The Dynamic Effects of Forward Guidance Shocks

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What are macroeconomic effects of forward guidance shocks?

Focus on economic activity & prices at the zero lower bound

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Can a standard model reproduce the estimated effects?

Disconnect Between Theory & Empirical Evidence

Standard models with nominal rigidities imply large effects

$\Rightarrow$ Lower expected rates imply significant expansion

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Empirical work suggests announcements may be contractionary

Campbell, Evans, Fisher, & Justiniano (2012)

Our Findings

In the Data

Exogenous decline in expected path of rates

$\Rightarrow$ Higher economic activity & inflation

$\Rightarrow$ Output increases by about 0.1% at its peak

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A Standard Model of Nominal Price Rigidity

Estimated model replicates empirical results

Generate model-implied futures curve to map to empirical results

Identify Macroeconomic Effects in the Data

Combine event-study approach with traditional monetary VAR

Isolate unexpected component of monetary policy

- Measure change in expectations around FOMC meetings
- Daily change in monthly federal funds futures contracts
- Use change in 12-month ahead futures rates as policy measure

The Macroeconomic Effects of Forward Guidance Shocks

Input policy surprises into a monthly VAR

December 2008 – December 2015 sample period

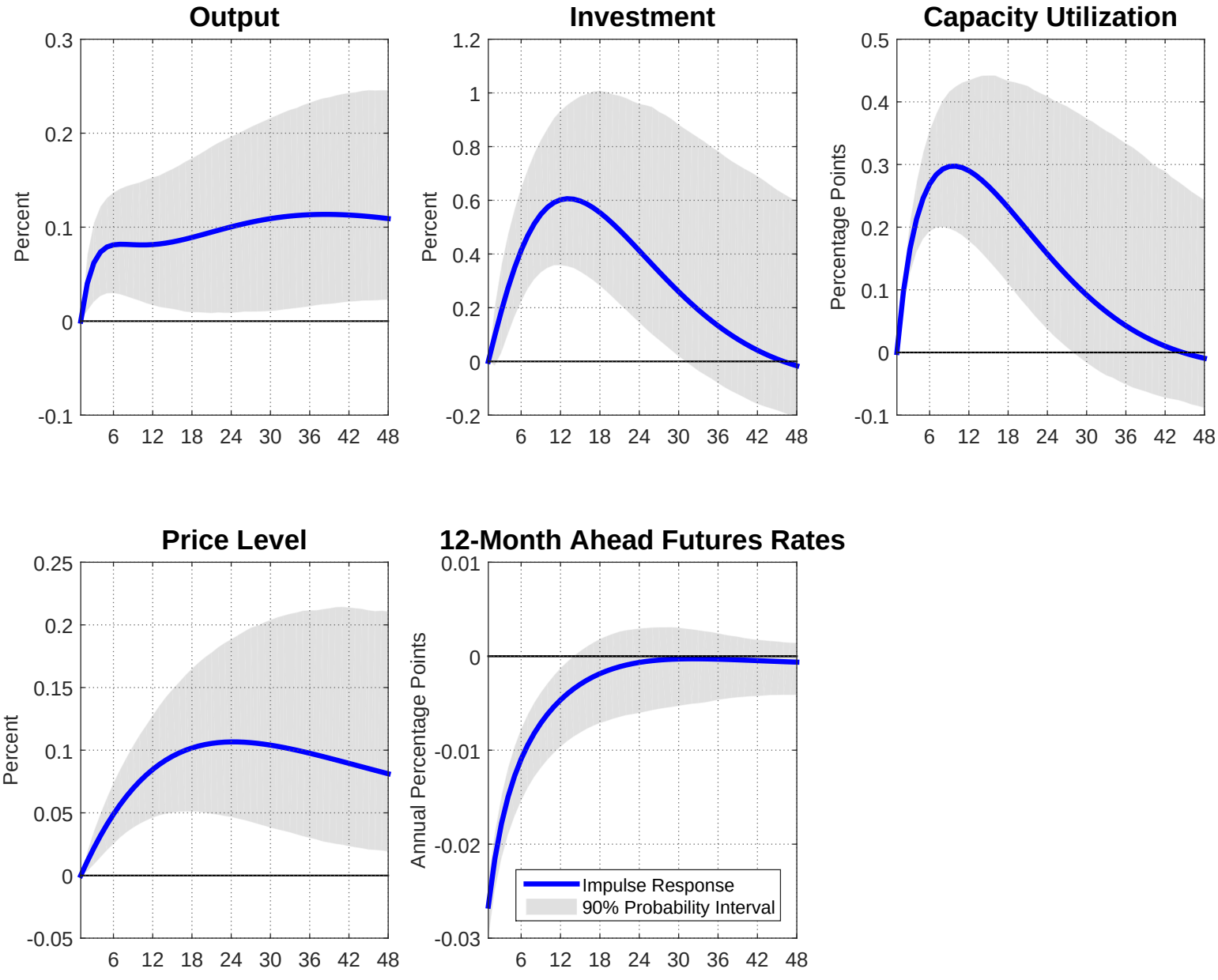
Macroeconomic Data: GDP, GDP deflator, investment, & capacity utilization

Monetary Policy: Funds rate implied by 12-month ahead futures

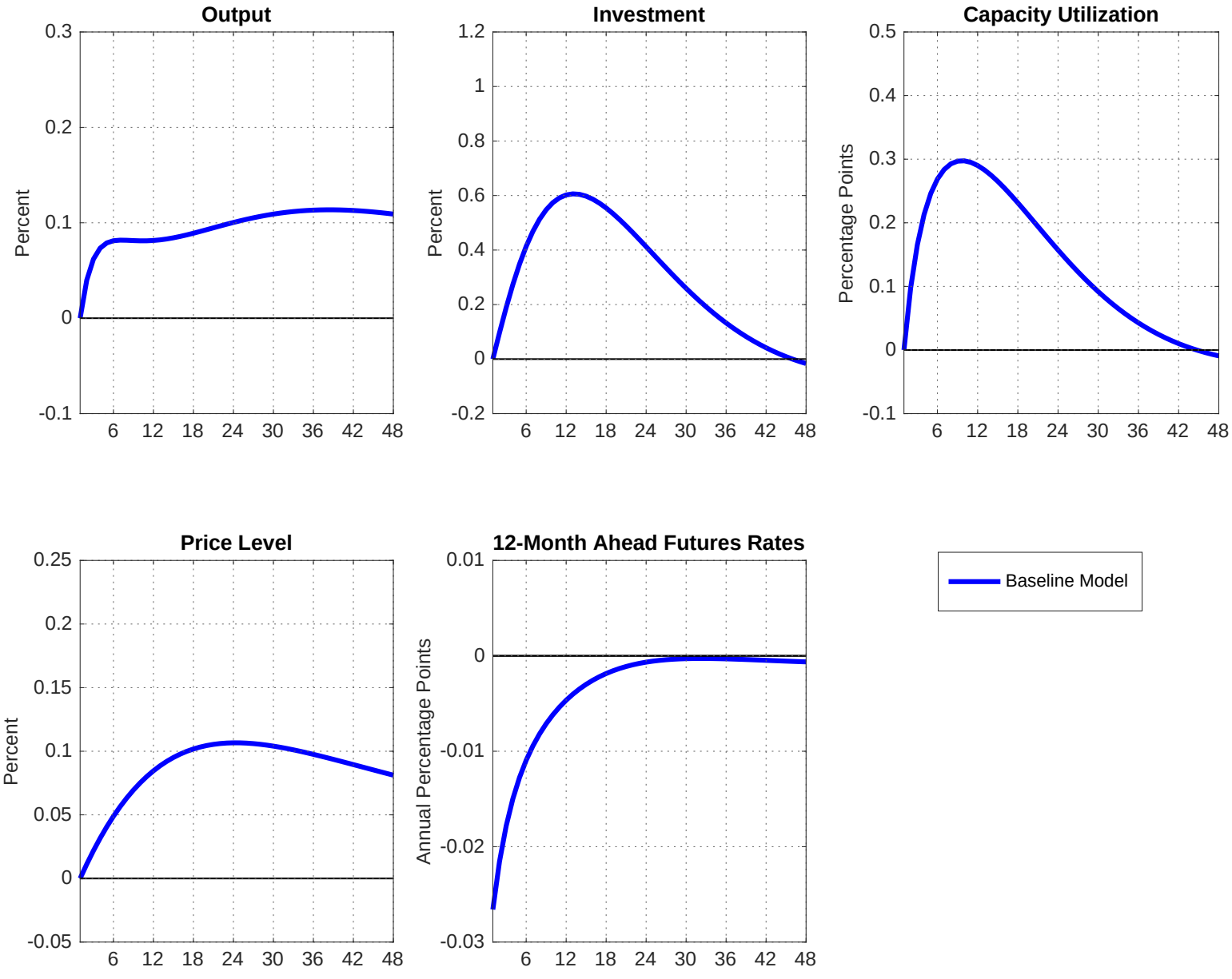
Order policy last using Cholesky identification

