
- The generalized impulse response functions (GIRFs) (see Koop et al. (1996)) are calculated based on 10,000 Monte Carlo simulations.
- The GIRFs are the average difference between the responses from agents learning in period 1 of a -50 basis point policy shock to that of a random shock.
- Three types of forward guidance (FG) are examined:
 1. No FG ($\alpha_0 = 1$)
 2. 1-quarter FG ($\alpha_0 = 0$ and $\alpha_1 = 1$)
 3. 1-quarter equal FG ($\alpha_0 = \alpha_1 = \sqrt{1/2}$)

Generalized Impulse Responses to a Policy Shock

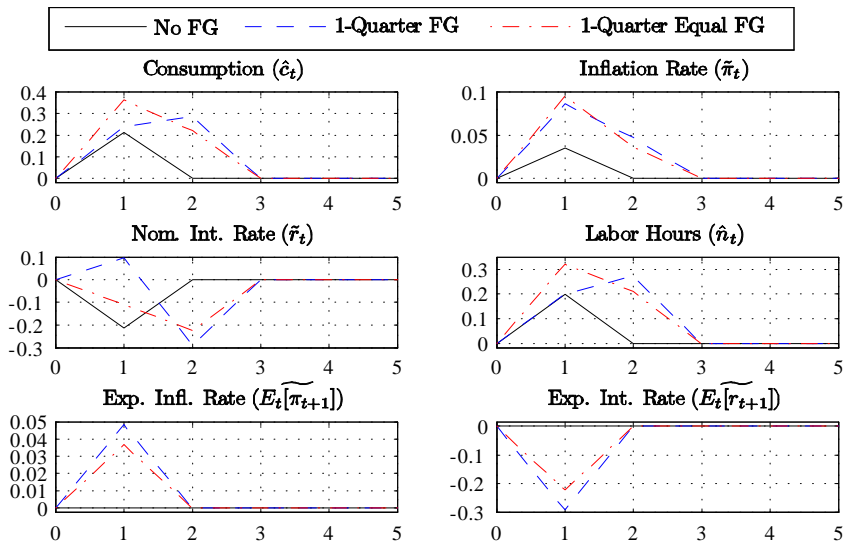
————— No FG

Consumption (\hat{c}_t)Inflation Rate ($\tilde{\pi}_t$)Nom. Int. Rate (\tilde{r}_t)Labor Hours (\hat{n}_t)Exp. Infl. Rate ($E_t[\widetilde{\pi}_{t+1}]$)Exp. Int. Rate ($E_t[\widetilde{r}_{t+1}]$)

Generalized Impulse Responses to a Policy Shock

Consumption (\hat{c}_t)Inflation Rate ($\tilde{\pi}_t$)Nom. Int. Rate (\tilde{r}_t)Labor Hours (\hat{n}_t)Exp. Infl. Rate ($E_t[\widetilde{\pi}_{t+1}]$)Exp. Int. Rate ($E_t[\widetilde{r}_{t+1}]$)

Generalized Impulse Responses to a Policy Shock



Decision Rules: 2-Quarter Horizon

- Key assumptions are all the same:
- Three cases are examined:
- 1. No FG ($\alpha_0 = 1$)

$$x_t = \varepsilon_{r,t}.$$

- 2. 2-quarter FG ($\alpha_0 = 0$, $\alpha_1 = 0$ and $\alpha_2 = 1$)

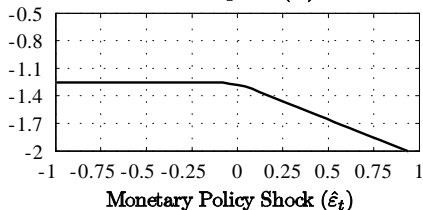
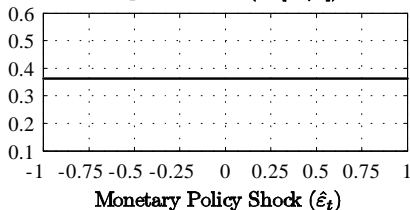
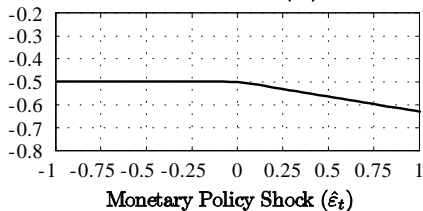
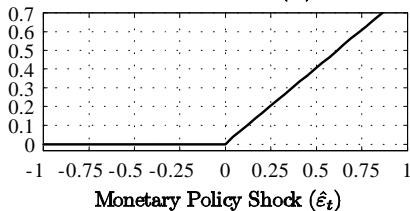
$$x_t = \varepsilon_{r,t-2}.$$

- 3. 2-quarter equal FG ($\alpha_0 = \alpha_1 = \alpha_2 = \sqrt{1/3}$)

