Forward Guidance and the State of the Economy

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What is Forward Guidance?

- Central bank communication about future policy (e.g., objectives, contingencies, policy actions, *etc.*)
- We focus on communication about future policy rates.
- Campbell et al. (2012) differentiate between two types:
  - Delphic forward guidance: A central bank's forecast of its own policy, which is based on its projections for inflation and real GDP growth as well as an established policy rule.
  - Odyssean forward guidance: A central bank's commitment to deviate from its policy rule at some time in the future when the policy rate is expected to rise above zero.

FORWARD GUIDANCE AT THE FED

- 12/08: FOMC lowered the FFR to $0 - 0.25\%$ and announced it would remain low for an *extended* period
- 8/11: low rate warranted "*at least through mid-2013*"
- 1/12: updated the date to "*at least through late 2014*" and expressed a more pessimistic economic outlook
- 9/12: "*considerable time after the economic recovery strengthens*" likely warranted "*at least through mid-2015*"
- 12/12: "*unemployment rate remains above* $6\text{-}1/2\%$"
- 12/13: "*well past the time the unemployment rate declines*"
- 6/14: "*considerable time after the asset purchase program*"
- 1/15: "it can be *patient* in beginning to normalize" rates

CONTRIBUTIONS TO THE LITERATURE

- We examine forward guidance (FG) in a model where FG impacts the economy via news shocks to the policy rule.
  - The news is the difference between the expected policy rates before and after the central bank's announcement.
  - The total weight on the news is held constant to isolate the effect of a longer horizon from a larger policy shock.
- We show how the following impact the efficacy of FG:
  - ZLB constraint
  - State of the economy
  - Size of the news shocks
  - Speed of the recovery
  - Forward guidance horizon
- We use our results to interpret the effects of recent FG

Key Findings

1. The stimulative effect of FG falls as the economy deteriorates or as households expect a slower recovery.
2. Longer FG horizons do not generate increasingly larger impact effects on output when the total amount of news is fixed, unlike with an exogenous interest rate peg.
3. In steady state, an unanticipated shock has a larger impact effect on output than a news shock, but a news shock has a larger cumulative effect in every state of the economy.
4. At the ZLB, the cumulative effect of a longer FG horizon increases over short horizons but decreases thereafter.
5. FG is stimulative in the absence of other shocks, but the observed effect on output is smaller or even negative if another shock simultaneously reduces demand.

KEY MODEL FEATURES

- Households:
  - Value consumption and leisure with preferences

$$E_0 \sum_{t=0}^{\infty} \widetilde{\beta}_t [\log c_t - \chi n_t^{1+\eta}/(1+\eta)]$$

    where $\chi > 0$, $\tilde{\beta}_0 \equiv 1$ and $\tilde{\beta}_t = \prod_{j=1}^{t} \beta_j$ for $t > 0$
  - Cashless economy and bonds are in zero net supply
- Monopolistically competitive intermediate firms:
  - Choose inputs to minimize costs
  - Choose prices to maximize the present value of profits subject to a quadratic price adjustment cost
- Perfectly competitive final goods firm:
  - Combines the intermediate inputs to produce a final good
  - Choose intermediate inputs to maximize profits

Central Bank and Forward Guidance

- Households receive forward guidance about future policy through a discretionary monetary policy shock.
- Central bank sets the nominal interest rate according to

$$i_t = \max\{\underline{\imath}, i_t^*\}, \qquad i_t^* = \bar{\imath}(\pi_t/\bar{\pi})^{\phi_\pi}(y_t/\bar{y})^{\phi_y}\exp(x_t),$$

$$x_t \equiv \sum_{j=0}^{q}\alpha_j\varepsilon_{t-j}, \quad \sum_{j=0}^{q}\alpha_j = 1,$$

  - x: news (either anticipated or unanticipated)
  - $\varepsilon \sim \mathbb{N}(0,\sigma^2)$: monetary policy shock
  - $\alpha_j \in [0,1]$: weight on the shock j periods in the future
  - q: forward guidance horizon
  - The restriction on the weights of the shocks allows us to isolate the effect of a longer horizon from a larger shock.

Advantages of News Shocks

- A way to model innovations in households' expectations
- Enables the policy rate to endogenously respond to changes in economic conditions, whereas an interest rate peg fixes the policy rate regardless of economic conditions
- Households' expectations incorporate the possibility that the central bank alters its previous forward guidance policy
- Households form expectations about the possibility the central bank will provide news that it plans to exit the ZLB
- Allows us to isolate the effects of different FG horizons
- They are important for matching data [Gomes et al. (2013); Milani and Treadwell (2012); Campbell et al. (2012)]

Competitive Equilibrium

Consists of sequences of quantities $\{c_t, n_t, y_t\}_{t=0}^{\infty}$, prices $\{w_t, i_t, \pi_t\}_{t=0}^{\infty}$, and shocks $\{\beta_t\}_{t=0}^{\infty}$ that satisfy:

$$w_t = \chi n_t^{\eta} c_t$$

$$1 = i_t E_t[\beta_{t+1}(c_t/c_{t+1})/\pi_{t+1}]$$

$$y_t = n_t$$

$$\varphi\left(\frac{\pi_t}{\bar{\pi}} - 1\right)\frac{\pi_t}{\bar{\pi}} = 1 - \theta + \theta w_t + \varphi E_t\left[\beta_{t+1}\frac{c_t}{c_{t+1}}\left(\frac{\pi_{t+1}}{\bar{\pi}} - 1\right)\frac{\pi_{t+1}}{\bar{\pi}}\frac{y_{t+1}}{y_t}\right]$$

$$c_t = [1 - \varphi(\pi_t/\bar{\pi} - 1)^2/2]y_t \equiv y_t^{gdp}$$

$$i_t = \max\{\underline{\imath}, \bar{\imath}(\pi_t/\pi^*)^{\phi_\pi}(y_t/\bar{y})^{\phi_y}\exp(x_t)\}$$

$$\beta_t = \bar{\beta}(\beta_{t-1}/\bar{\beta})^{\rho_\beta}\exp(\upsilon_t)$$

Data and Calibration

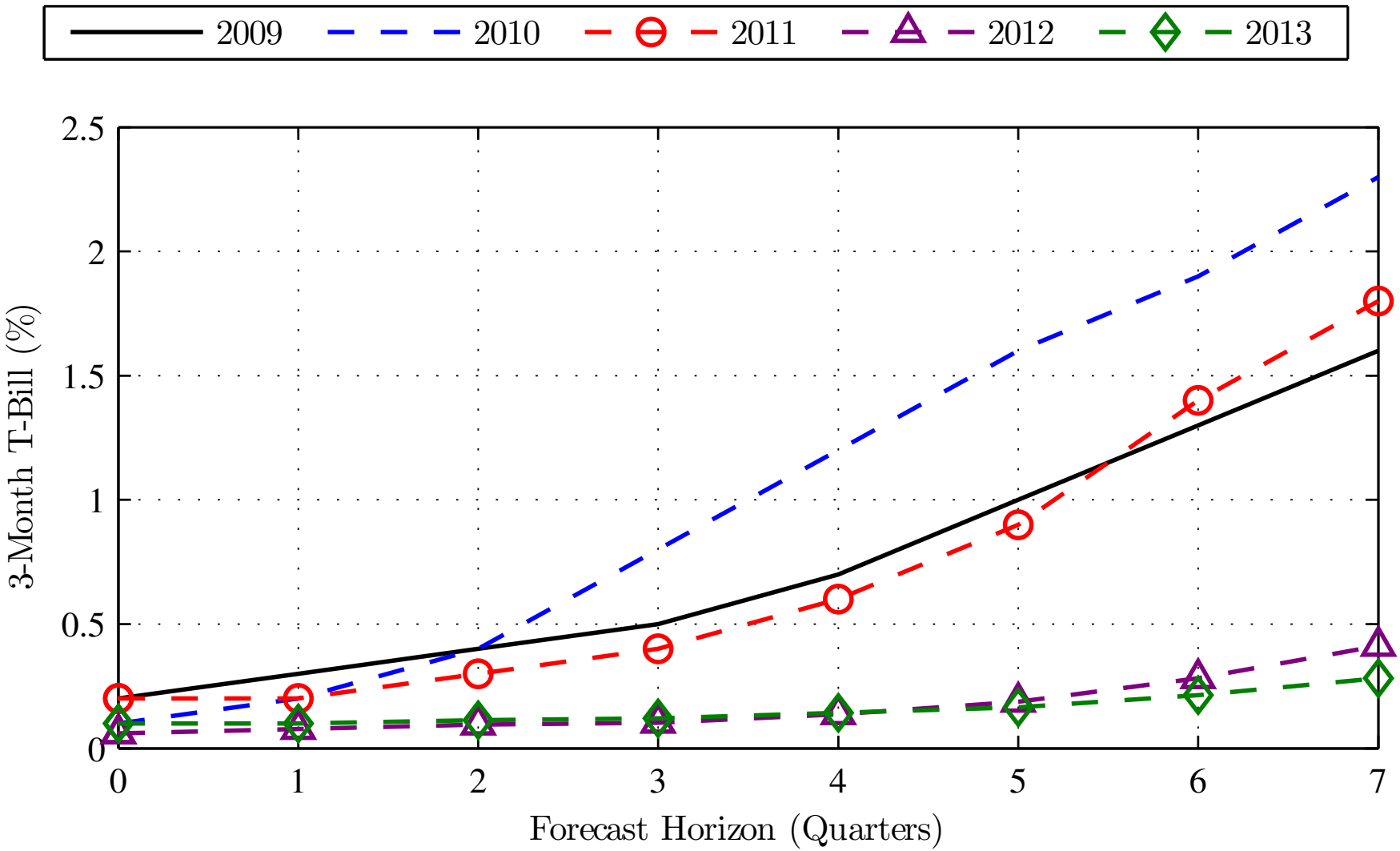
Calibration (Quarterly)