Robust to alternative ordering & policy indicators

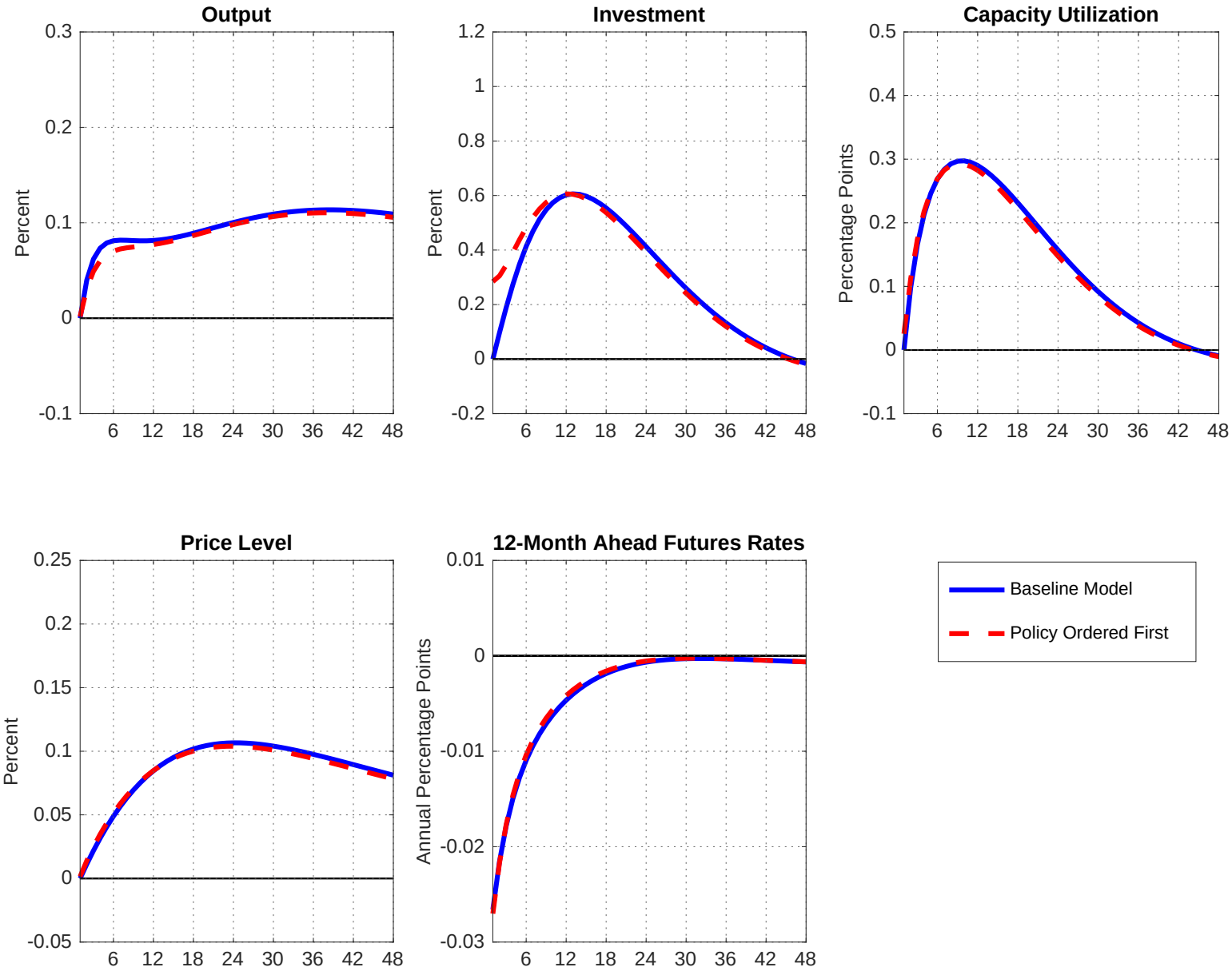
Empirical Responses to Forward Guidance Shock



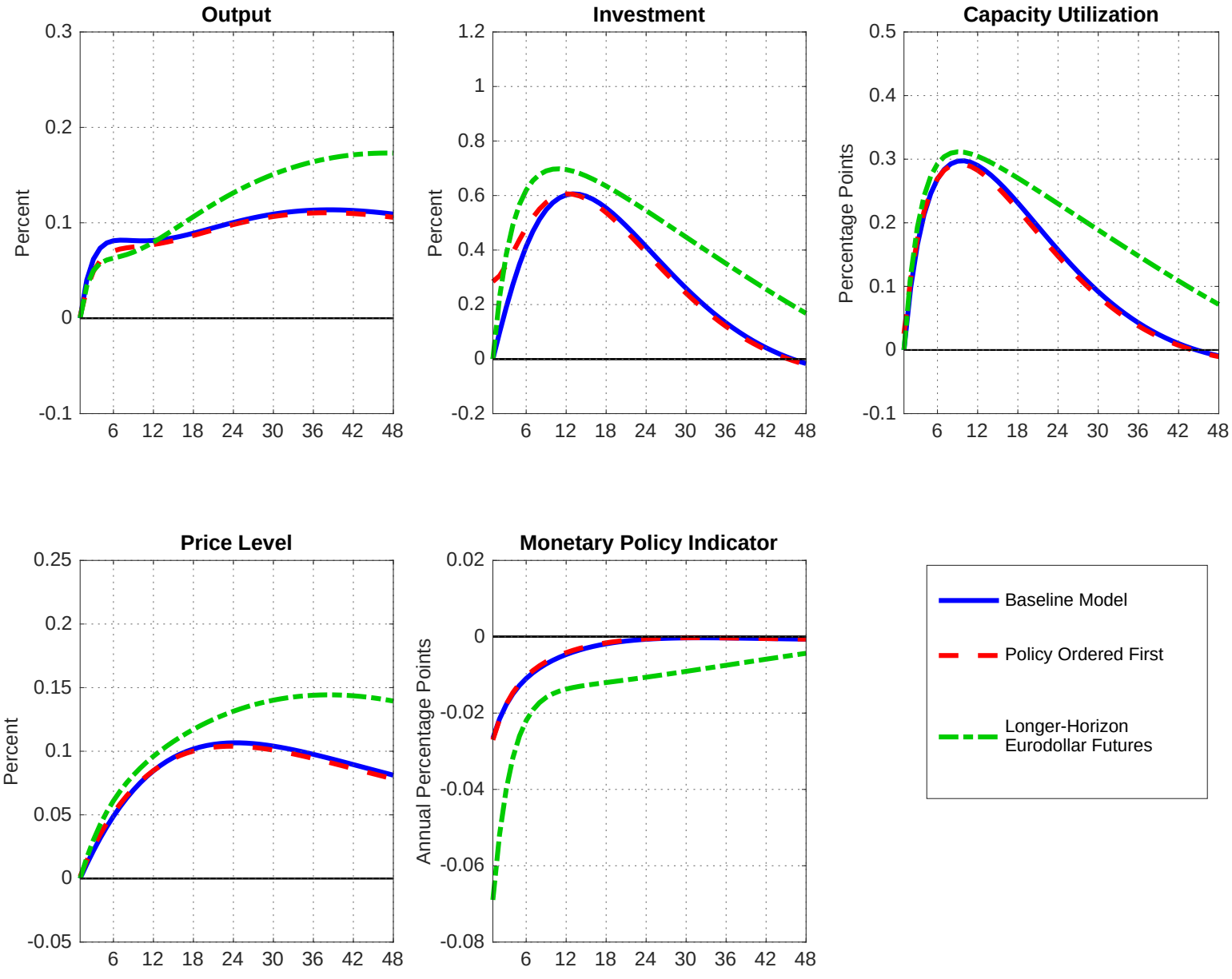
Robustness of Empirical Findings



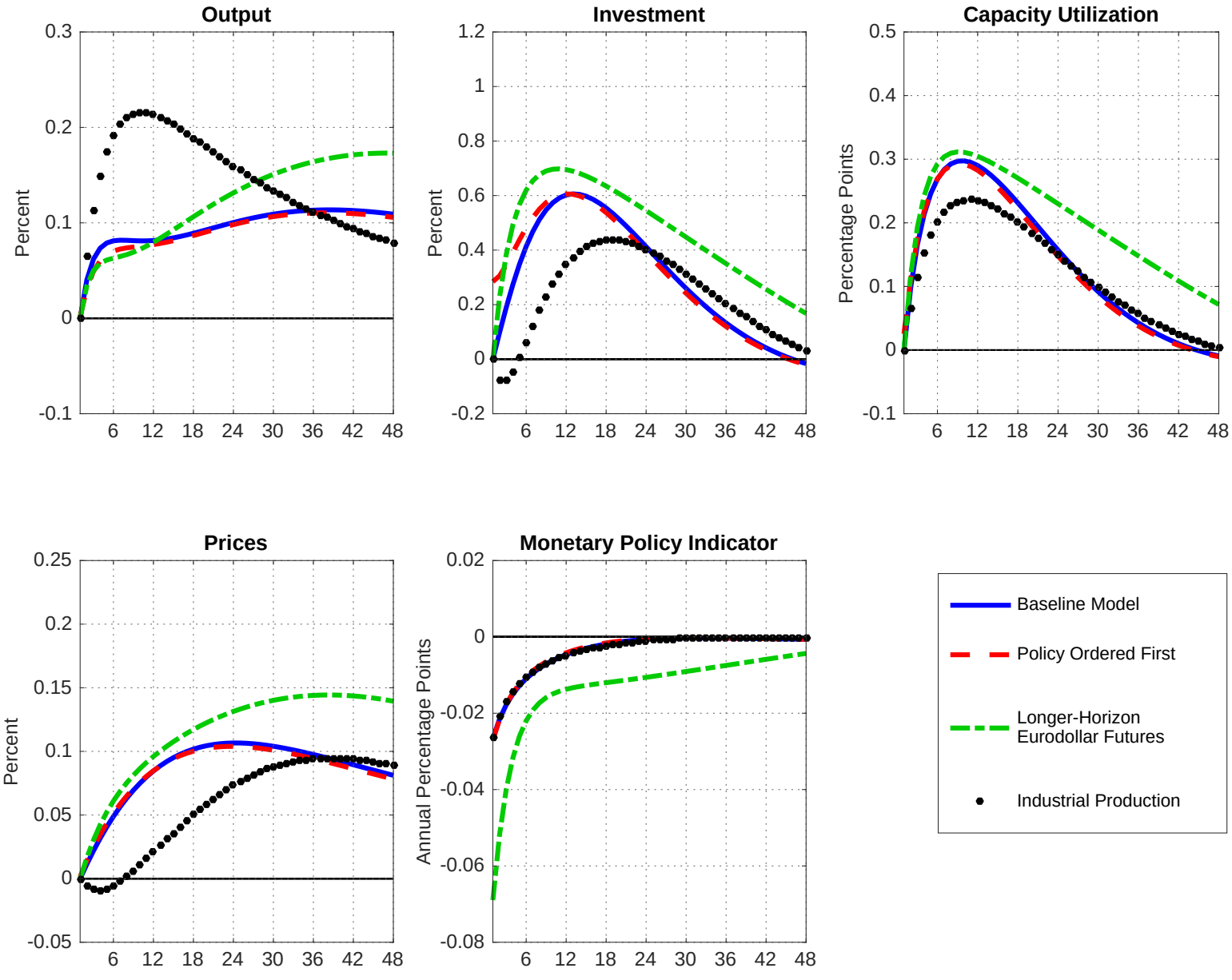
Policy Indicator Ordered First



Longer-Horizon Futures Contracts



Measure Output Using Industrial Production



Can Model Reproduce Empirical Findings?