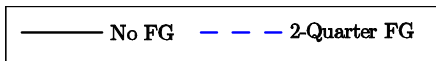
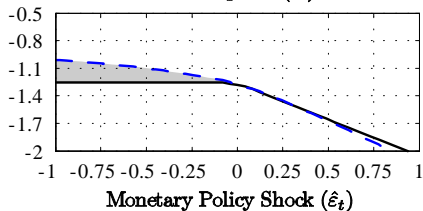
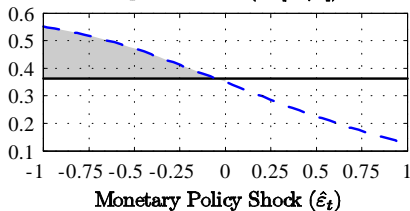
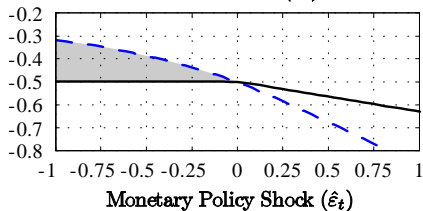
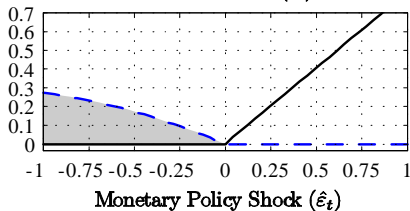
$$x_t = \sqrt{1/3}(\varepsilon_{r,t} + \varepsilon_{r,t-1} + \varepsilon_{r,t-2}).$$

Decision Rules: 2-Quarter Horizon

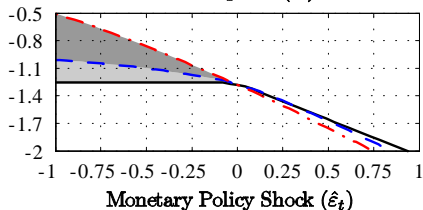
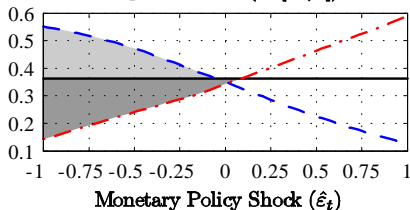
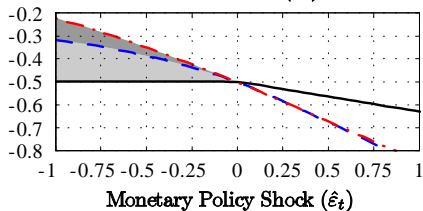
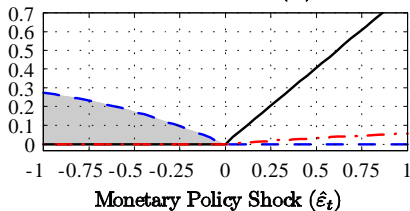
— No FG

Consumption (\hat{c}_t)Exp. Int. Rate ($E_t[\tilde{r}_{t+1}]$)Inflation Rate ($\tilde{\pi}_t$)Nom. Int. Rate (\tilde{r}_t)

Decision Rules: 2-Quarter Horizon

Consumption (\hat{c}_t)Exp. Int. Rate ($E_t[\tilde{r}_{t+1}]$)Inflation Rate ($\tilde{\pi}_t$)Nom. Int. Rate (\tilde{r}_t)

Decision Rules: 2-Quarter Horizon

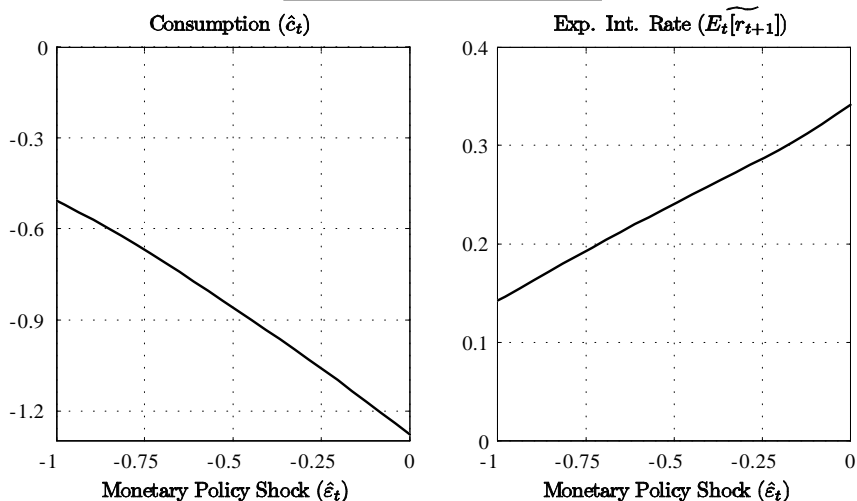
Consumption (\hat{c}_t)Exp. Int. Rate ($E_t[\widetilde{r}_{t+1}]$)Inflation Rate ($\widetilde{\pi}_t$)Nom. Int. Rate (\widetilde{r}_t)