Steady-State Disc. Factor	$\bar{\beta}$	0.9957	Lower Bound	$\underline{\imath}$	1.00022
Frisch Labor Supply Elasticity	$1/\eta$	3	Response to Inflation	ϕ_π	2
Elasticity of Substitution	θ	6	Response to Output	ϕ_y	0.08
Price Adjustment Cost	φ	160	Disc. Factor Persistence	ρ_β	0.87
Steady-State Labor	$\bar{n}$	0.33	Disc. Factor St. Dev.	σ_ε	0.00225
Steady-State Inflation	$\bar{\pi}$	1.0057	Policy Shock St. Dev.	σ_ν	0.003

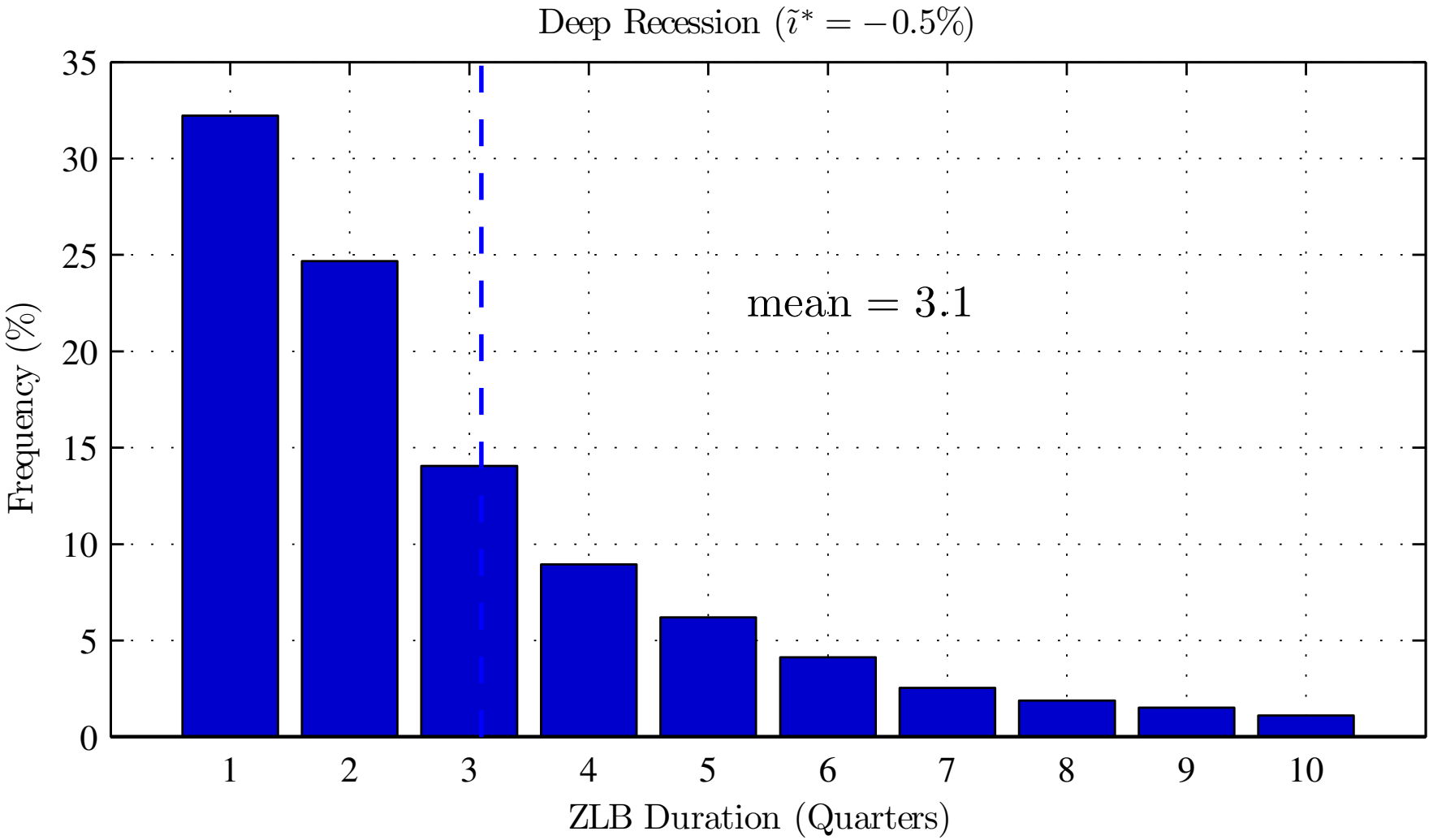
Standard Deviations

	Real GDP Growth	Inflation (Deflator)	Interest Rate (T-Bill)
Data	2.58%	0.99%	2.79%
Model	2.45%	1.07%	2.29%
	(1.92%, 3.67%)	(0.74%, 1.63%)	(1.83%, 2.90%)

Blue Chip Consensus Forecasts



Distribution of ZLB Events



Solution Method

- Compute nonlinear solutions using policy function iteration
  - Linear interpolation and Gauss Hermite quadrature
- We are the first to study FG using a global solution method
- This method enhances our analysis in several ways:
  1. Enables ZLB events to endogenously reoccur, which impacts households' expectations of future policy rates and the central bank's ability to provide economic stimulus
  2. Allows us to examine FG in any state of the economy
  3. We can study FG in a setting where changes in economic conditions alter the probability and duration of a ZLB event
  4. We are able to analyze FG across all possible realizations of shocks, which nonlinearly impact the economy

EXPERIMENTS: 1-QUARTER HORIZON

- Key Assumptions:
  - We initialize the discount factor at $\hat{\beta}_t = 0.6$, which is the minimum value of $\hat{\beta}$ necessary for the ZLB to bind.
  - In the absence of any "news" shocks, agents expect $\hat{\beta}$ to gradually revert to its mean so that $E_t[i_{t+k}] > 0$, $k > 0$.
- Three types of forward guidance are examined:
  1. No FG ($\alpha_0 = 1$)

$$x_t = \varepsilon_t$$

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

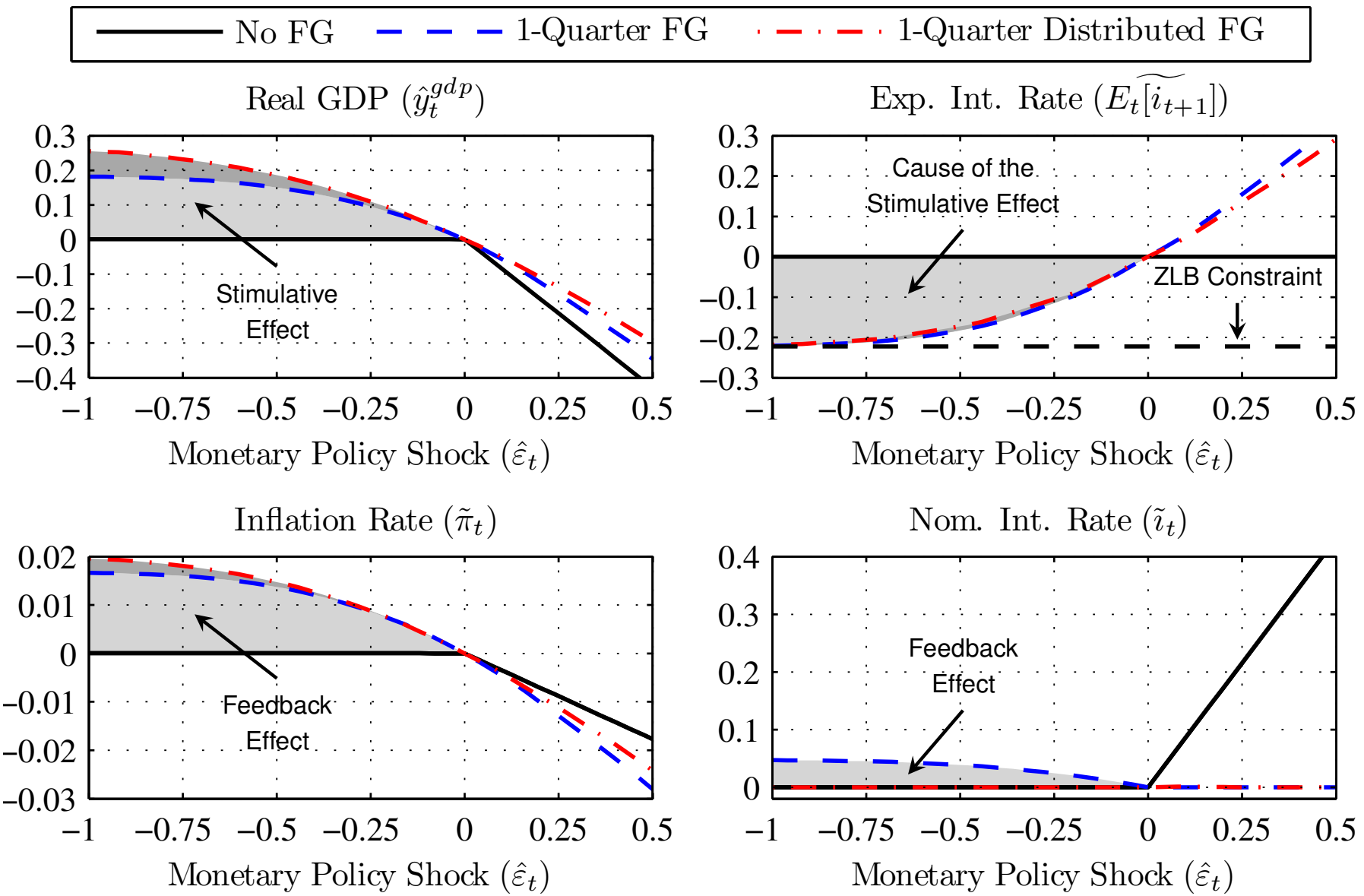
$$x_t = \varepsilon_{t-1}$$

  3. 1-Quarter Distributed FG ($\alpha_0 = 0.13$ and $\alpha_1 = 0.87$)

