Disentangling the Information and Forward Guidance Effects of Monetary Policy Announcements

Lars Other

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Research Question

What are the effects of monetary policy?

- On financial markets & the real economy

Standard approaches to identification

- Monetary policy shocks orthogonal to the state of the economy (SVAR: Christiano et al., 1999)
- …or orthogonal to the information set of market participants (High-frequency identification: Gürkaynak et al., 2005)

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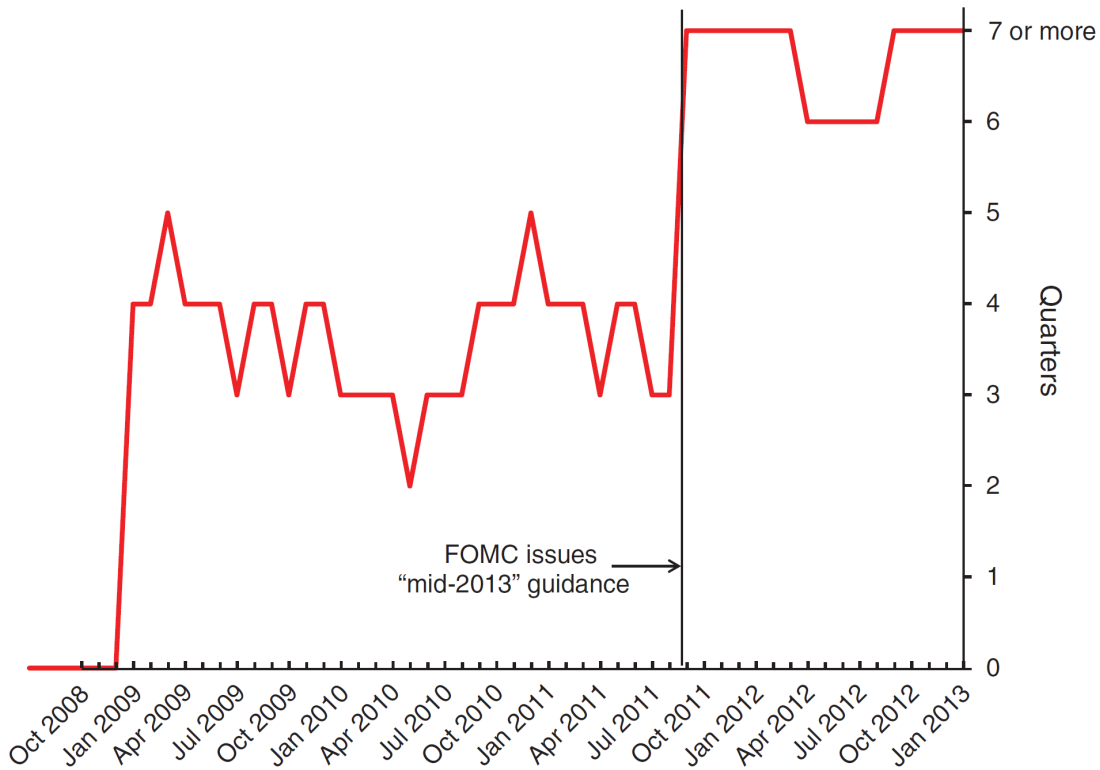
Identification problem

- Monetary policy is mostly endogenous and market participants are aware of that $\Rightarrow$ Fed information effect (Romer and Romer, 2000, Nakamura and Steinsson, 2018)

FOMC on August 9, 2011

Calender-based forward guidance

- Since March 2009: Fed funds rate will remain exceptionally low for an "*extended period*"
- In August 2011: exceptional low levels will remain "*at least through mid-2013*"



Note: Expected number of quarters until first Fed funds rate hike (Source: Swanson and Williams, 2014)