2-Quarter Equal and Full Forward Guidance

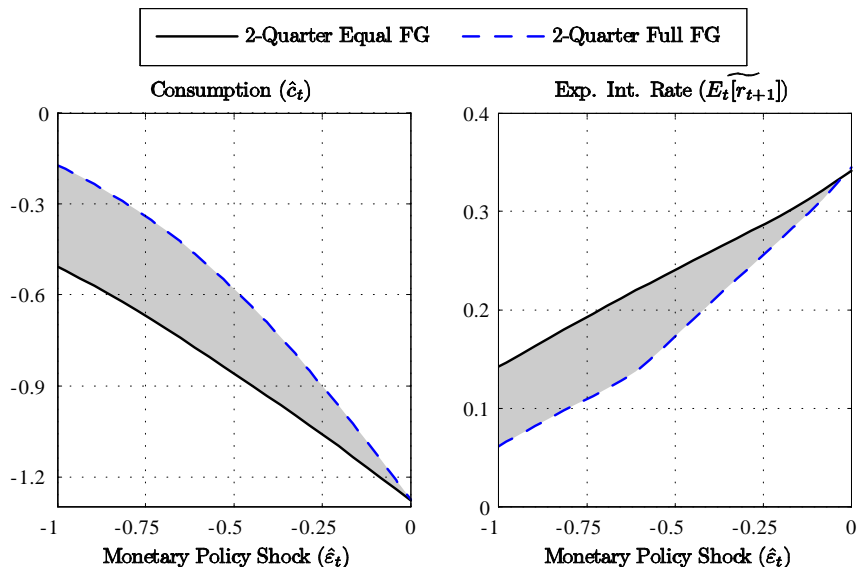
- Laseen and Svensson (2011), Carlstrom et al. (2012), Del Negro et al. (2012) and others examine forward guidance but do not hold the news process constant.
- We compare the stimulative effects of 2-quarter equal FG ($\alpha_0 = \alpha_1 = \alpha_2 = \sqrt{1/3}$) with 2-quarter full FG ($\alpha_0 = \alpha_1 = \alpha_2 = 1$).
- Same assumptions apply as in the original decision rules.

2-Quarter Equal and Full Forward Guidance

— 2-Quarter Equal FG



2-Quarter Equal and Full Forward Guidance



Longer Horizons: GIRFs to a Policy Shock

- To reduce dimensionality of our problem, the continuous distribution of the news shock is discretized using Tauchen's (1986) method.
- That is, we specify three values in the state space $(-50,0,50)$ for the news shock and calculate the probabilities of each event.
- The initial shadow interest rate, \tilde{r}_t^* , is set to -0.24 which is its average value conditional on the ZLB binding in a 500,000 quarter simulation.
- The GIRFs are calculated based on 10,000 Monte Carlo simulations.

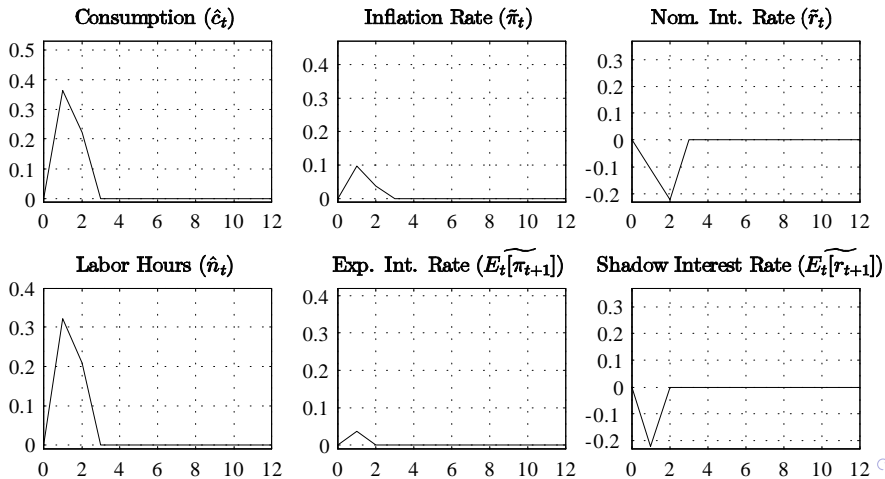
Longer Horizons: GIRFs to a Policy Shock cont'

- The GIRFs are the average difference between the responses from agents learning in period 1 of a -50 basis point policy shock to that of a random shock.
- Four types of FG are examined: 1-quarter, 4-quarter, 8-quarter, and 10-quarter equal FG:

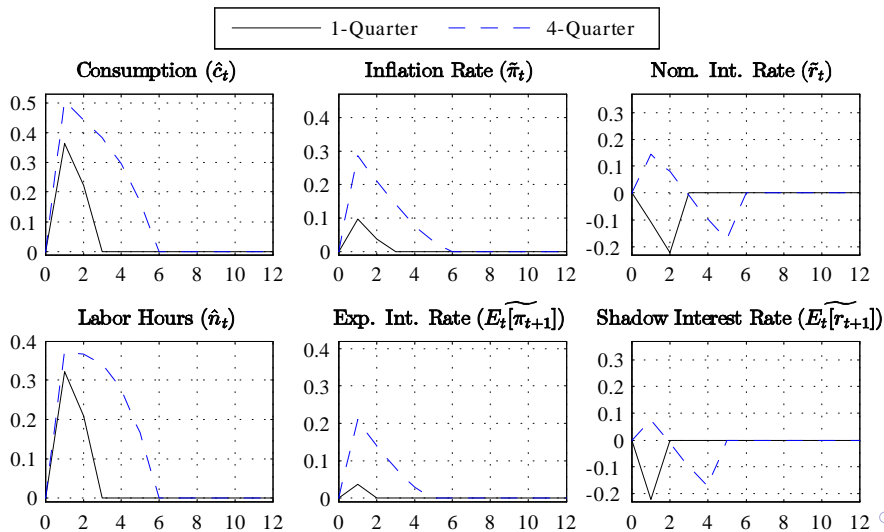
$$\{\alpha_i\}_{i=0}^m = \sqrt{1/(1+m)} \text{ for } i = 0, 1, \dots, m.$$

Longer Horizons: Generalized Impulse Responses to a Policy Shock

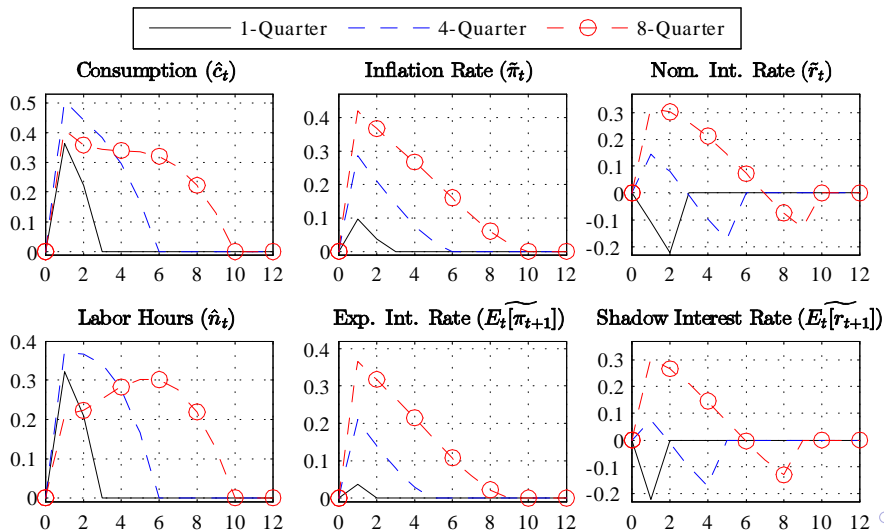
— 1-Quarter



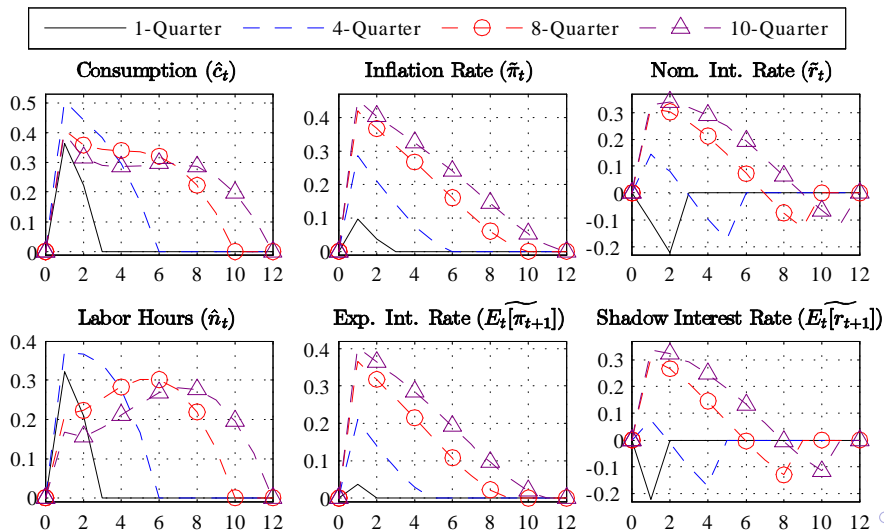
Longer Horizons: Generalized Impulse Responses to a Policy Shock