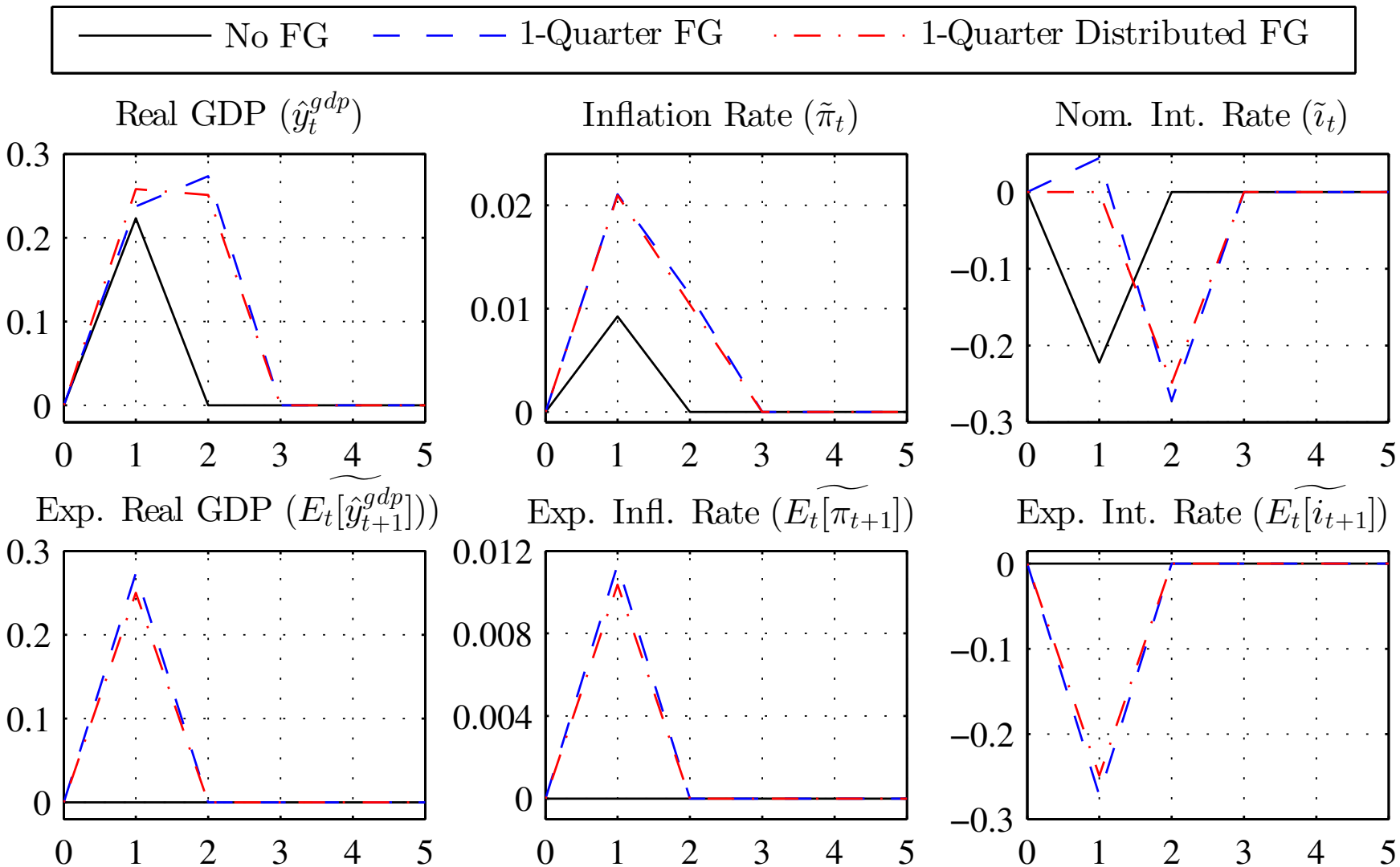
$$x_t = 0.13\varepsilon_t + 0.87\varepsilon_{t-1}.$$

     These weights eliminate feedback effects on the policy rate.