Standard New-Keynesian sticky price model with capital

Household consumes, works, & receives firm dividends

- Habits in consumption

Firms employ labor & produce

- Investment adjustment costs, variable capital utilzation

Constant probability of adjusting nominal price each period

Monetary Policy

$$r_t^d = \phi_r r_{t-1}^d + \Big(1 - \phi_r\Big)\Big(r + \phi_\pi\big(\mathsf{E}_{t-1}\pi_t - \pi\big) + \phi_x \mathsf{E}_{t-1} x_t\Big) + \nu_t$$

$$r_t = \max\Big(0, r_t^d\Big)$$

$$\nu_t = \rho_\nu \nu_{t-1} + \sigma^\nu \varepsilon_t^\nu$$

Away from ZLB: Conventional monetary policy shock

At ZLB: Forward guidance shock

Mapping Model to Empirical Evidence Using Futures

Use stochastic discount factor to price futures in the model

Determine price of 1-month ahead futures contract:

$$f_t^1 = \mathsf{E}_t \left\{ \left(\beta \frac{\lambda_{t+1}}{\lambda_t} \right) \left(1 - 12 r_{t+1} \right) \right\}$$

n-month contract at t becomes an $n-1$ contract at $t+1$:

$$f_t^n = \mathsf{E}_t \left\{ \left(\beta \frac{\lambda_{t+1}}{\lambda_t} \right) \left(f_{t+1}^{n-1} \right) \right\}$$

Solve nonlinear model using piecewise-linear solution

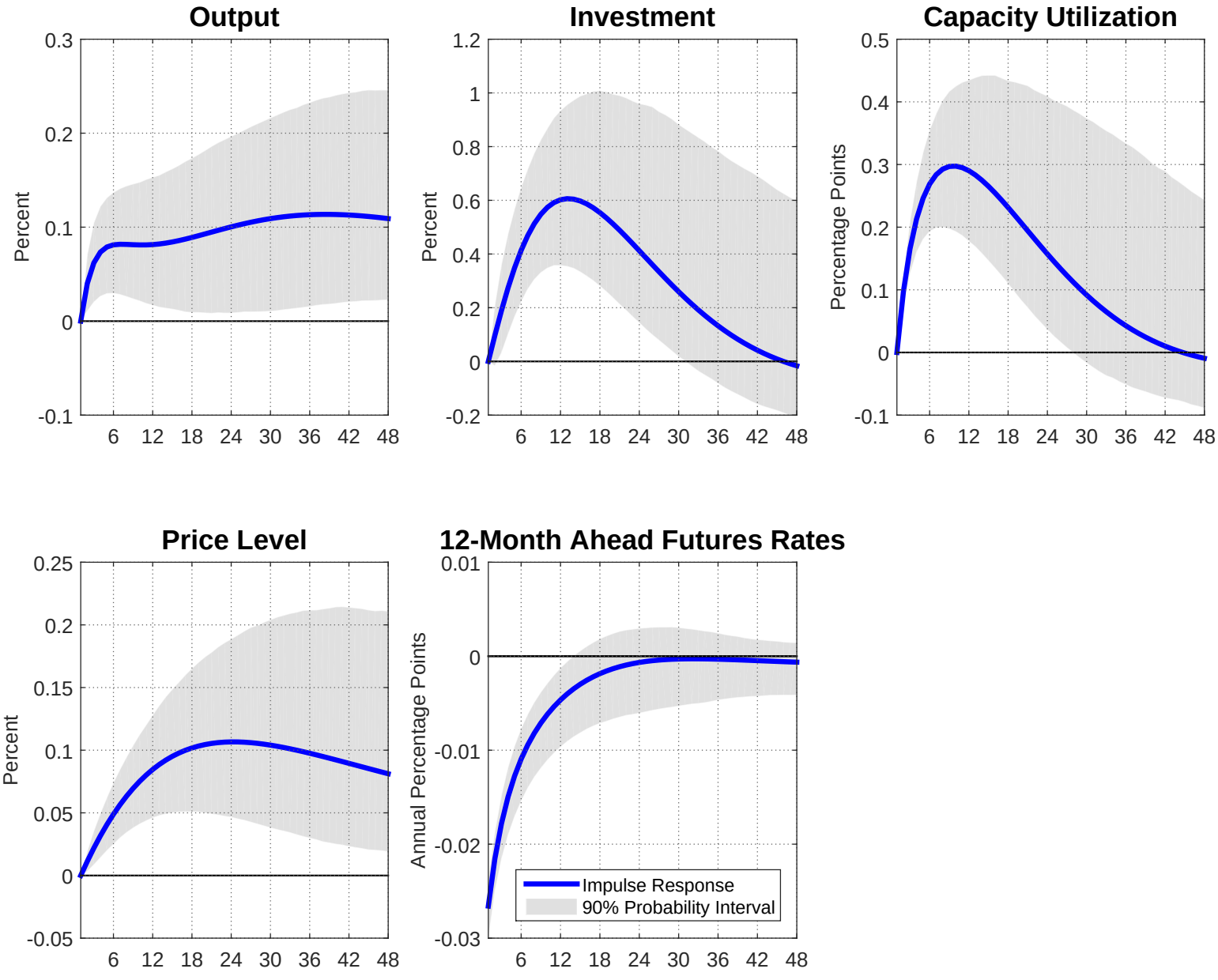
Examine forward guidance shock at zero lower bound:

1. Use demand shock to simulate zero lower bound episode
2. Simulate an exogenous decline in expected rates

Estimate model using impulse response matching

Pick shock so futures in model generate same movement as in data

Empirical & Model-Implied Responses



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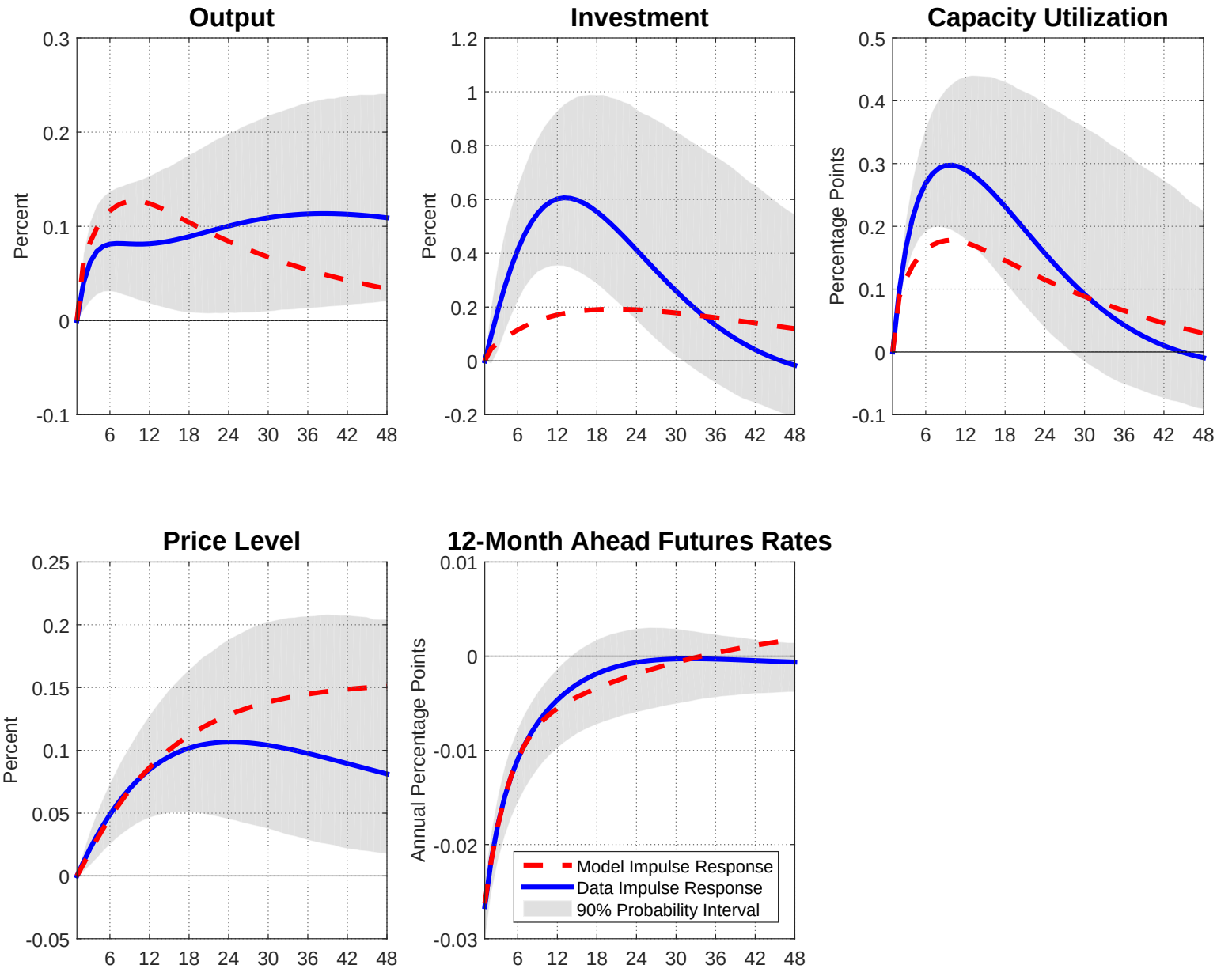