Longer Horizons: Generalized Impulse Responses to a Policy Shock



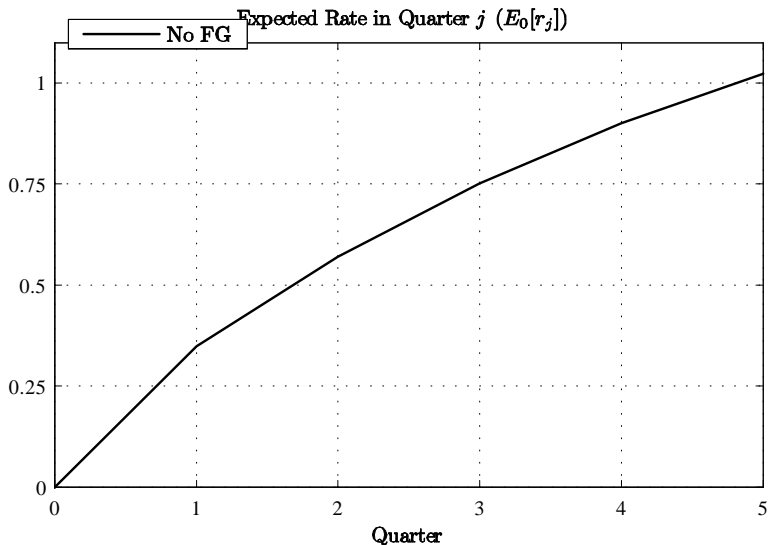
Longer Horizons: Generalized Impulse Responses to a Policy Shock



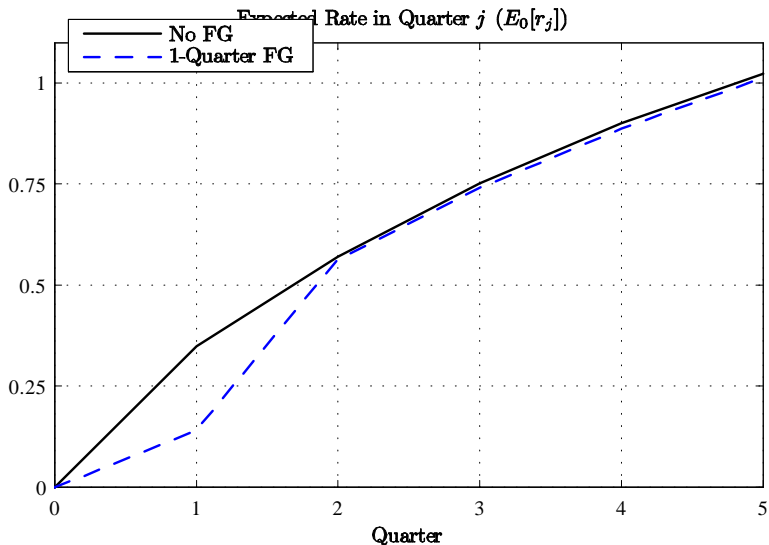
The Impact of a Policy Shock on Interest Rates

- Key assumptions same as earlier experiments
- Agents learn in period 0 about a -50 basis point shock.
- Four types of forward guidance (FG) are examined:
 1. No FG ($\alpha_0 = 1$)
 2. 1-quarter equal FG ($\alpha_0 = \alpha_1 = \sqrt{1/2}$)
 3. 2-quarter equal FG ($\alpha_0 = \alpha_1 = \alpha_2 = \sqrt{1/3}$)
 4. 4-quarter equal FG ($\alpha_0 = \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \sqrt{1/5}$)

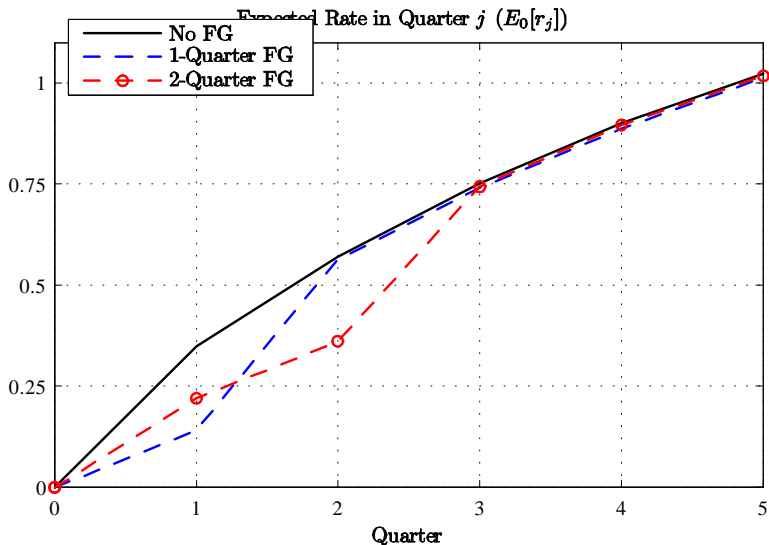
The Expected Interest Rate and Forward Guidance