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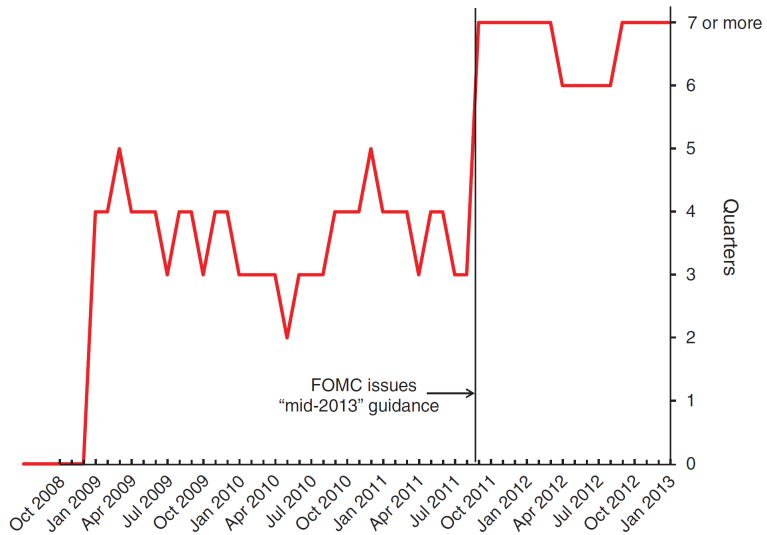

Note: Expected number of quarters until first Fed funds rate hike (Source: Swanson and Williams, 2014)

$\Rightarrow$ Del Negro et al. (2012) and Andrade et al. (2017): expectations about economic prospects **worsen** rather than improved

Reconsidering the identification of monetary policy shocks

- Novel identification strategy to disentangle monetary and non-monetary news $\Rightarrow$ exploiting the response of the entire yield curve
- Construct instruments for three structural shocks: target shock, forward guidance, and information effect
- Information effect reflects news about the economic prospects and risks to the outlook

This Paper

Reconsidering the identification of monetary policy shocks

- Novel identification strategy to disentangle monetary and non-monetary news $\Rightarrow$ exploiting the response of the entire yield curve
- Construct instruments for three structural shocks: target shock, forward guidance, and information effect
- Information effect reflects news about the economic prospects and risks to the outlook

Transmission to the real economy

- Investigation of the effects on the term structure using event-study approach
- Local projection to study the dynamic macro effects

Contributions

1. Monetary policy news are confounded with news about nominal risks to the economic prospects

$\Rightarrow$ effects on different components of the nominal term structure

Literature

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   $\Rightarrow$ effects on different components of the nominal term structure

2. Different dimensions of policy announcement have distinct effects on the term structure

   $\Rightarrow$ term premium response important for transmission of monetary policy

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   $\Rightarrow$ effects on different components of the nominal term structure

2. Different dimensions of policy announcement have distinct effects on the term structure

   $\Rightarrow$ term premium response important for transmission of monetary policy

3. Once one accounts for information effect, no puzzling responses to monetary policy shocks

   $\Rightarrow$ news about risk to economic prospects have real effects

Literature

Asymmetric Information

- Policy action and central bank communication reveal private information to the public (Romer and Romer, 2000)
- Monetary policy surprise:
  1. Exogenous monetary policy shock
  2. Endogenous response to the economic state the public was not (fully) aware of

Identification: Problem

Asymmetric Information

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Econometricians' perspective

- Observed movements in the term structure on announcement day
- Interest rate movements driven by both monetary policy news and news about economic prospects

Identification: Assumption

Assumption

- Long-run monetary neutrality $\Rightarrow$ monetary policy announcement do not affect long-run inflation expectations