Empirical Response of Output to Expected Rates

We find no disconnect between empirical evidence & model

Prior work argues output is too responsive to expected rates in models

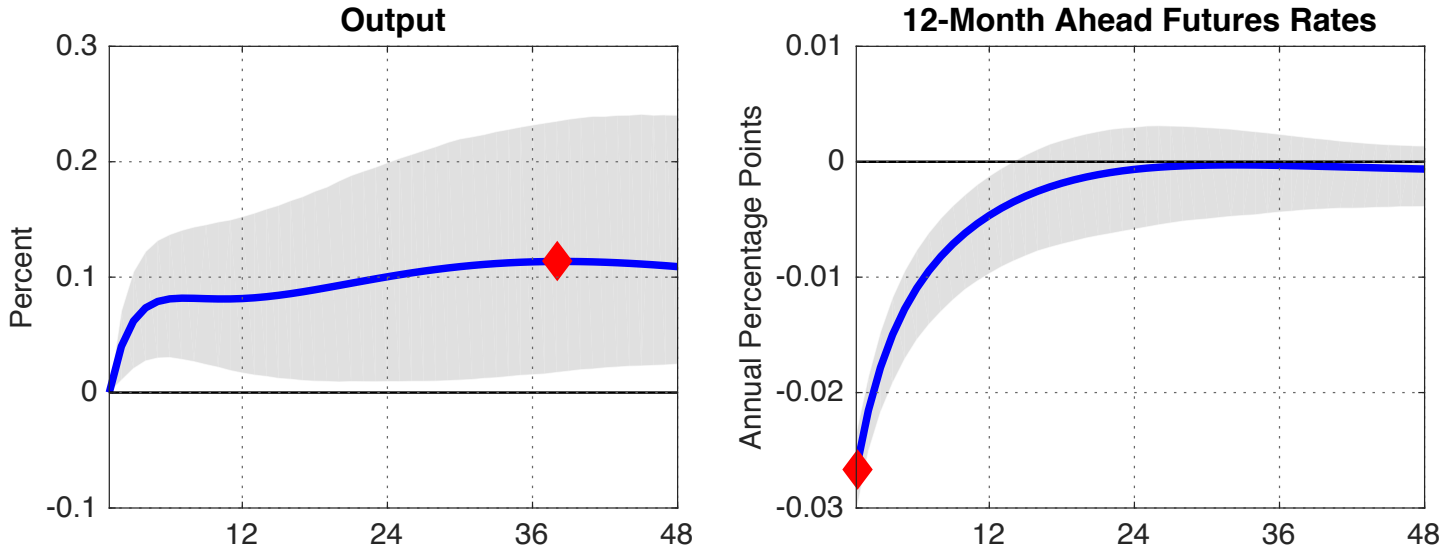
Is our empirical elasticity of output with respect to expected future rates implausibly large?

Compare elasticity to estimates in the policy shock literature

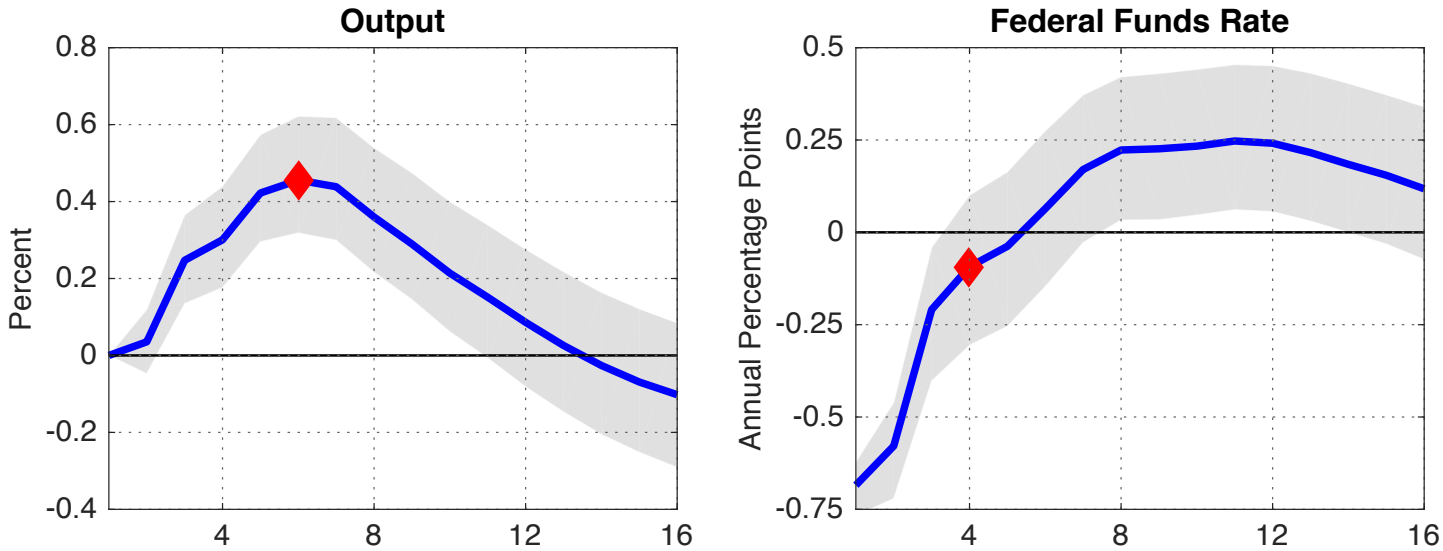
- Christiano, Eichenbaum, & Evans (2005)
- Romer & Romer (2004)

Elasticity of Output with Respect to Expected Policy Rates

Baseline VAR



Christiano, Eichenbaum, & Evans (2005)



Comparison with Conventional Monetary Policy Shocks

Elasticity with Respect to 1-Year Ahead Funds Rate

Estimate	Output	Price Level
Baseline	4.3	4.0
Christiano et al. (2005)	4.9	3.5
Romer & Romer (2004)	3.9	6.2

Quantitative Easing & Forward Guidance

Asset purchases often accompanied policy announcements

No need to disentangle effects if purchases reflect signaling

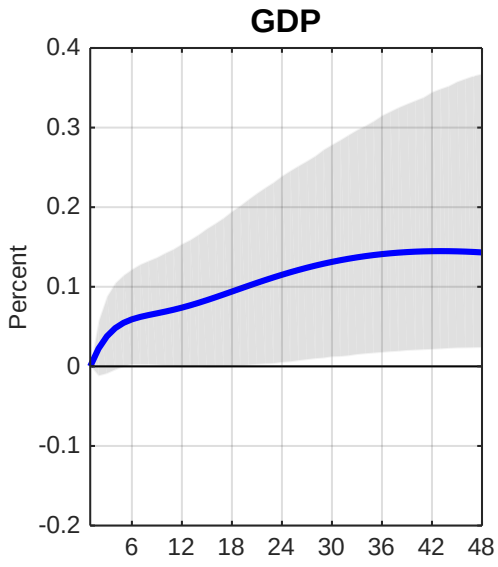
Bias results under significant portfolio-rebalancing channel

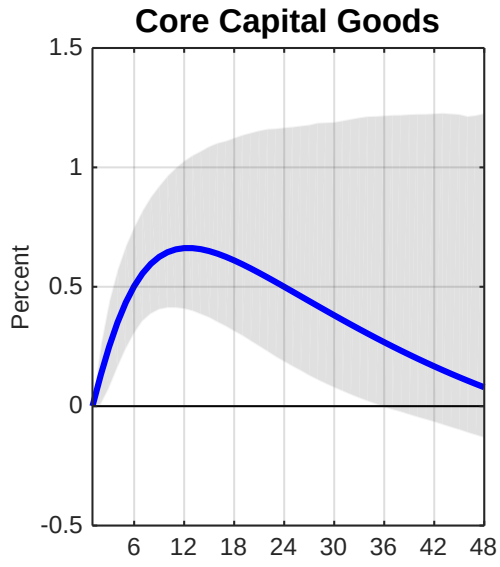
Difficult to disentangle during zero lower bound period

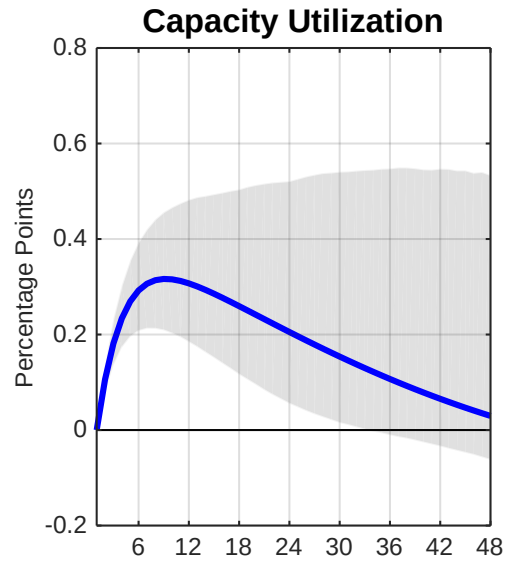
Examine forward guidance announcements before & after 2009

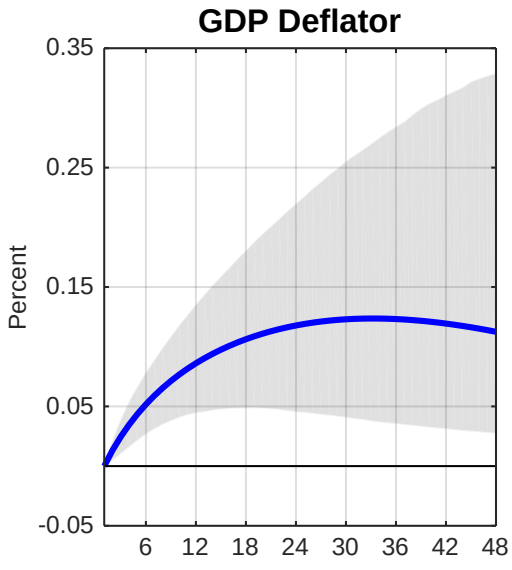
Use Gurkaynak, Sack, & Swanson (2005) path factor

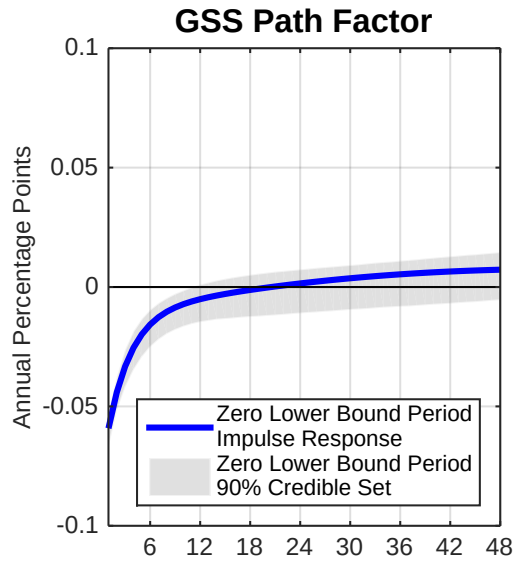
Path Factor Shock During Zero Lower Bound