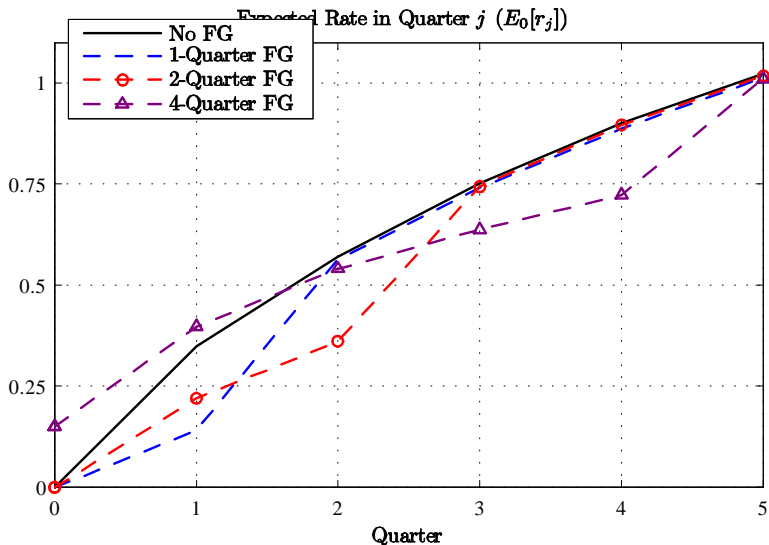
The Expected Interest Rate and Forward Guidance



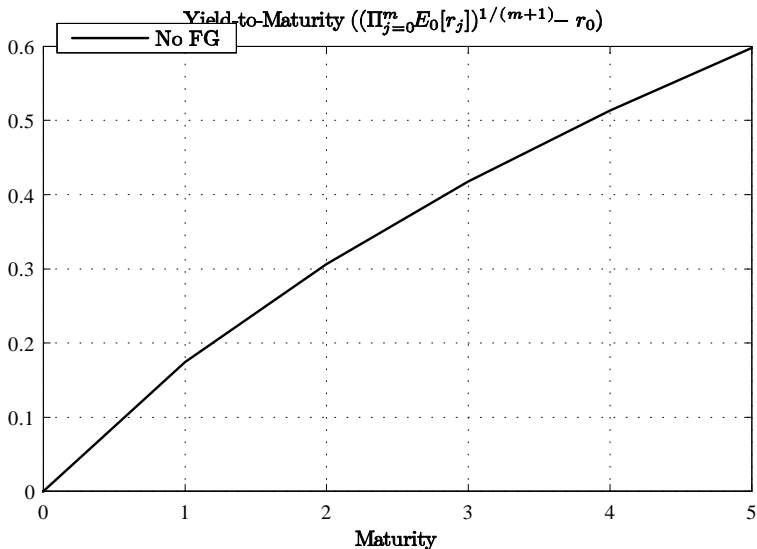
The Expected Interest Rate and Forward Guidance



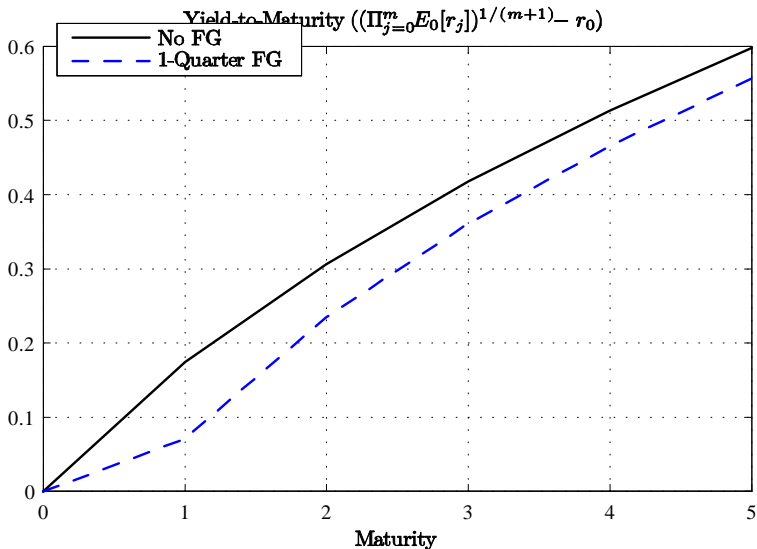
The Expected Interest Rate and Forward Guidance