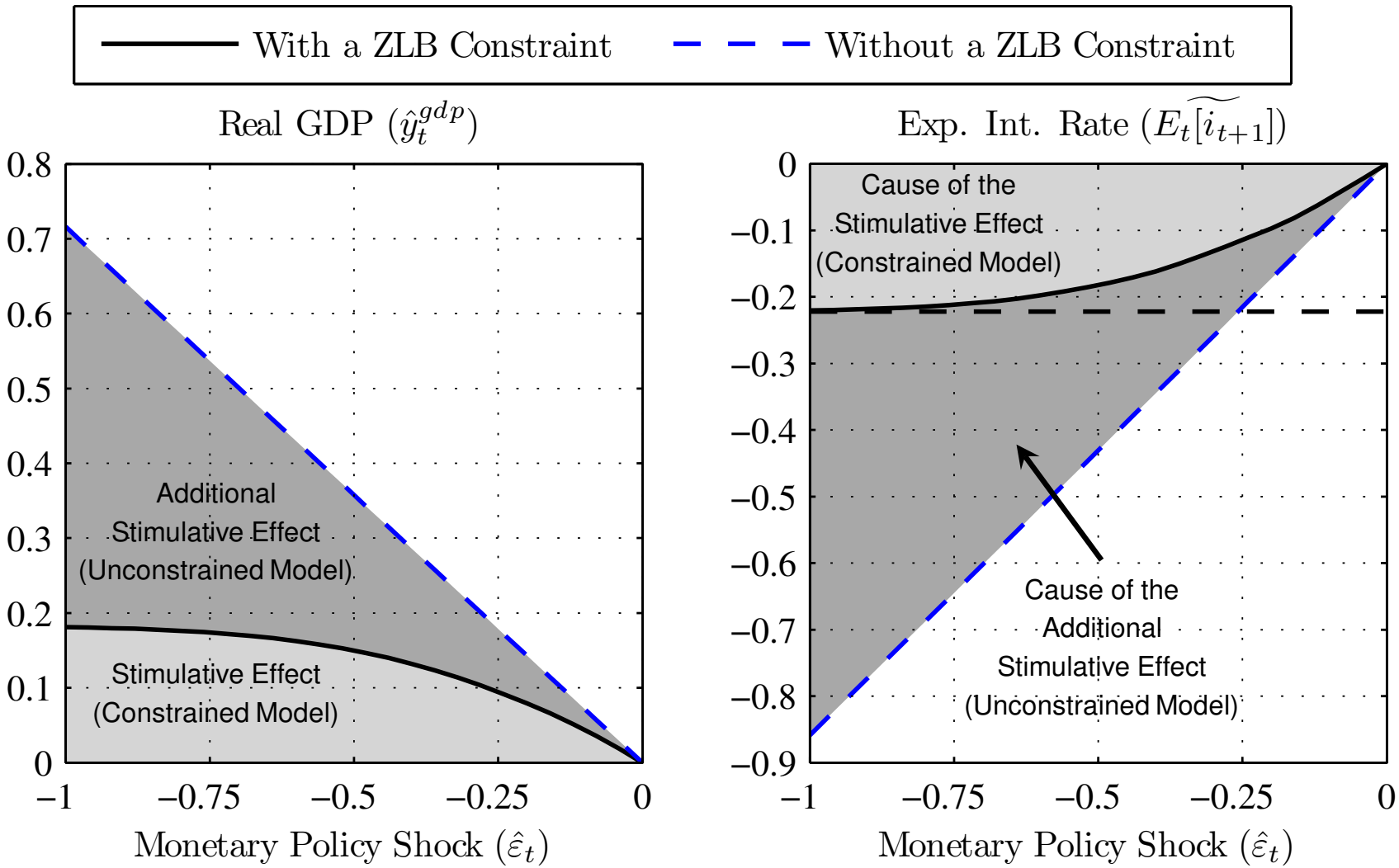
Solution: 1-Quarter Horizon



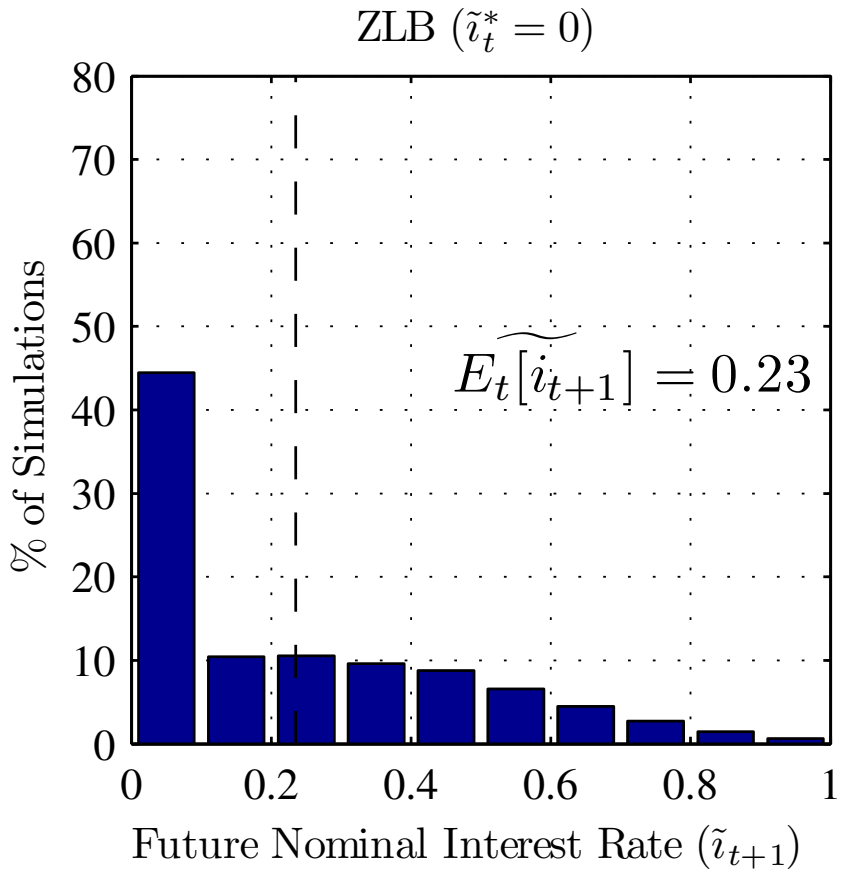
Impulse Responses: 1-Quarter Horizon

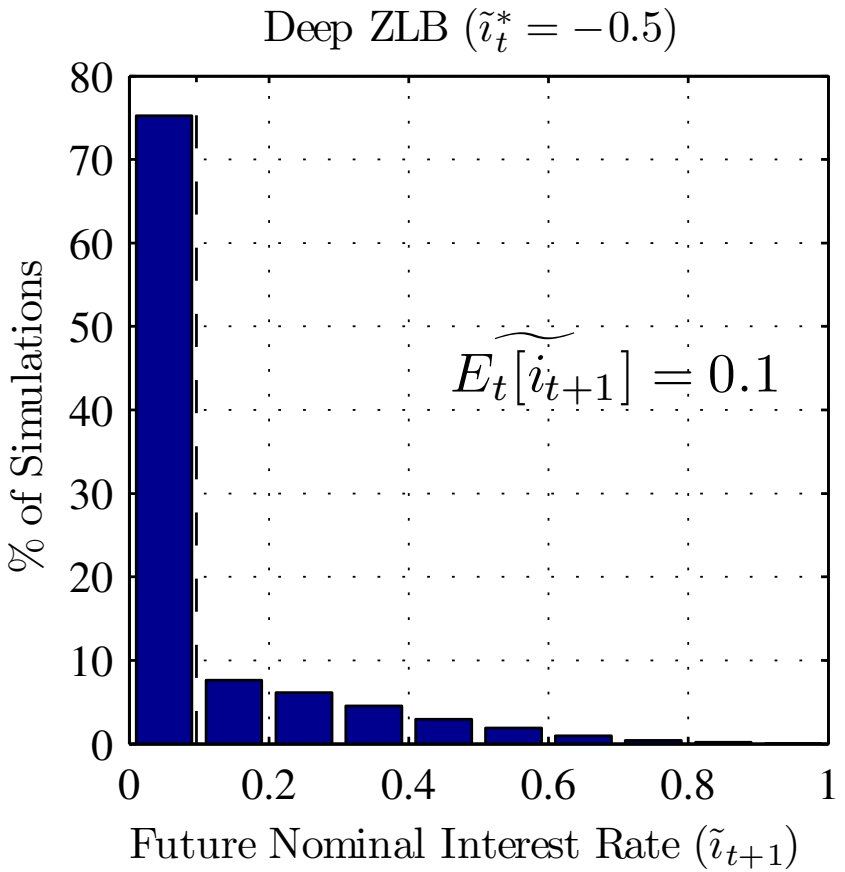


Importance of the ZLB Constraint

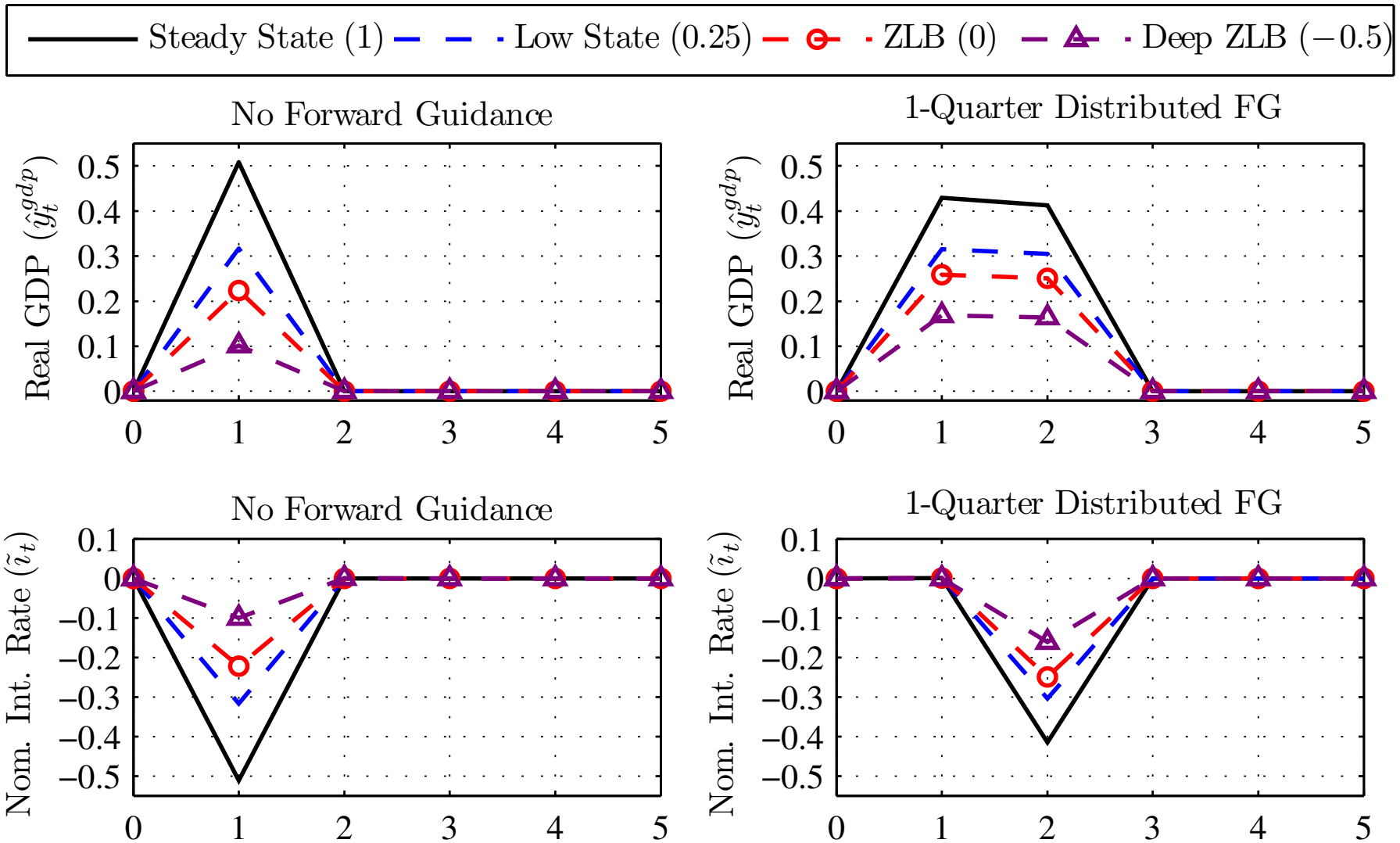


Future Interest Rate Distributions

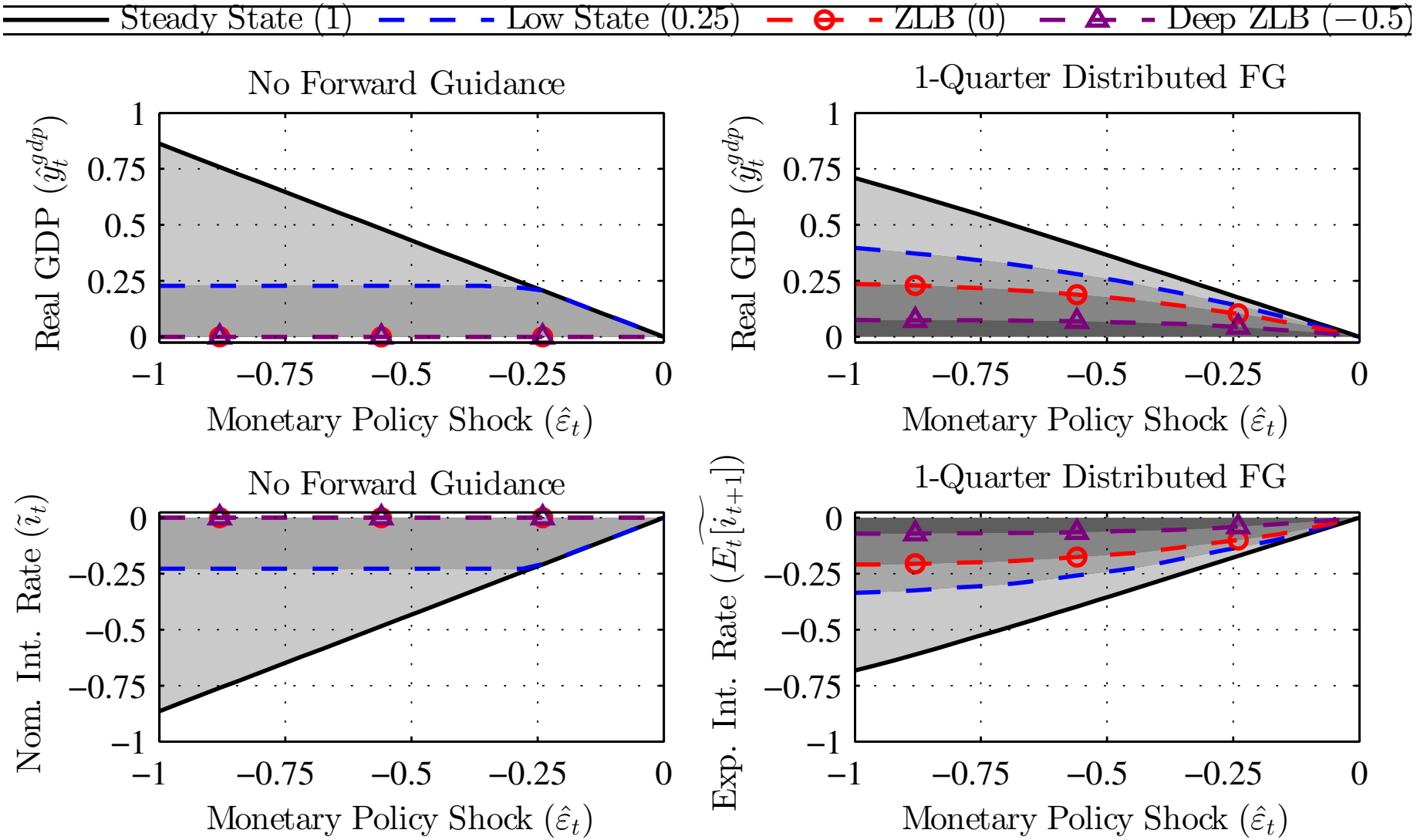




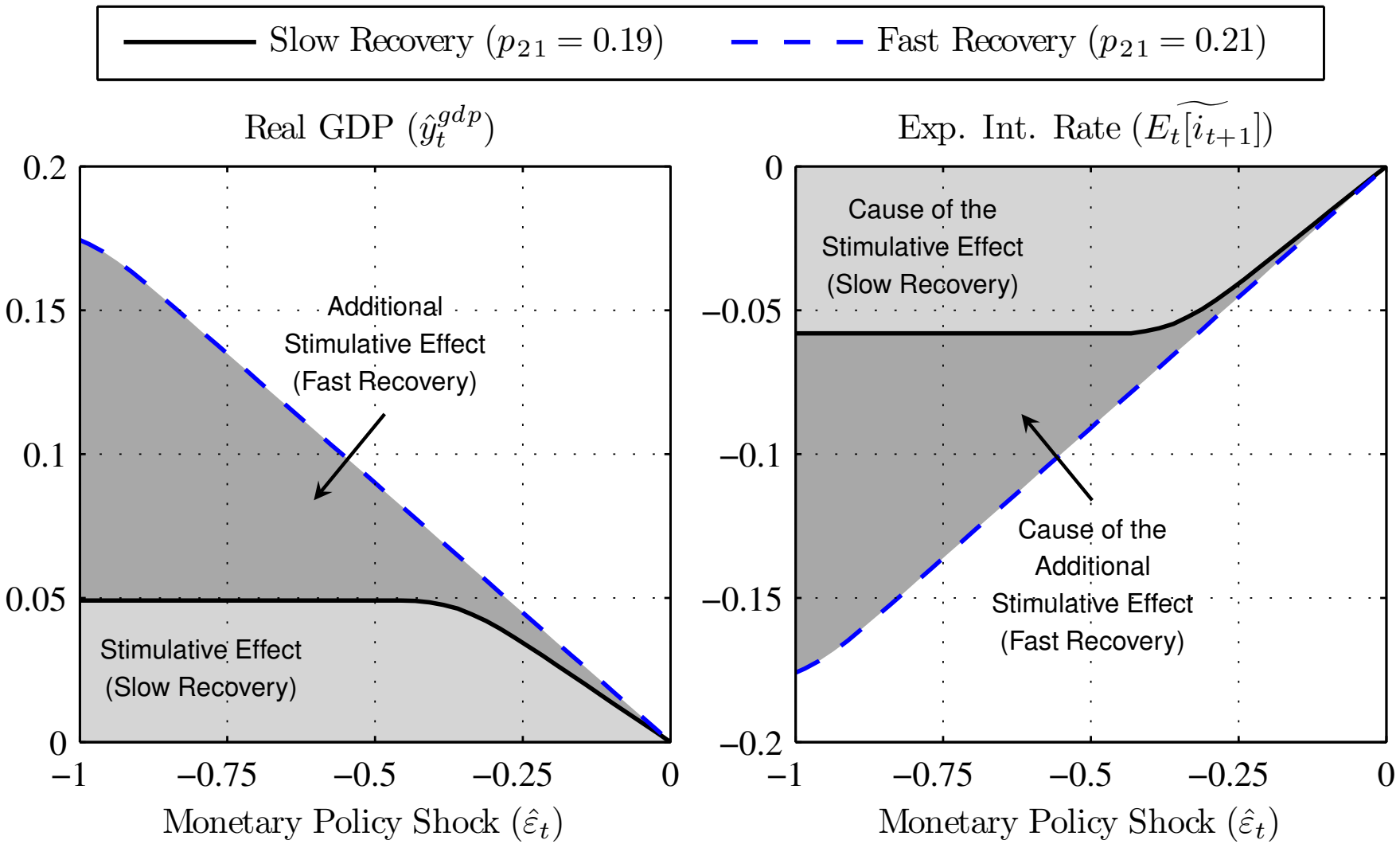
State of the Economy



Size of the Shock



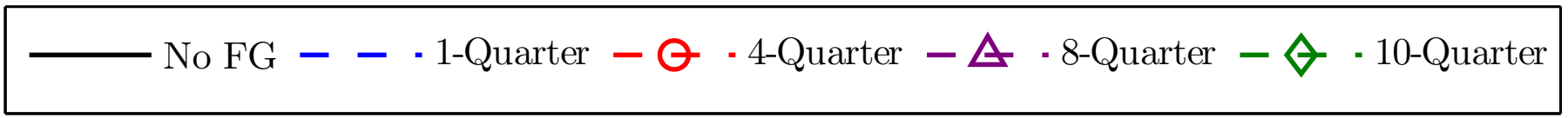
Speed of the Recovery

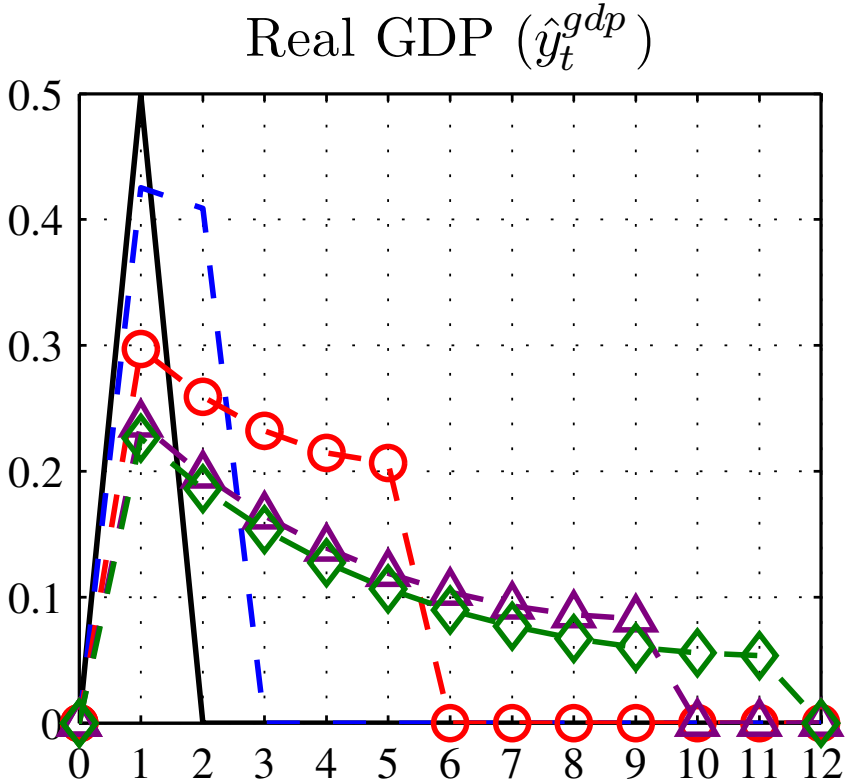


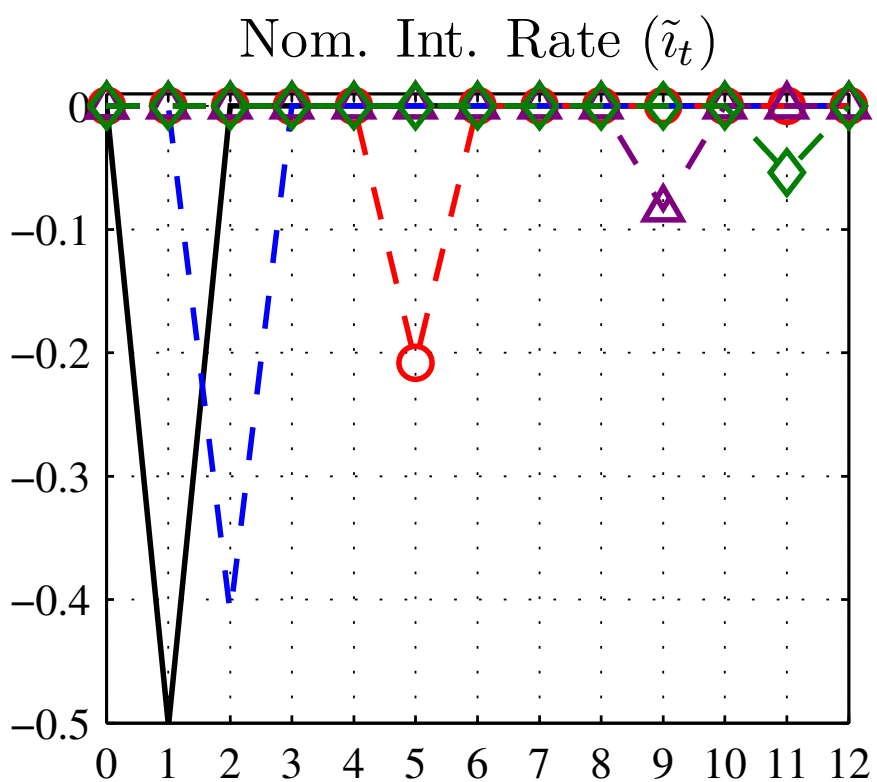
EXPERIMENTS: LONGER HORIZONS

- To reduce the dimensionality of our problem, the continuous distribution of the news shock is discretized using the method described in Tauchen (1986).
- We specify three values $(-60, 0, 60)$ for each news shock and calculate the probabilities of each event.
- Agents learn in period 1 about a -60 basis point policy shock that is distributed over the forward guidance horizon.
- Four types of FG are examined: 1-quarter, 4-quarter, 8-quarter, and 10-quarter distributed FG.
- In each simulation, the weights (α_j, $j = 0, 1, \ldots, q$) are set to eliminate any feedback effects on the policy rate.