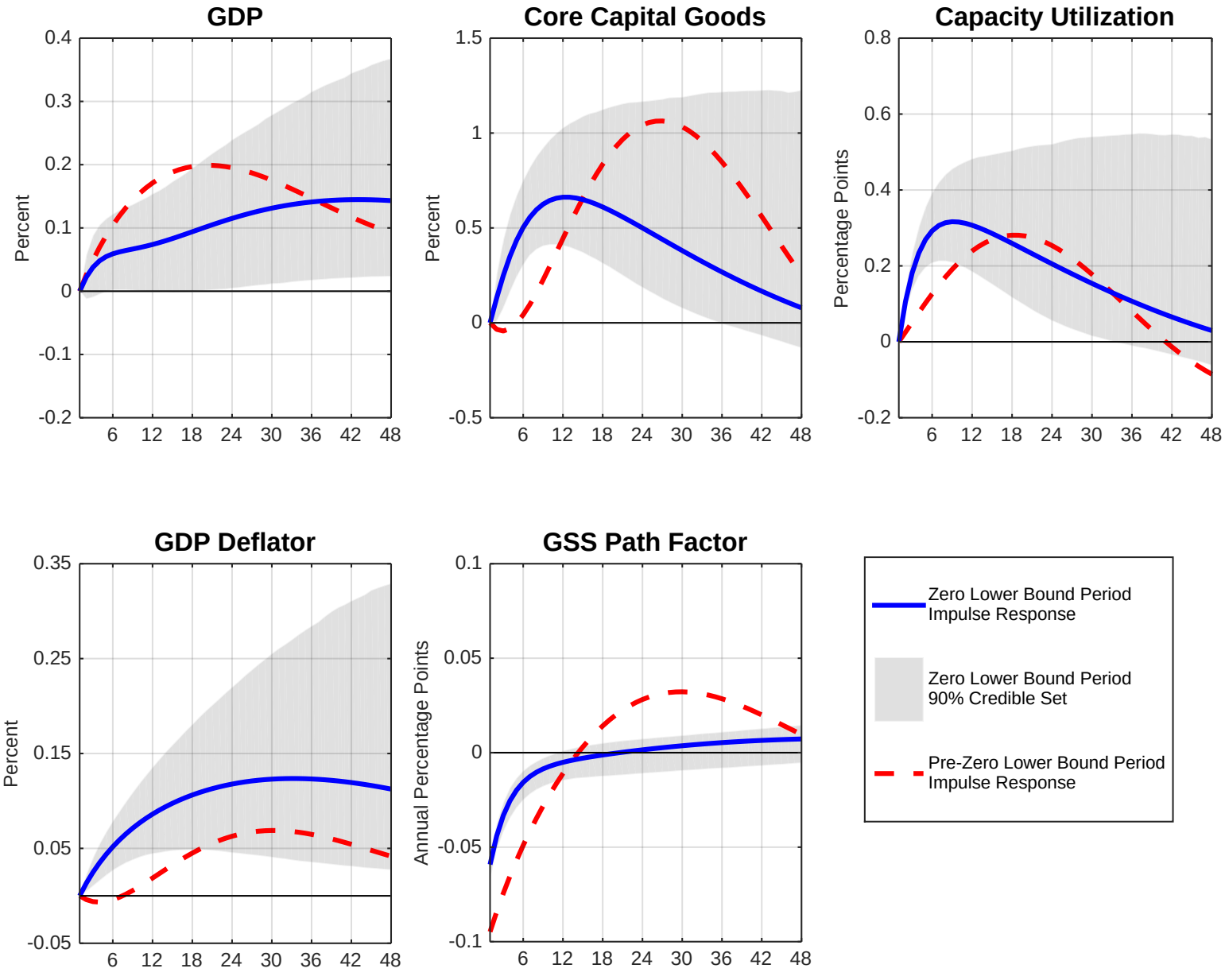








Path Factor Shock Before the Zero Lower Bound



Conclusions

Forward guidance shocks that lower expected path of rates

$\Rightarrow$ Modest increase in economic activity & inflation

Consistent with standard model of monetary policy

Discipline forward guidance process in model using futures data

Additional Details

Where is the Forward Guidance Puzzle?

Previous work argues these models overestimate effects

Del Negro, Giannoni, & Patterson (2012), Kiley (2014)

Simulate one-year extension of zero policy rates

Implies very large movements in activity & prices

"Forward Guidance Puzzle"

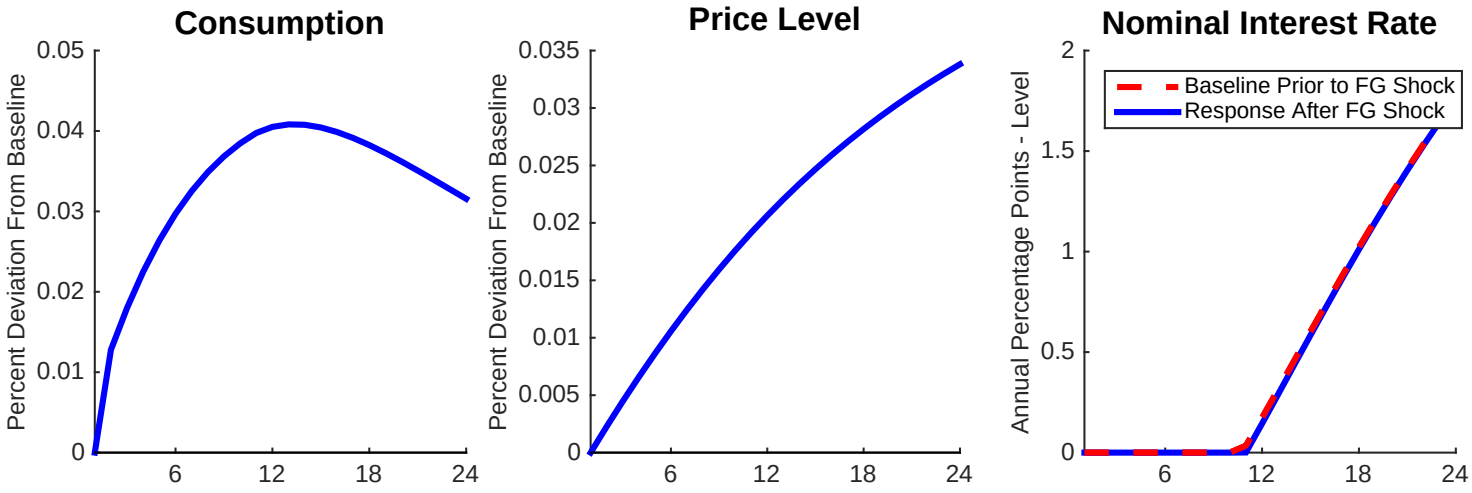
We estimate a significantly smaller forward guidance shock

Extends zero lower bound duration by one month

Discipline shock process in model using futures data

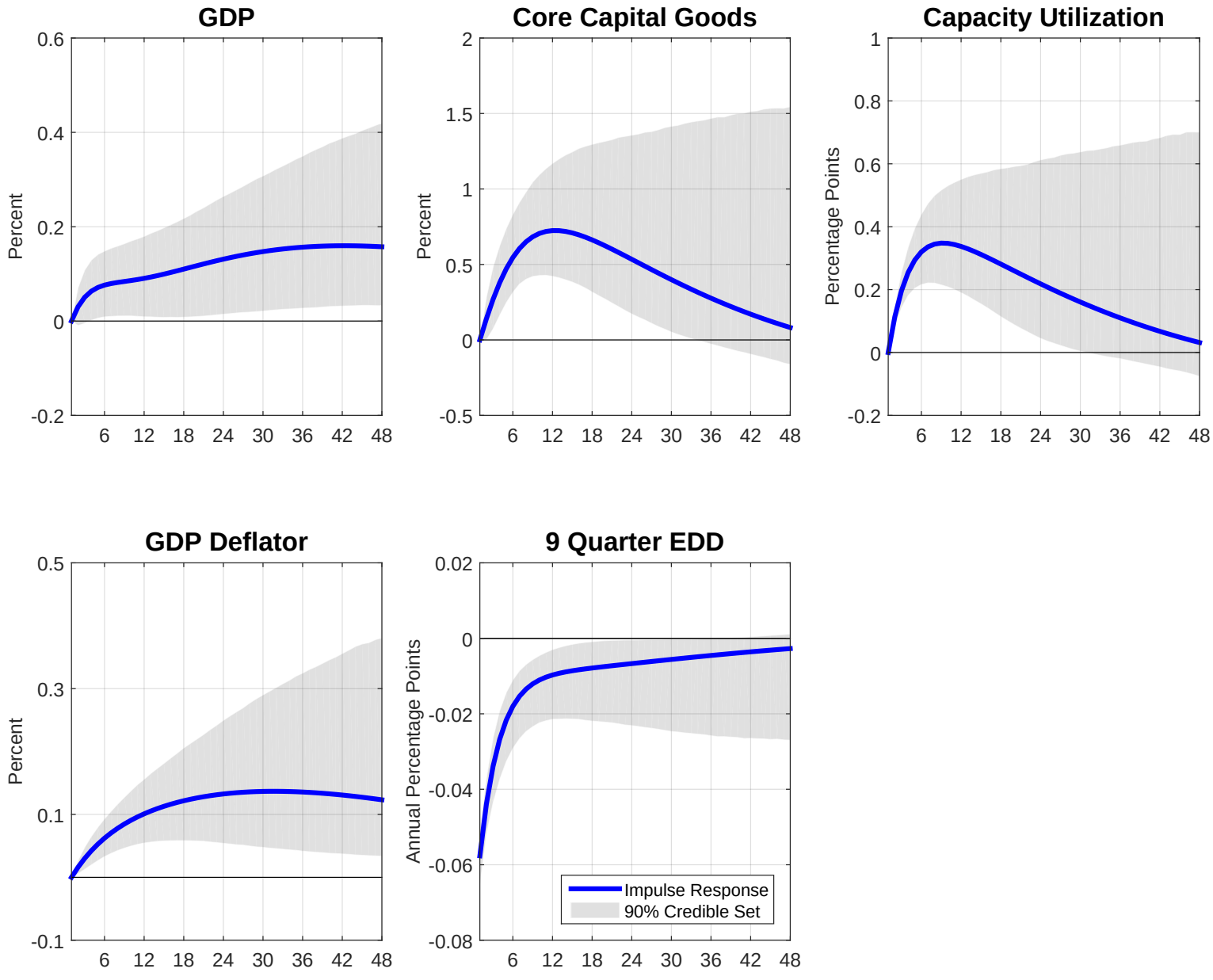
The Forward Guidance Puzzle?