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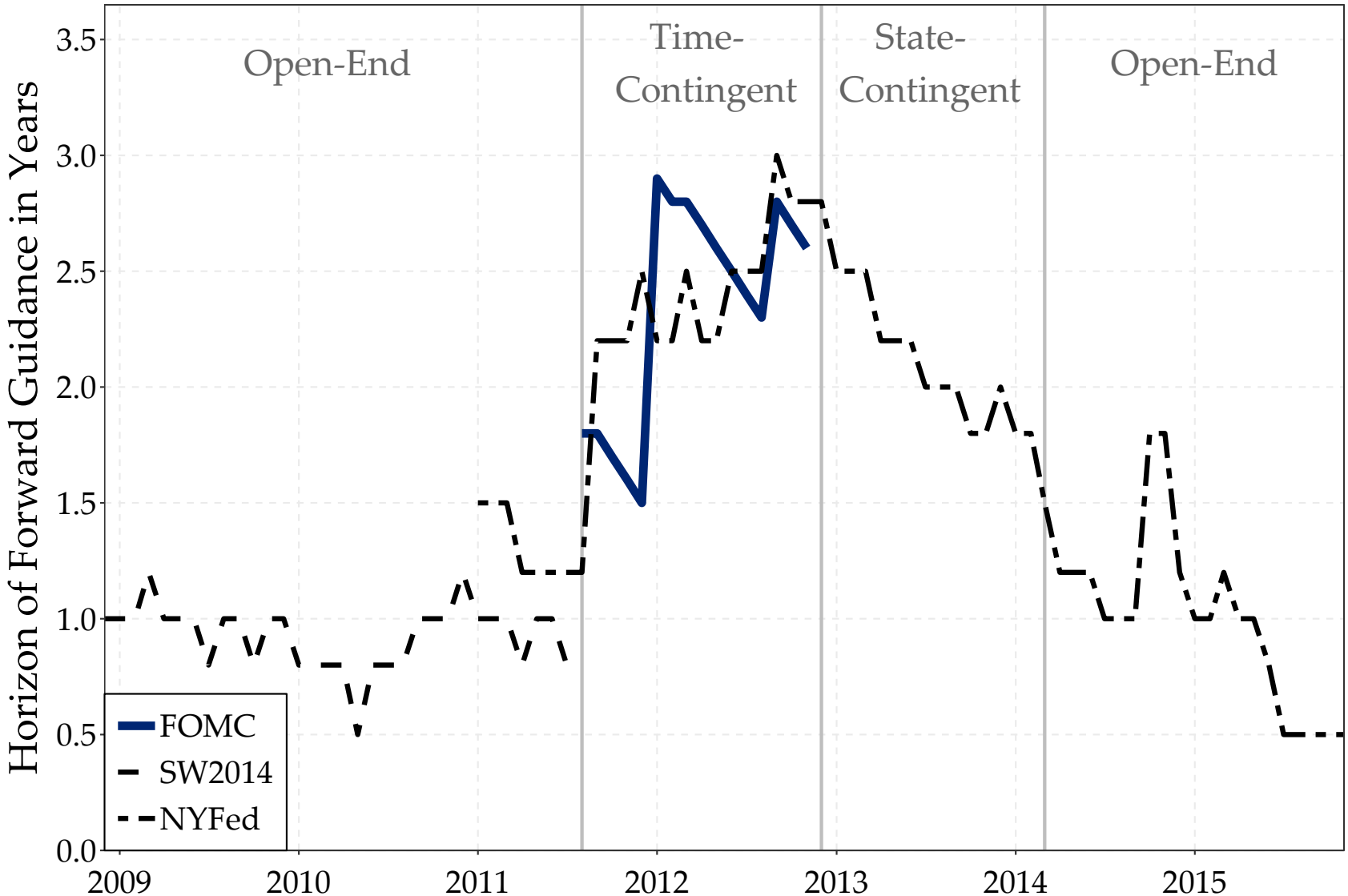
Empirically

$\Rightarrow$ Variations in 5-Year, 5-Year forward breakeven inflation rates are driven by information about economic prospects (risks) but not by monetary policy news

AF16/JK19 BEI rate

Historical Implementation of Forward Guidance



Inflation Targeting

Identification: Data

High-frequency identification: instruments for monetary policy shocks (Kuttner, 2001, Gürkaynak et al., 2005)

- Changes in money market futures rates surrounding FOMC meeting summarize surprise component of the announcement
- Sample period July 1991 - September 2017
- Eight asset prices along the yield curve:
  - Current-month and three-month-ahead Federal funds futures
  - Two-, three-, and four-quarter-ahead Eurodollar futures
  - Two-, five-, and ten-year Treasury yields