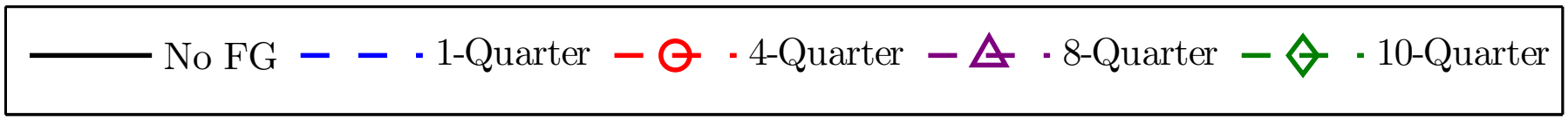
RESPONSES AT STEADY STATE

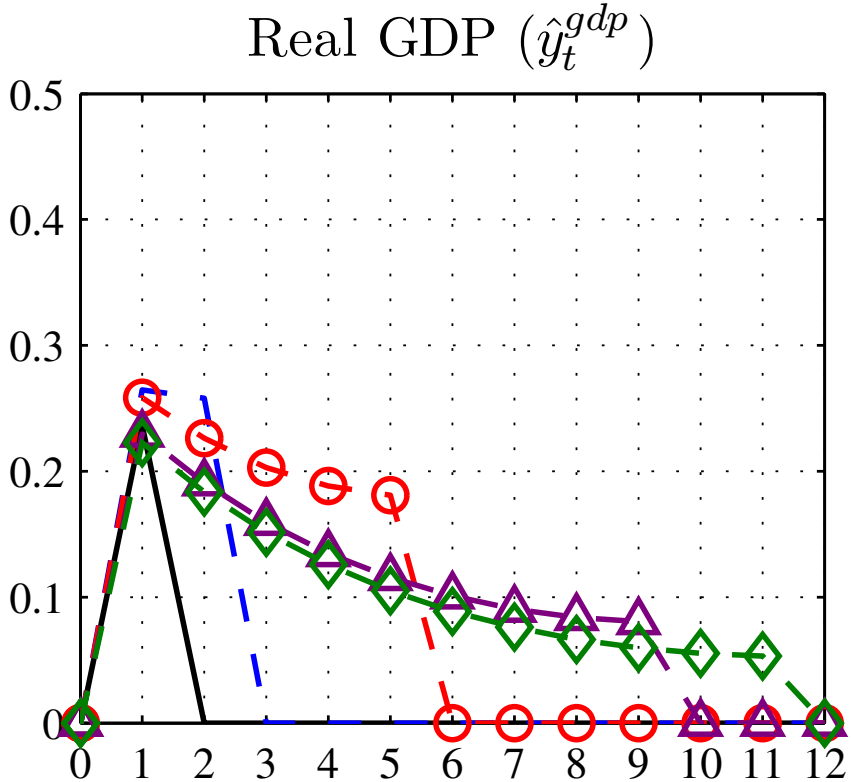


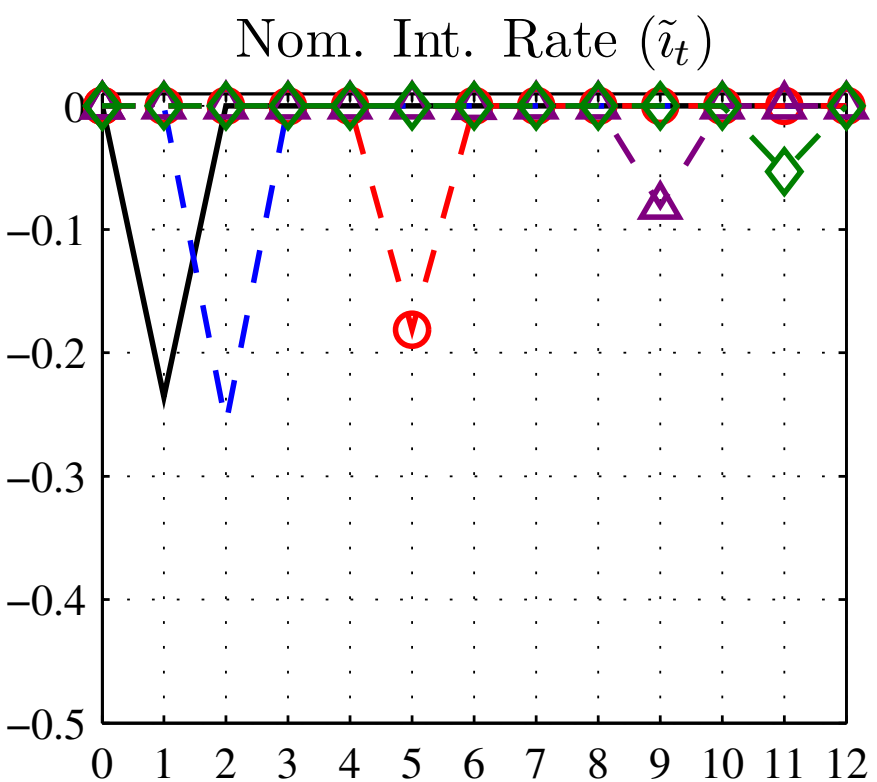




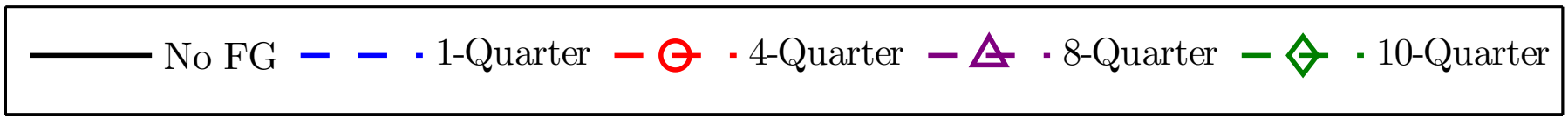
Responses at the ZLB

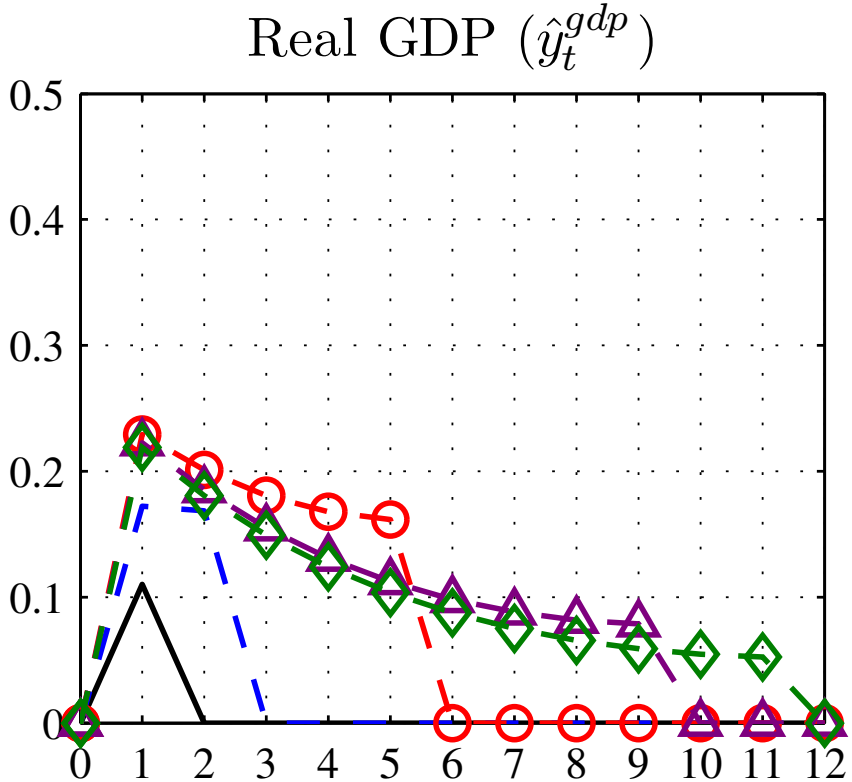


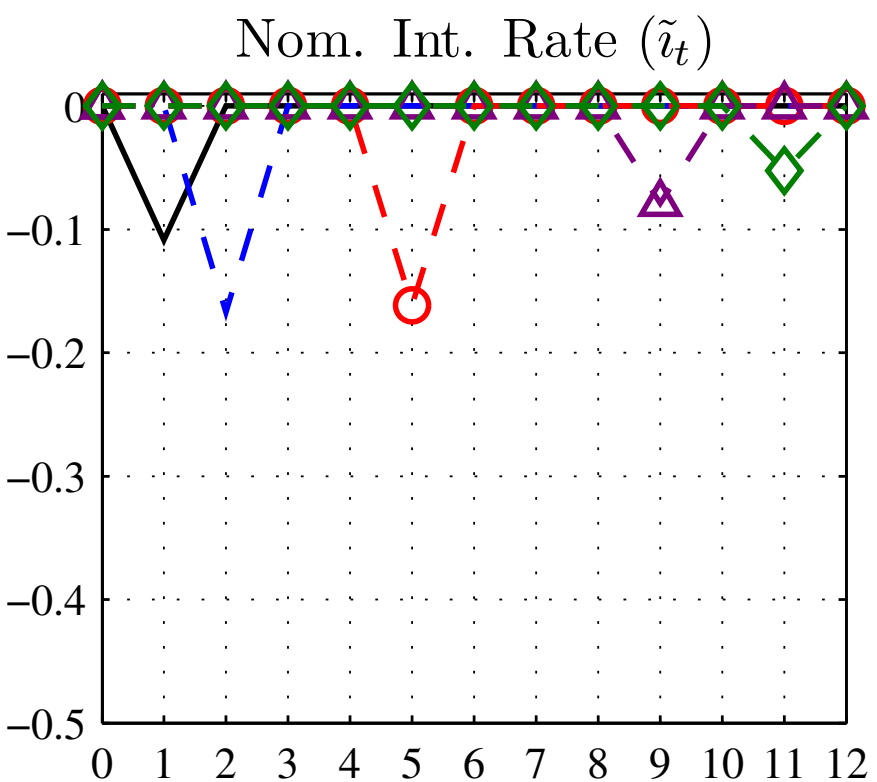




Responses at a Negative Notional







Cumulative Effect on Output

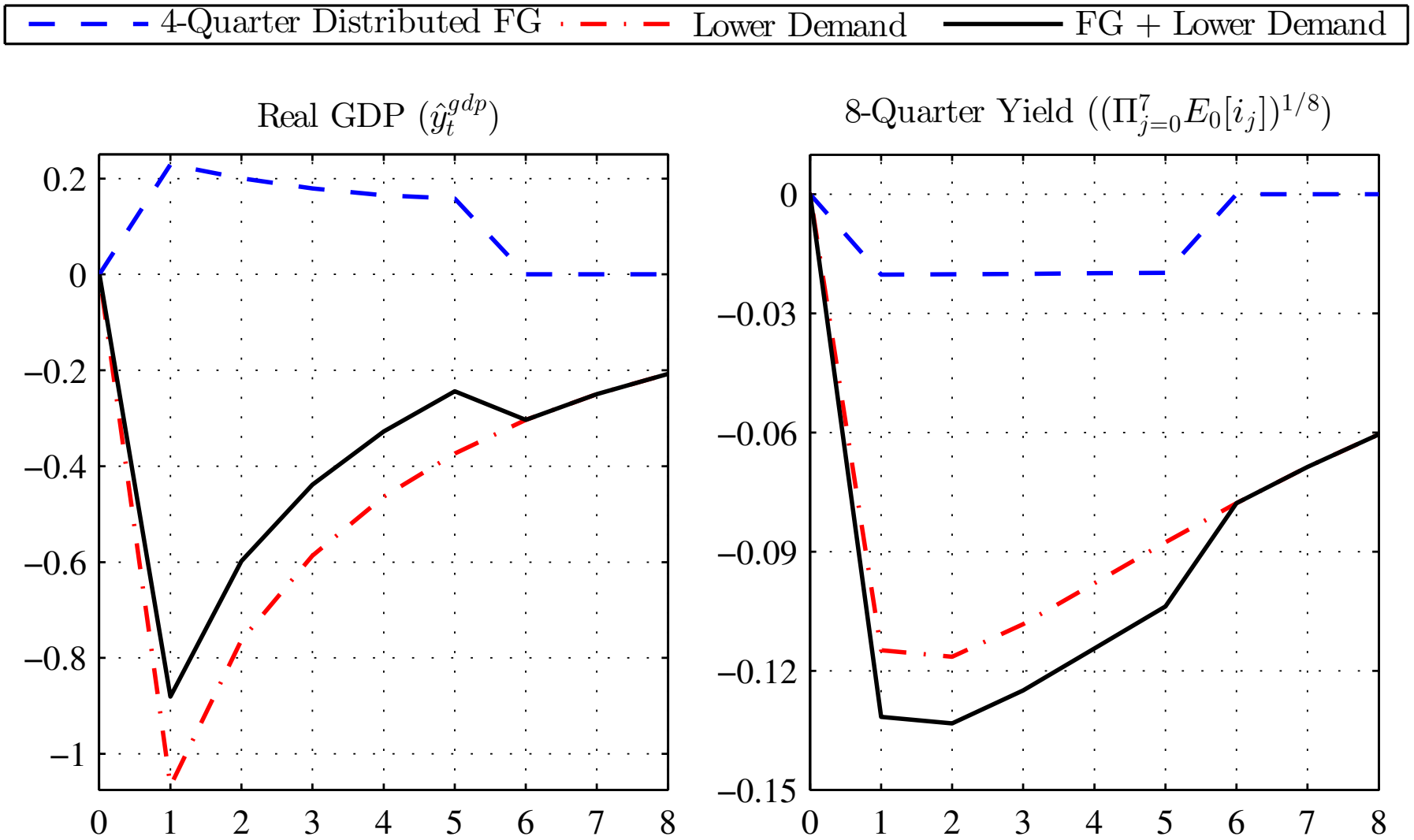
Present value of the cumulative percent change in real GDP:

$$\text{Cumulative Effect } \hat{y}(q) = \frac{1}{N}\sum_{j=1}^{N}\sum_{t=1}^{q+1}\frac{100(y_{j,t}^{\varepsilon}/y_{j,t}^{no\ \varepsilon}-1)}{\prod_{k=2}^{t} r_{j,k}},$$

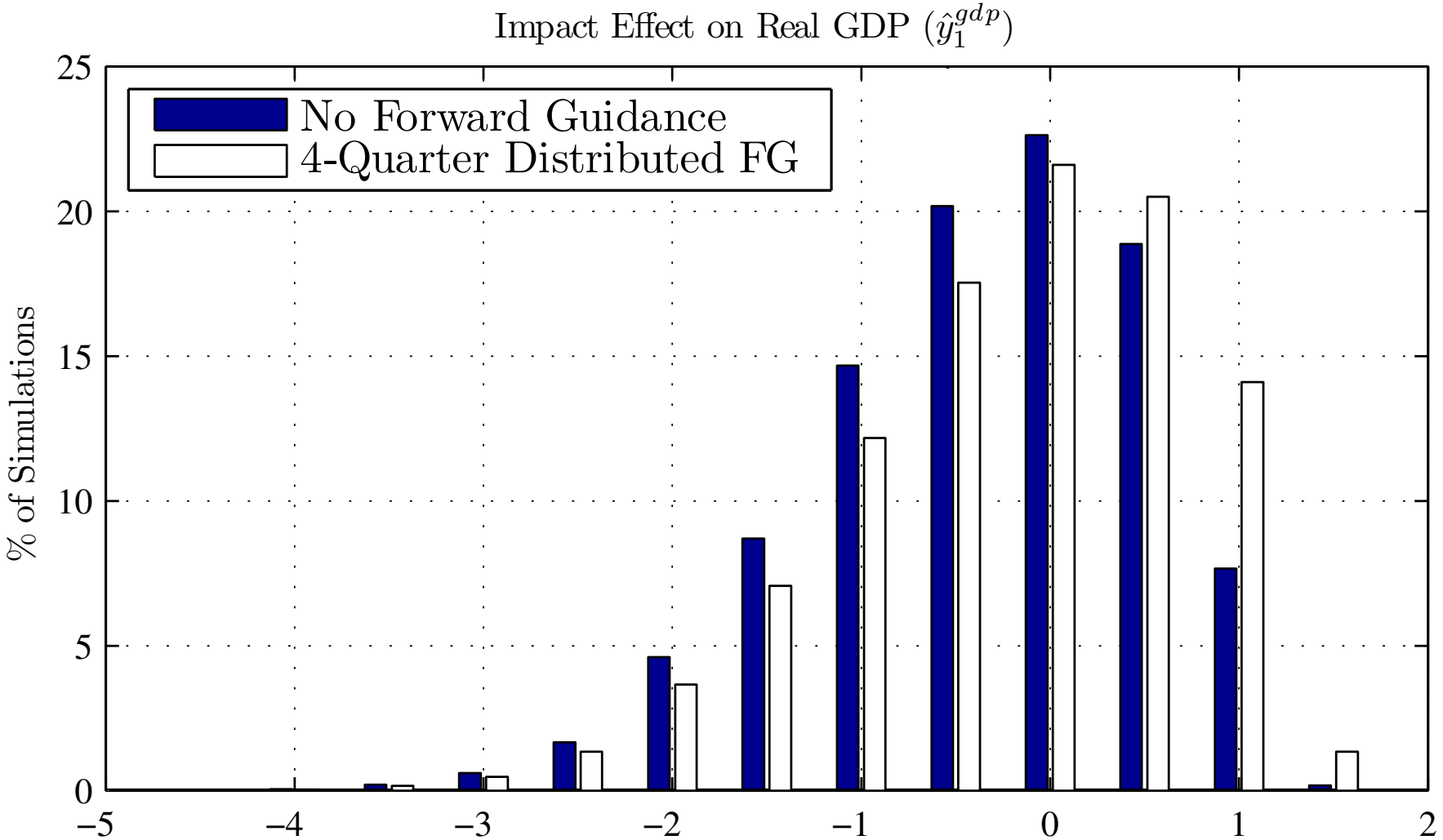
Initial State of the Economy	Forward Guidance Horizon 0	1	4	8	10
Steady State ($\tilde{i}_0^* = 1$)	0.50	0.83	1.19	1.20	1.17
Recession ($\tilde{i}_0^* = 0$)	0.23	0.51	1.00	1.09	1.09
Deep Recession ($\tilde{i}_0^* = -0.5$)	0.11	0.33	0.87	1.03	1.04