One-Month Extension of Zero Lower Bound Duration

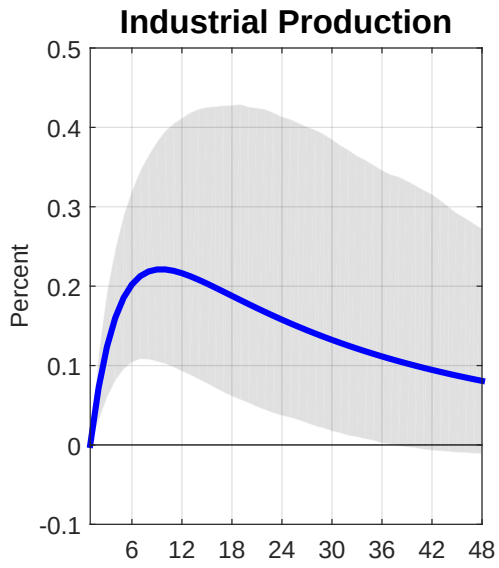


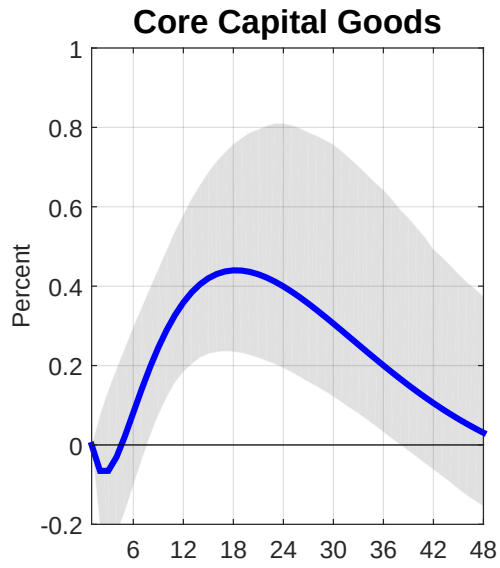
One-Year Extension of Zero Lower Bound Duration