Identification: Factor model

Factor model: asset price responses are driven by three factors
$\Rightarrow$ Swanson (2017)

$$\underbrace{X}_{(T\times n)} = \underbrace{F}_{(T\times 3)}\ \underbrace{\Lambda}_{(3\times n)} + \xi$$

- Latent factors F estimated as the first three principal components
  $\Rightarrow$ explain 94% of variance of X

Three Factors

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- Latent factors F estimated as the first three principal components
  $\Rightarrow$ explain 94% of variance of X
- Orthogonal rotation matrix $\mathbf{U}$ $(UU' = I) \Rightarrow$ structural interpretation of factors $\tilde{F} = FU$

Three Factors

Identification: Rotation matrix

Restrictions on **rotation matrix U**

1. & 2. Forward guidance and target shock do not move 5-Year, 5-Year forward breakeven inflation rates

Identification: Rotation matrix

Restrictions on **rotation matrix U**

1. & 2. Forward guidance and target shock do not move 5-Year, 5-Year forward breakeven inflation rates

$\Rightarrow$ External instrument approach (Mertens and Ravn, 2013): only the information effect is correlated with long-term inflation expectation forwards (sample period: $01/2001 - 06/2008$ & $06/2009 - 09/2017$)

Identification Loadings

Identification: Rotation matrix

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3. Forward guidance does not affect the very short-end of the yield curve

Identification Loadings

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3. Forward guidance does not affect the very short-end of the yield curve

$\Rightarrow$ Forward guidance orthogonal to the current policy decision (Gürkaynak et al., 2005)

Identification Loadings

Three shocks

1. Target shock $\Rightarrow$ exogenous change in policy rate
2. Forward guidance shock $\Rightarrow$ announcement of an exogenous target shock in the future
3. Information effect $\Rightarrow$ news about nominal risks in the future

Interpretation of Factors

Three shocks

1. Target shock $\Rightarrow$ exogenous change in policy rate
2. Forward guidance shock $\Rightarrow$ announcement of an exogenous target shock in the future
3. Information effect $\Rightarrow$ news about nominal risks in the future

Information effect

- Higher inflation risk $\Rightarrow$ nominal bonds become less valuable $\Rightarrow$ term premium increases
- Important: news about higher inflation is orthogonal to the expected monetary policy path

Effects of monetary policy:

- Monetary policy: average expected short-term interest rate vs. term premium? $\Rightarrow$ Woodford (2012), Filardo and Hoffmann (2014)
- Feroli et al. (2017) and Mishkin (2018): Forward guidance conditioned on observable indicators is more effective than time-contingent/open-end forward guidance

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Event-study regressions:

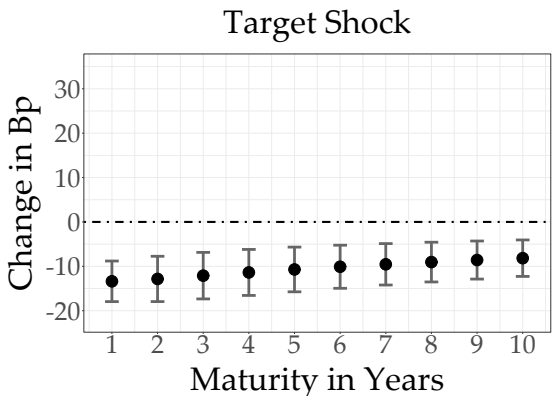
$$\Delta i_t^m = \alpha + \beta^{\mathbf{m}} mps_t^i + \epsilon_t$$