$\rightarrow$ Limit on how far the horizon can extend and add stimulus.

Effect of Lower Demand



Distribution of Real GDP



Effects of an Interest Rate Peg

Nominal interest rate:

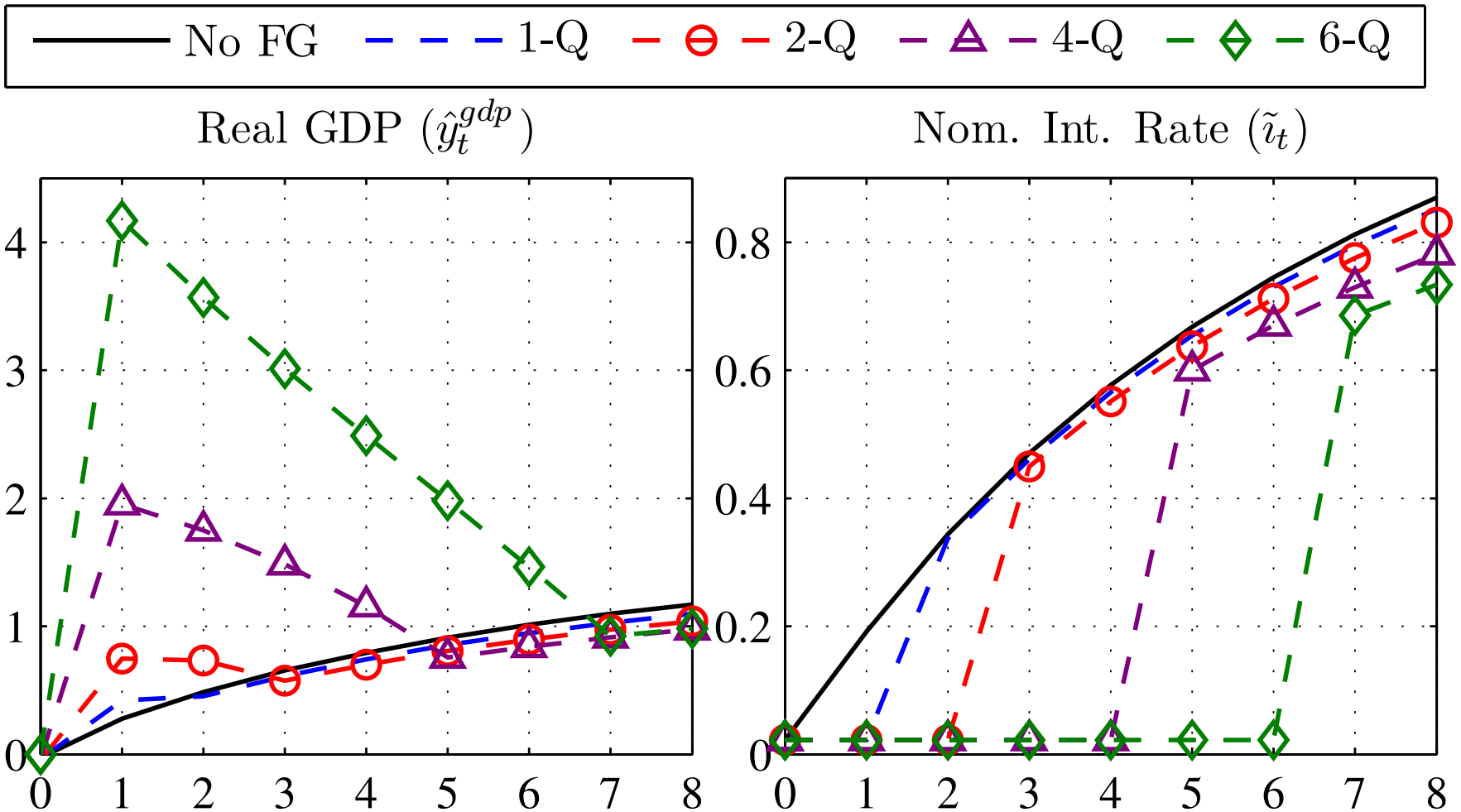
$$i_t = \begin{cases} \max\{\underline{\imath}, i_t^*\} & \text{for } e_t = 0 \\ \underline{\imath} & \text{for } e_t = 1 \end{cases}$$

FG is characterized by a vector of nominal interest rate policies, $[e_t, e_{t+1}, \ldots, e_{t+q}]$, communicated in period t over horizon q.

Example: 1-Quarter FG:

$$F(1) = \begin{bmatrix} 0 & 0 \\ 1 & 0 \\ 0 & 1 \\ 1 & 1 \end{bmatrix} \qquad P(1) = \begin{bmatrix} p & 0 & 1-p & 0 \\ p & 0 & 1-p & 0 \\ 0 & p & 0 & 1-p \\ 0 & p & 0 & 1-p \end{bmatrix}$$

Effects of an Interest Rate Peg



Drawbacks of an Interest Rate Peg

- Cannot respond to changes in economic conditions
- Households never expect the central bank to modify previously announced forward guidance policies
- An interest rate peg does not allow the effects of additional news to be separated from a longer horizon
- Less flexible than news shocks (i.e., a peg represents a specific sequence of news that pushes the expected nominal interest rate to zero over a given horizon)

Case Study: Forward Guidance in 2011

- The FOMC announced in its August 9, 2011 policy statement that it expected the federal funds rate to remain between 0-25 basis points until mid-2013.
- Estimating the effect of that announcement is complicated by the fact that GDP was revised downward just 11 days before the FOMC's statement was released.
- To separate the impact of the events, we use consensus forecasts from the Blue Chip Financial Forecasts (BCFF) and the Blue Chip Economic Indicators (BCEI) survey.

3-Month T-Bill Consensus Forecasts

	2011Q4	2012Q1	2012Q2	2012Q3	2012Q4
BCFF (7/20-21)	0.14	0.26	0.43	0.75	1.08
			GDP revision (7/29)		
BCEI T-bill (8/4-5)	0.13	0.19	0.29	0.50	0.77
			FOMC Announcement (8/9)		
BCFF (8/24-25)	0.07	0.09	0.12	0.14	0.20
Total Change	−0.07	−0.17	−0.31	−0.61	−0.88
Change after GDP	−0.01	−0.07	−0.13	−0.25	−0.31
Change after FOMC	−0.06	−0.10	−0.18	−0.36	−0.57

- GDP revision limited the ability of FG to reduce rates
- Larger decline after the FOMC than the GDP revision

Real GDP Growth Consensus Forecasts

	2011Q4	2012Q1	2012Q2	2012Q3	2012Q4
BCFF (7/20-21)	3.09	2.75	2.97	3.07	3.17
			GDP revision (7/29)		
BCEI T-bill (8/4-5)	2.53	2.38	2.59	2.81	2.88
			FOMC Announcement (8/9)		
BCFF (8/24-25)	2.17	2.13	2.44	2.69	2.90
Total Change	−0.92	−0.62	−0.53	−0.38	−0.27
Change after GDP	−0.56	−0.37	−0.38	−0.26	−0.29
Change after FOMC	−0.36	−0.25	−0.15	−0.12	0.02

- The statement expressed pessimism about the economy:

  "*The Committee now expects a somewhat slower pace of recovery over coming quarters*..."

- Smaller decline after the FOMC than the GDP revision

Main Takeaways

- We study FG in a New Keynesian model with news shocks
- The FG horizon, the state of the economy, the speed of the recovery, and the size of policy shocks all nonlinearly impact the effects of FG due to the ZLB constraint
- At the ZLB, the cumulative effect on real GDP from lengthening the horizon decreases beyond two years
  - There are limits on how far FG can extend into the future and continue to add stimulus, unlike with a policy rate peg
- Recent FG often associated with declines in real GDP:
  - News often accompanied by weak economic assessments
  - Prior expectations of a weak economy gave policymakers a small margin to lower expected future policy rates