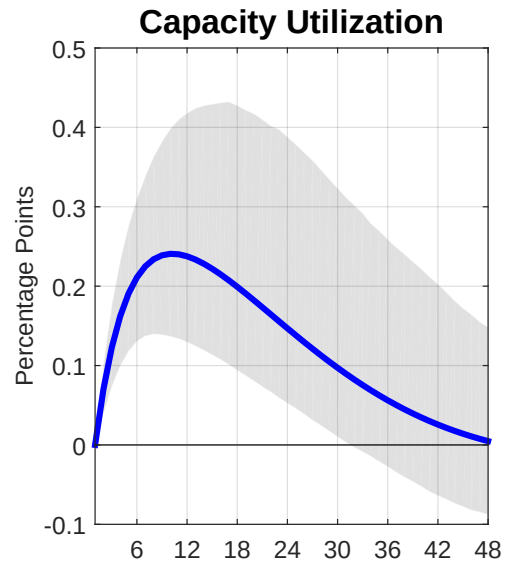
Longer-Horizon Eurodollar Futures

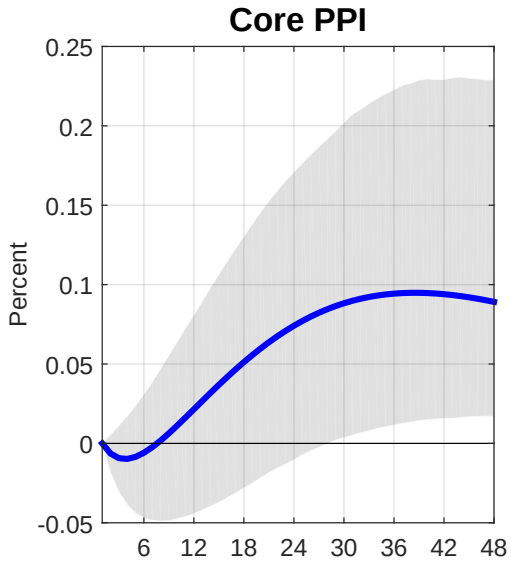


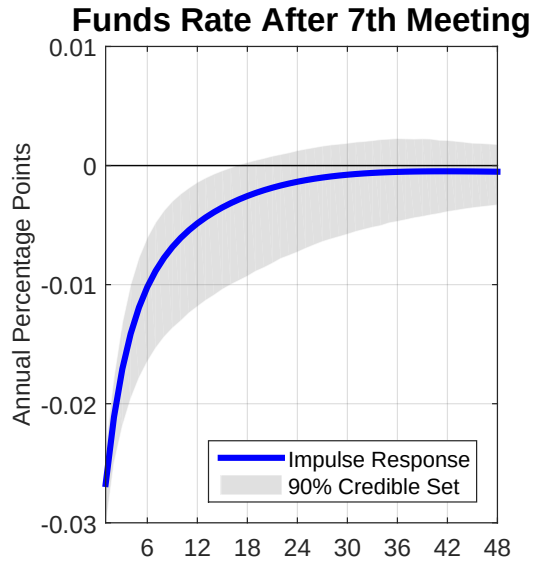
Industrial Production



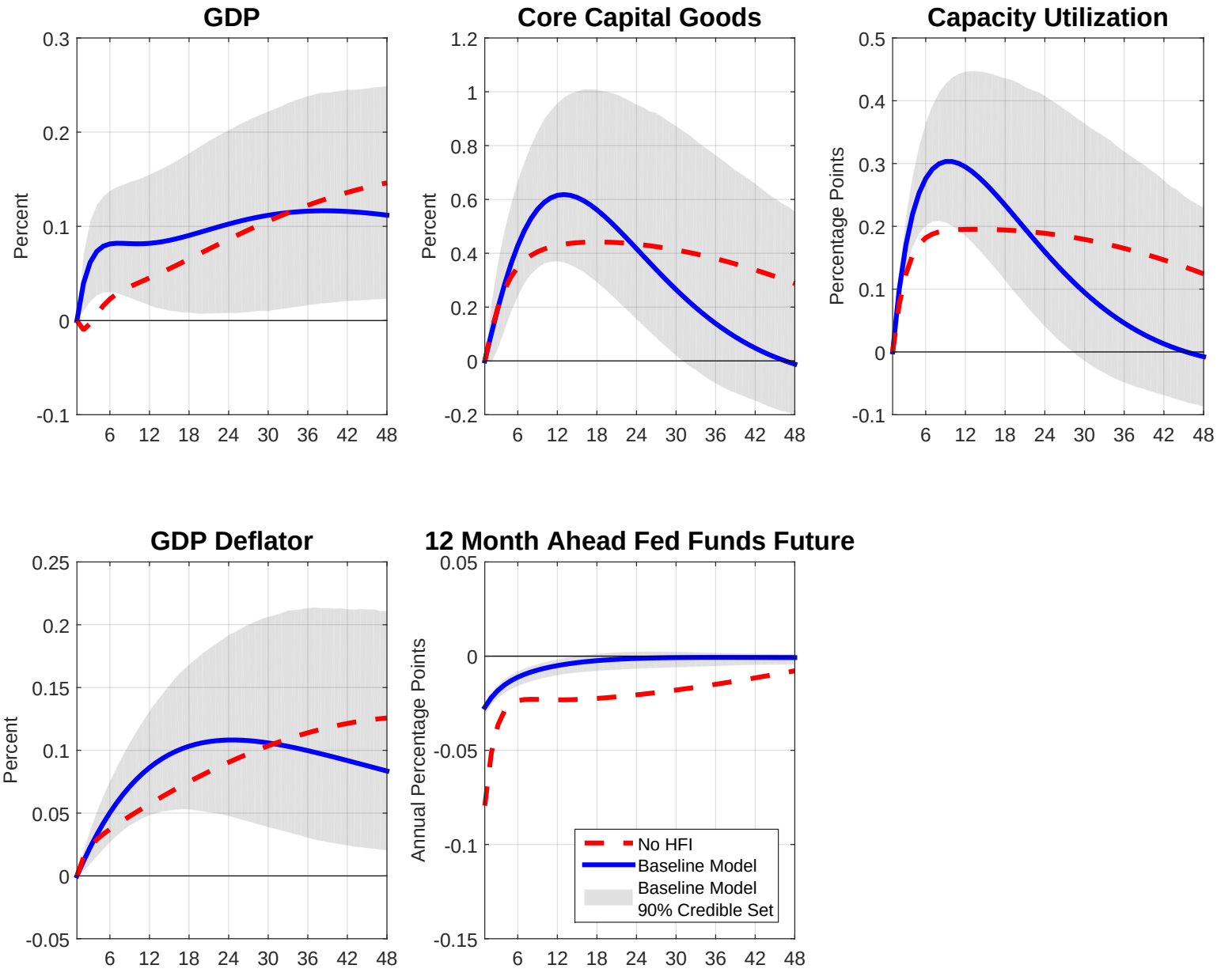








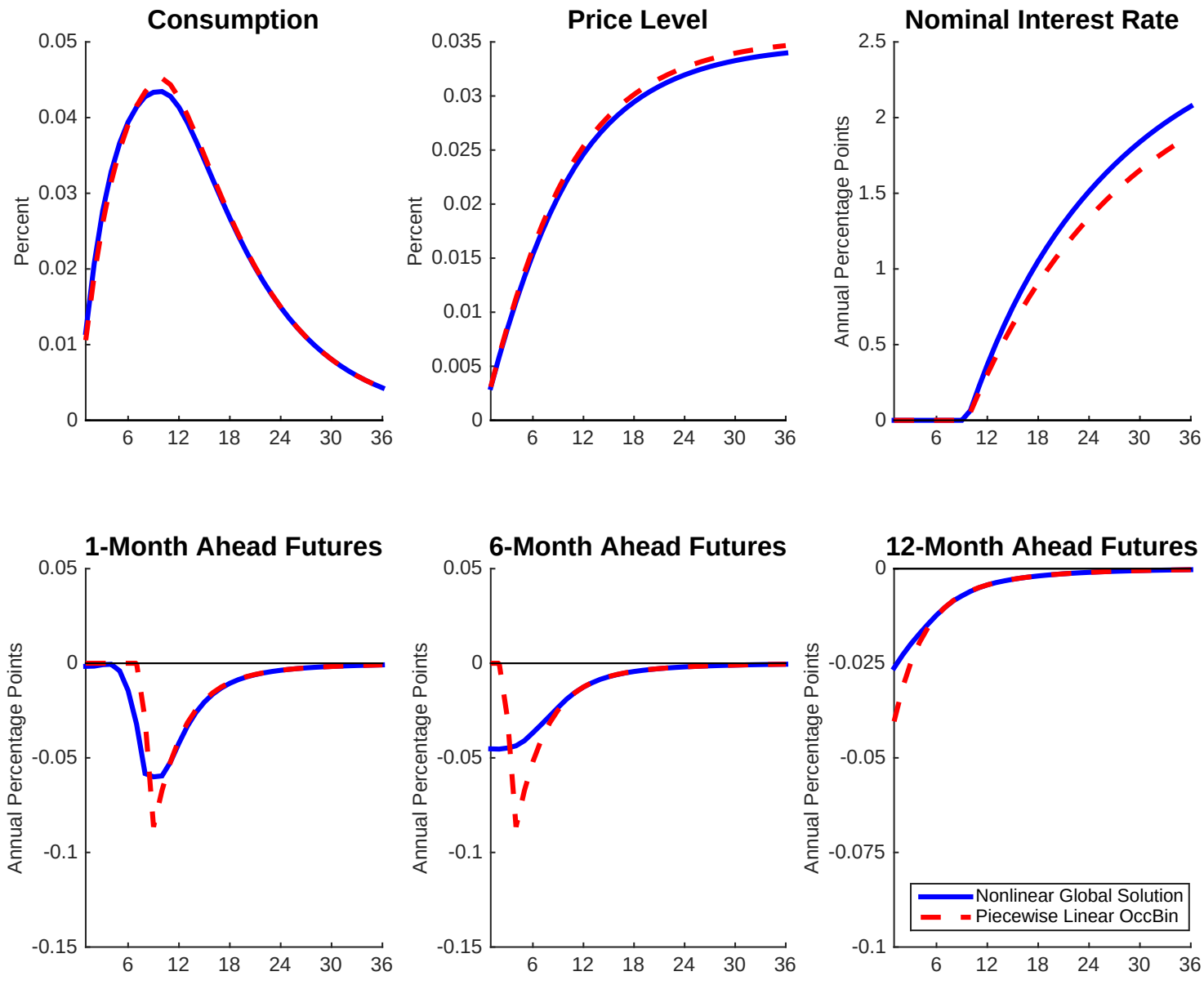
No High-Frequency Identification or Cumulative Sum



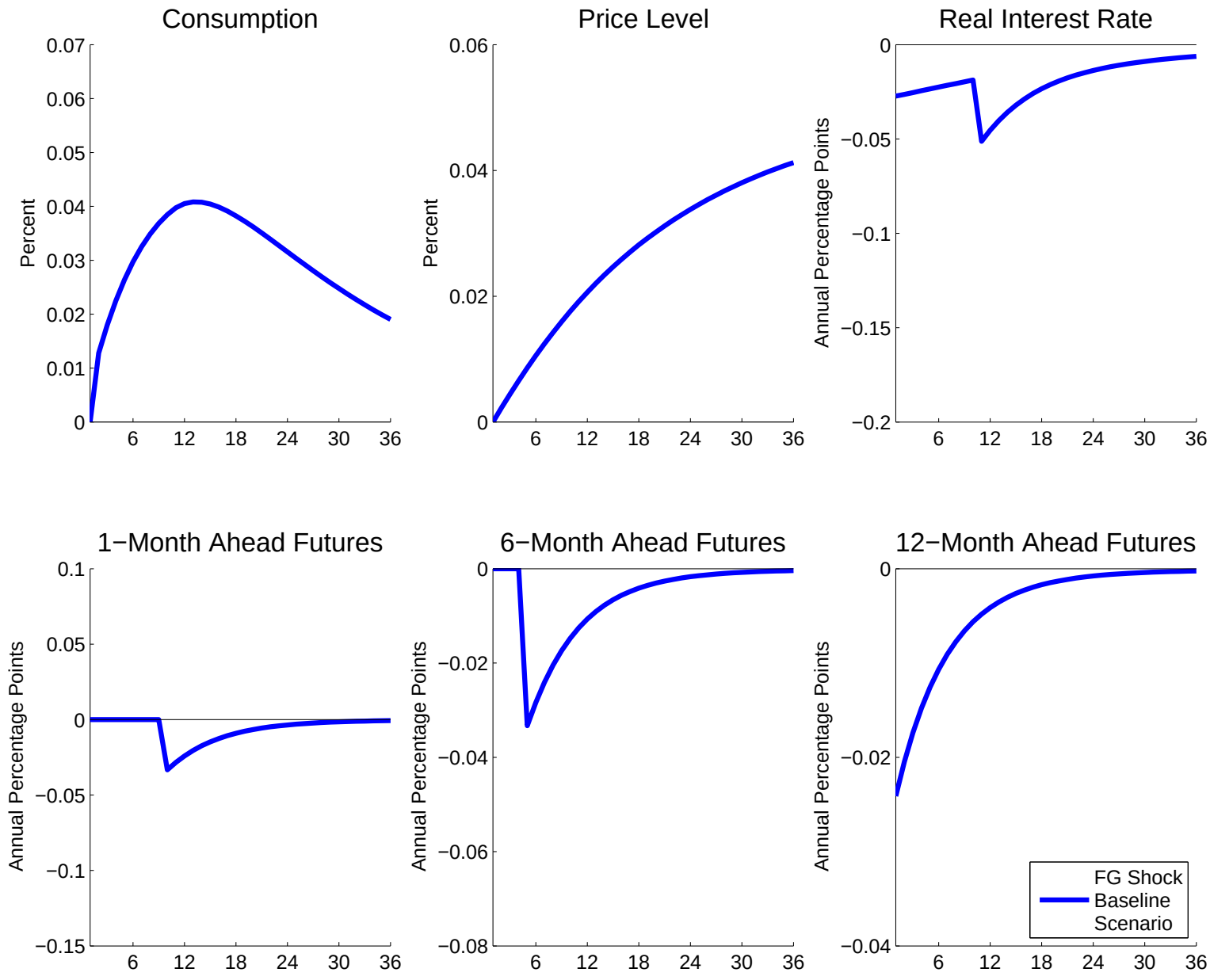
Estimated Model Parameters

		Prior			Posterior	
Parameter	Description	Distribution	Mode	Std. Dev.	Mode	Std. Dev.
b	Habit Persistence	Beta	0.50	0.25	0.7827	0.0224
ω	Calvo Probability	Beta	0.93	0.02	0.9535	0.0005
χ	Degree of Lagged Indexation	Beta	0.50	0.25	0.3033	0.0108
ϕ_r	Policy Rate Smoothing	Beta	0.75	0.25	0.7471	0.0090
κ	Investment Adjustment	Gamma	2.48[3]	60.0	4.1553[3]	4.2880
σ_δ	Capacity Utilization Curvature	Gamma	0.01[3]	60.0	0.0314[3]	0.0001
ρ_ν	Policy Shock Persistence	Beta	0.50	0.25	0.9530	0.0004
$1200 \times \sigma_\nu$	Std. Dev. of Policy Shock	Gamma	25.0	1200	0.1111	0.0049