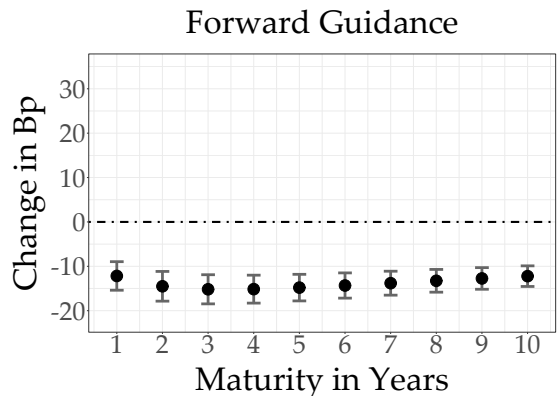
Scaling of the monetary policy shocks

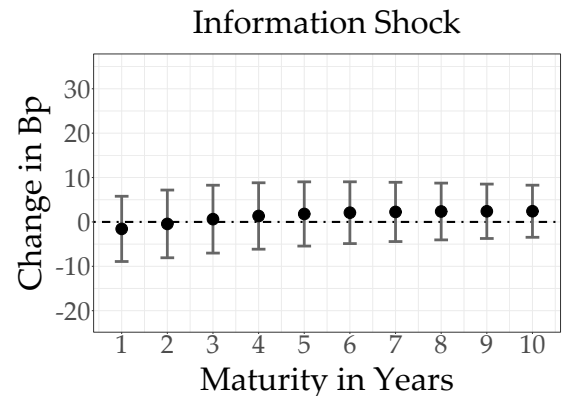
- Target shock: current-month Federal funds futures 25 Bp $\downarrow$
- Forward guidance: one-year-ahead Eurodollar futures 25 Bp $\downarrow$
- Information effect: ten-year Treasury rate 25 Bp $\uparrow$

Effects on Treasury Yields (Adrian et al., 2013)

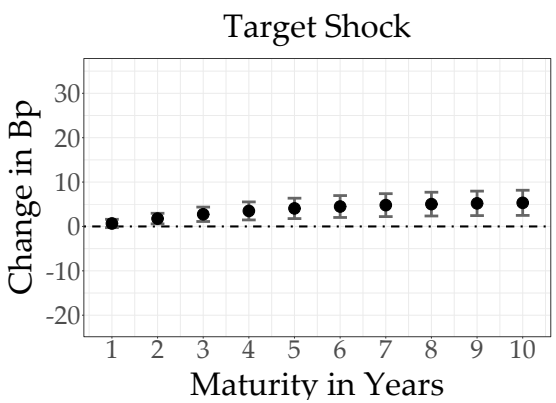
Expected average level of short-term interest rates