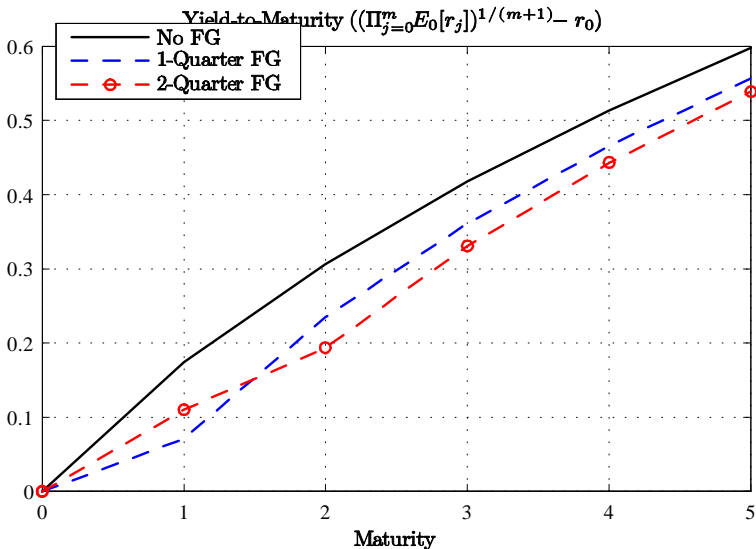
The Yield Curve and Forward Guidance



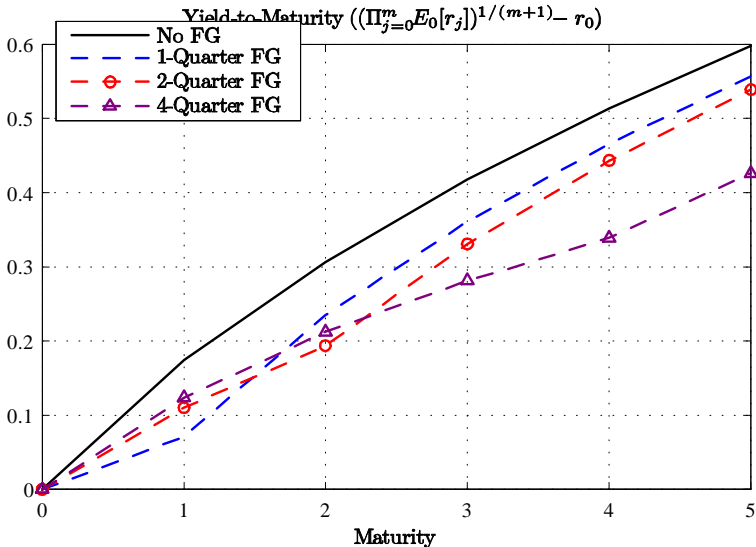
The Yield Curve and Forward Guidance

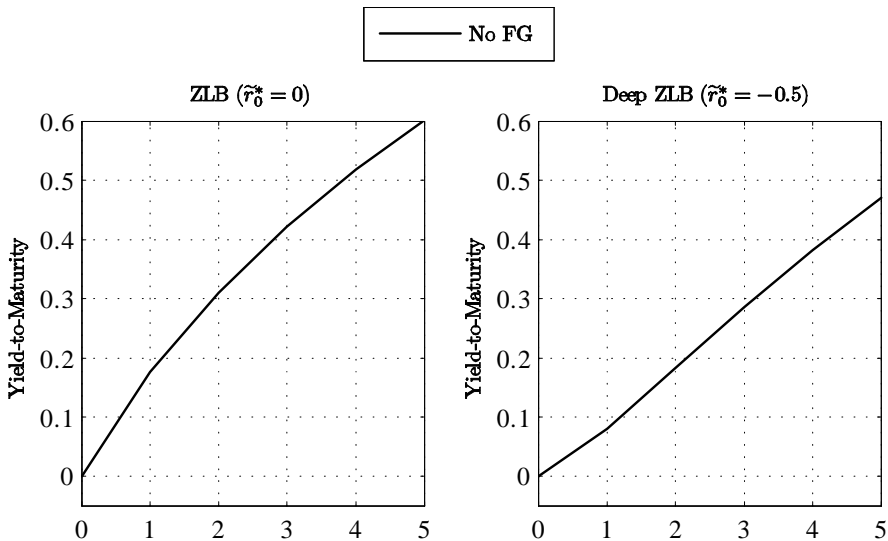


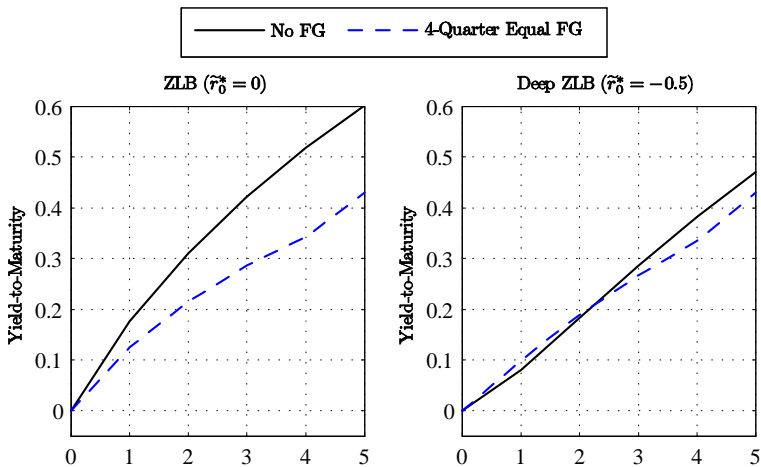
The Yield Curve and Forward Guidance



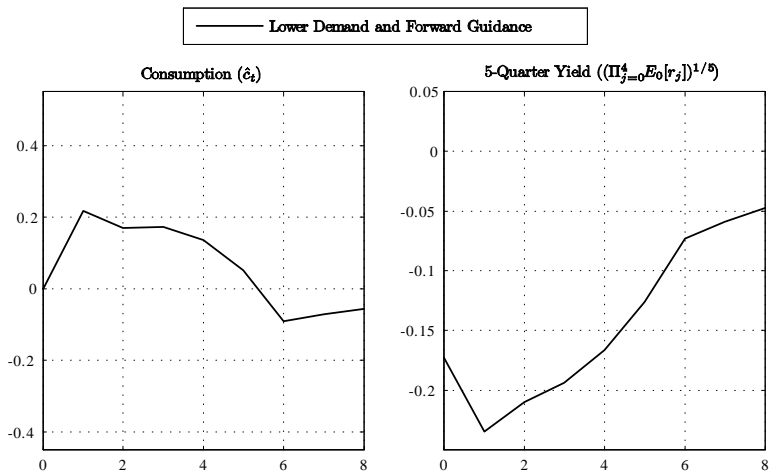
The Yield Curve and Forward Guidance



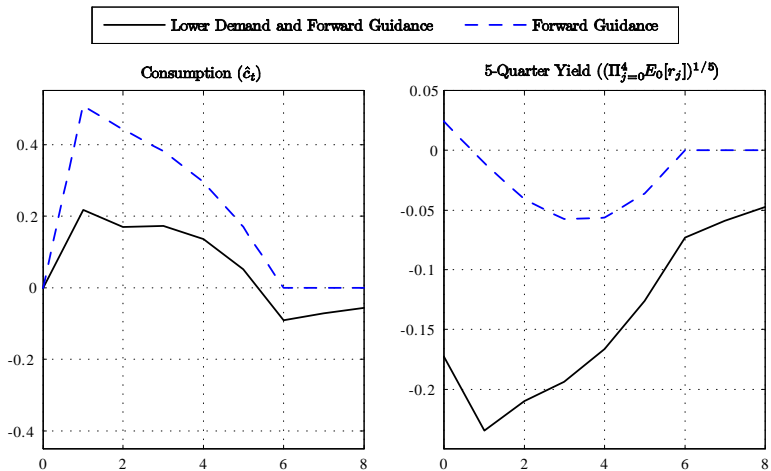
The Impact of the shadow interest rate at time t 

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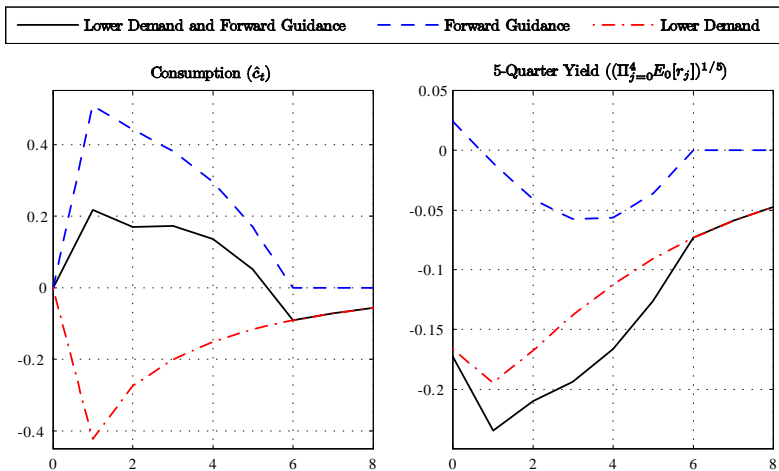
Low demand shock and 4-quarter equal forward guidance



Low demand shock and 4-quarter equal forward guidance



Low demand shock and 4-quarter equal forward guidance



Conclusions

- This paper examines forward guidance (FG) in a New Keynesian model where FG impacts the economy via news shocks to the monetary policy rule.
- Key findings:
 1. Conventional monetary policy is more stimulative than FG away from the ZLB.
 2. If agents believe the economy will recover slowly, then the stimulative effect of FG is limited.
 3. Longer FG horizons do not reverse the stimulative effect, but rather spread the effect across the entire horizon.