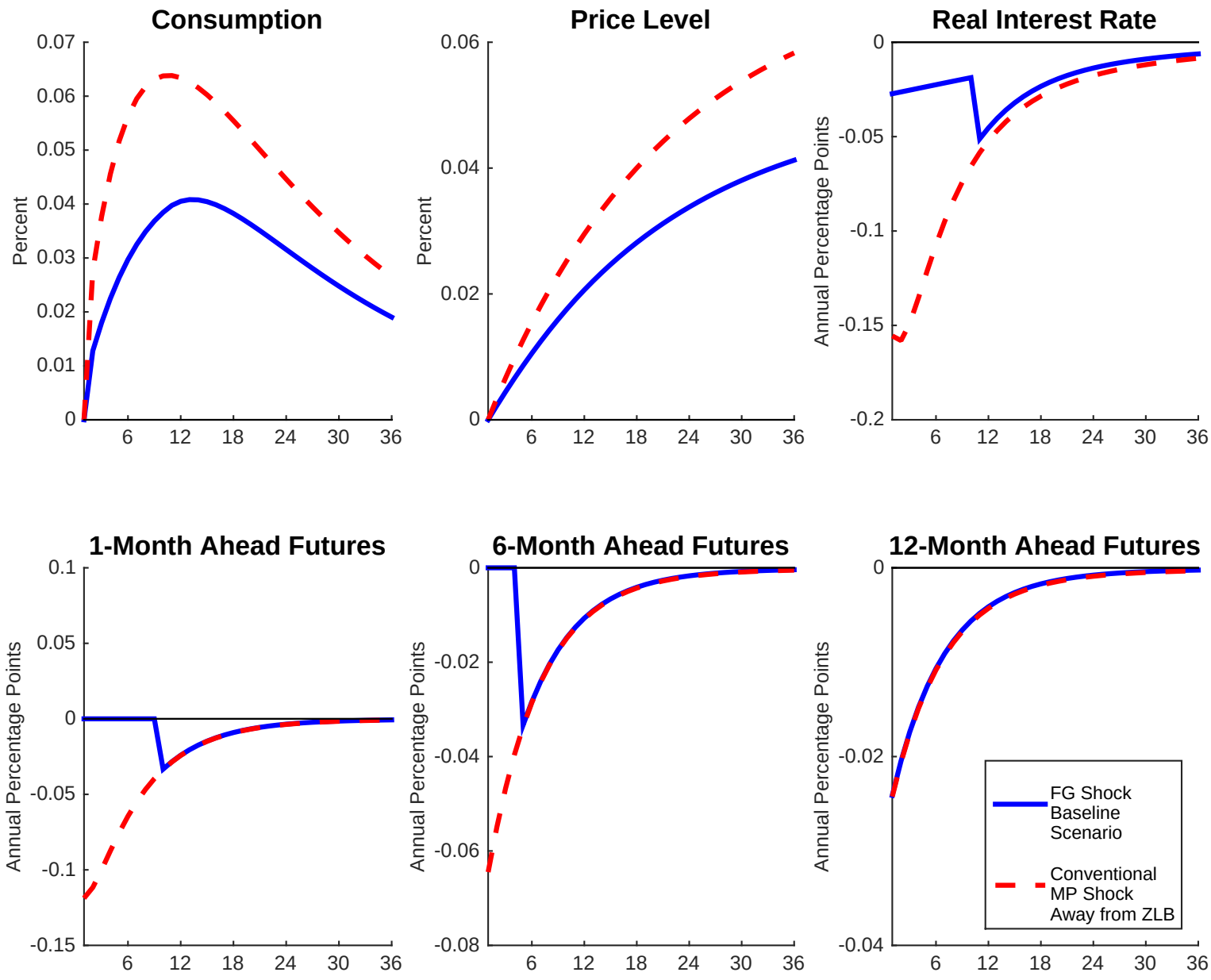
Global Solution and OccBin Solution



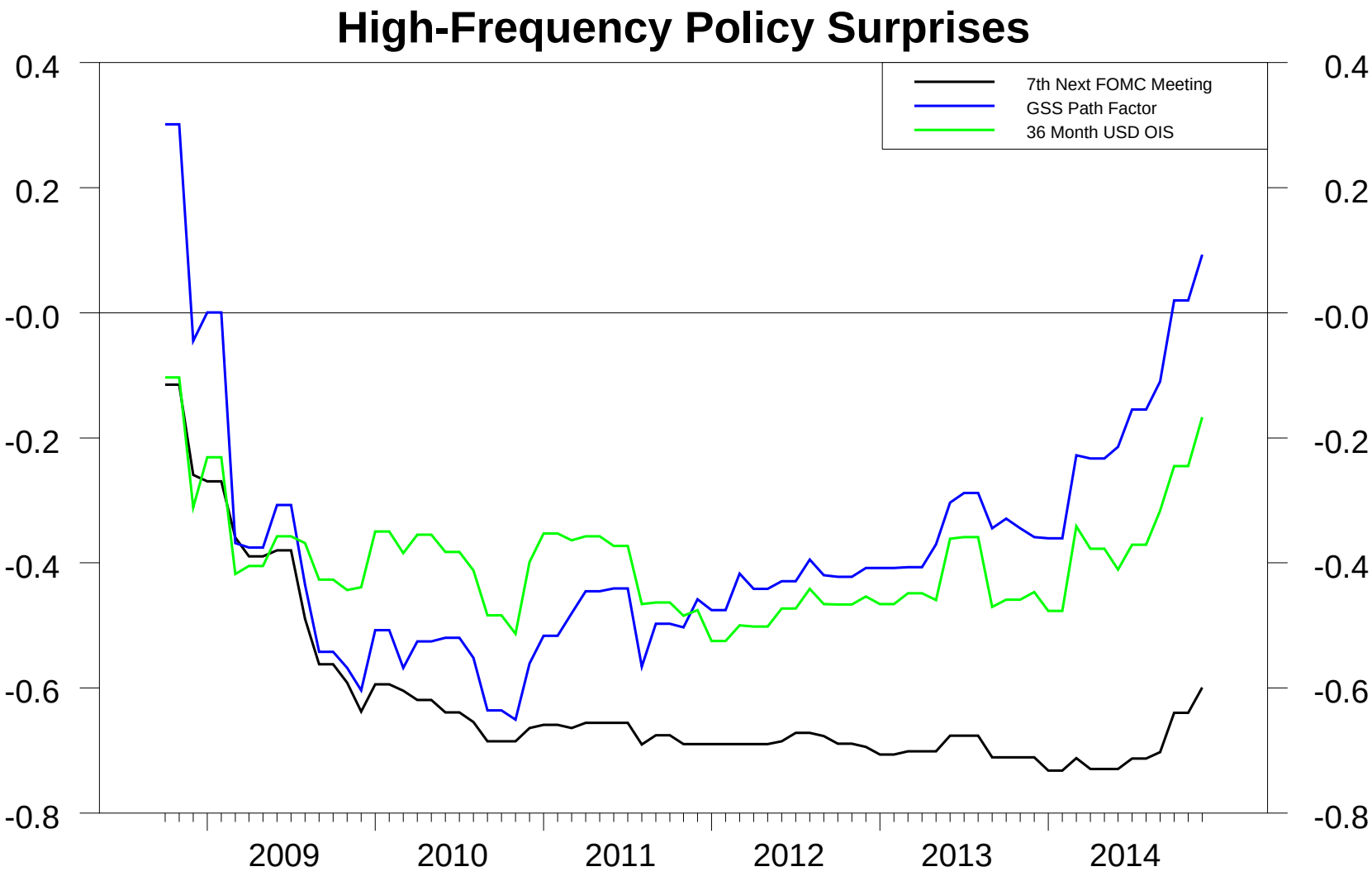
Responses of Additional Variables



Forward Guidance & Conventional Monetary Policy Shock



Policy Surprises



How Important are Forward Guidance Shocks?

Examine variance decompositions of forecast errors

Forward Guidance Shocks

Variable	1 Year	2 Year	5 Year
Output	9	16	30
Price Level	19	35	45

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Examine variance decompositions of forecast errors

Forward Guidance Shocks

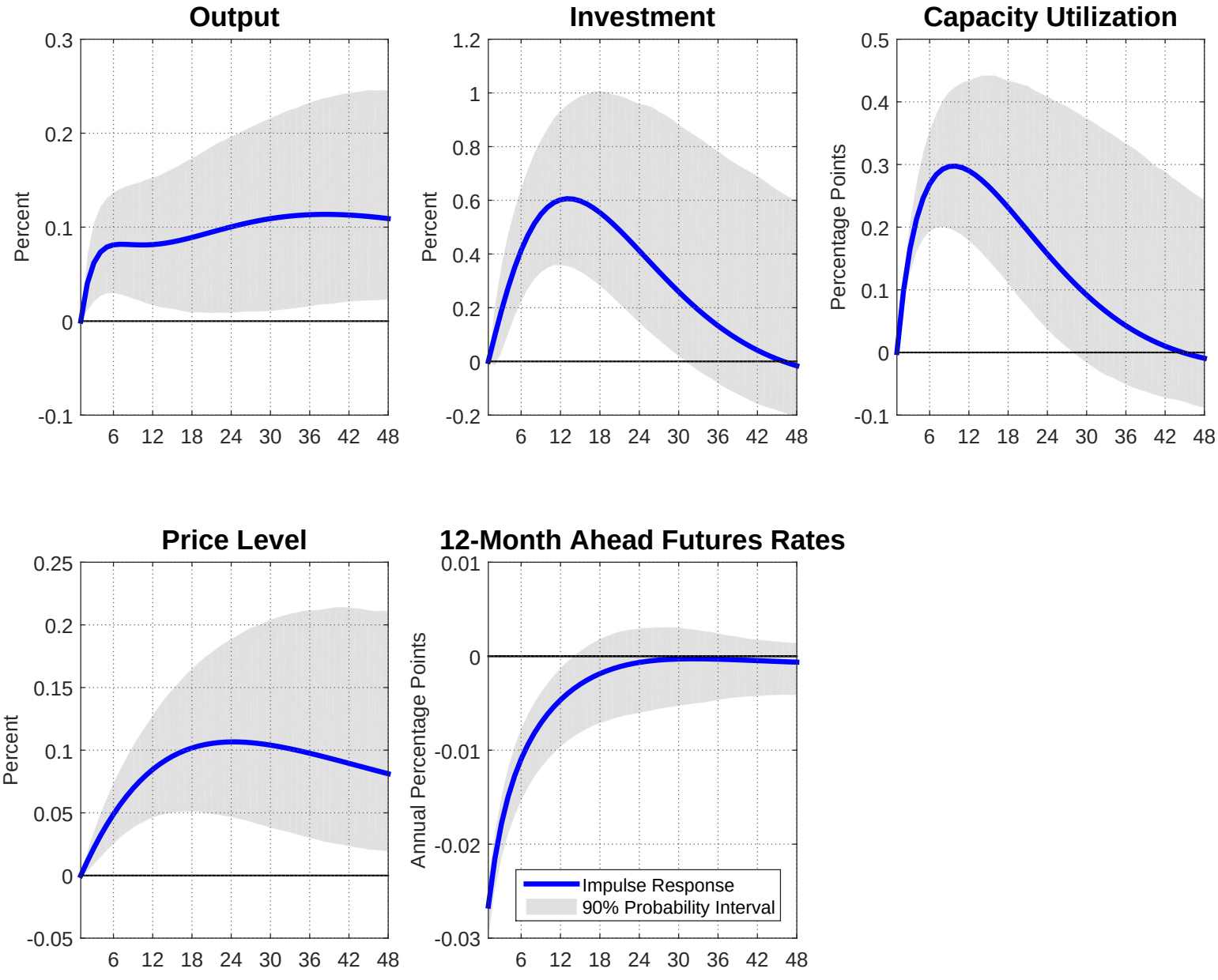
Variable	1 Year	2 Year	5 Year
Output	9	16	30
Price Level	19	35	45

Conventional Policy Shocks*

Variable	1 Year	2 Year	5 Year
Output	15	41	26
Price Level	1	1	14

*Source: Christiano, Eichenbaum, Evans (2005)

Baseline Assumption - Policy Ordered Last



Alternative Assumption - Policy Ordered First