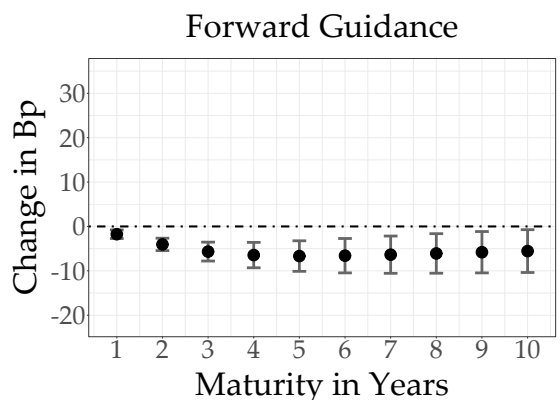


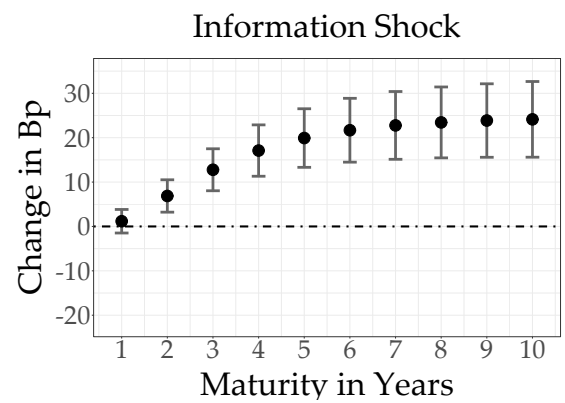




Term premium







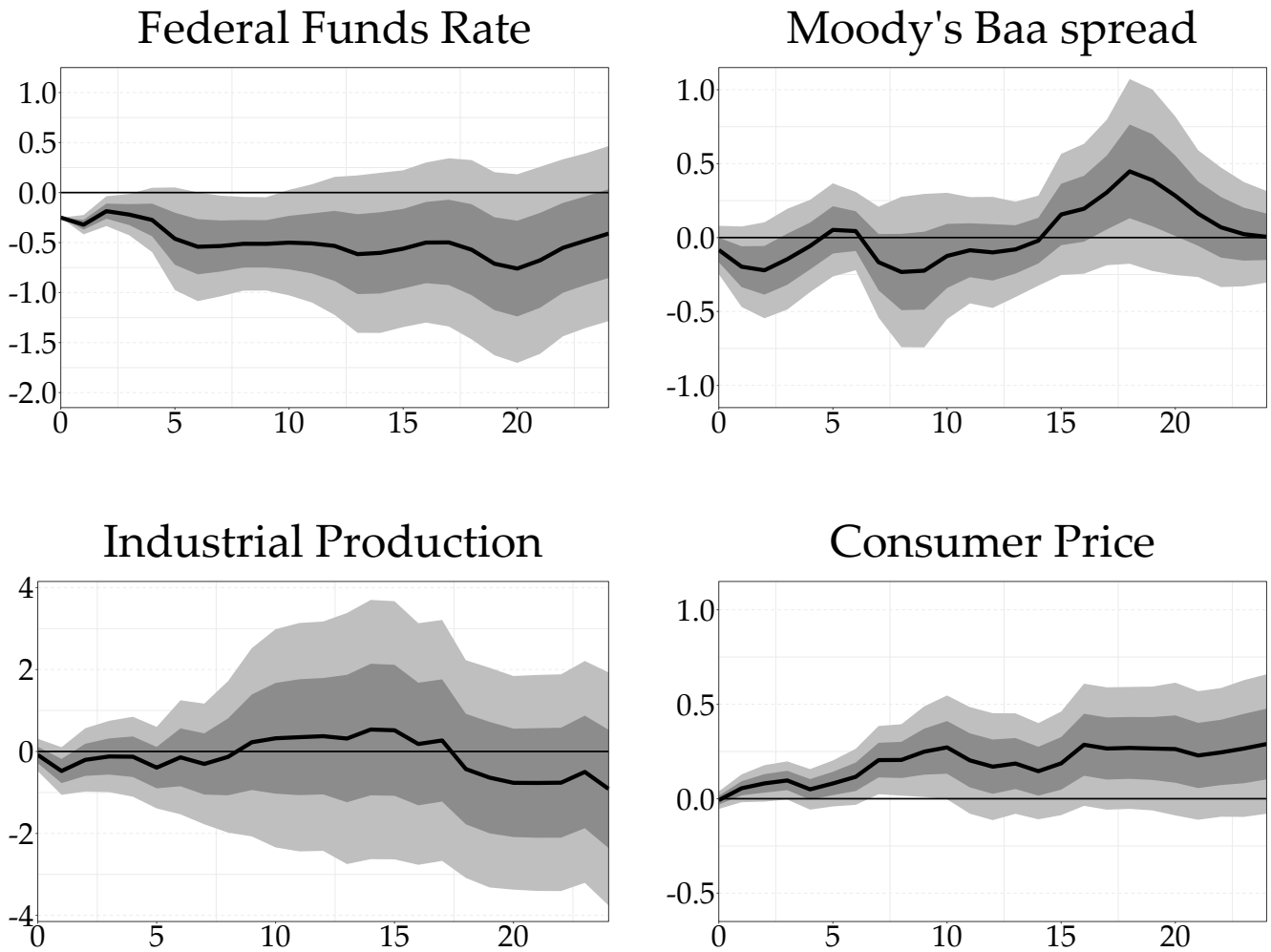
Persistence Real Rates Asymmetric Forward Guidance

Instrumental variables local projection (Jordá, 2005, Stock and Watson, 2018)

$$Y_{i,t+h} = \alpha_{i,h} + \gamma_{i,h} W_t + \theta_{i,h} Y_{1,t} + \xi_{i,t+h}, \tag{1}$$

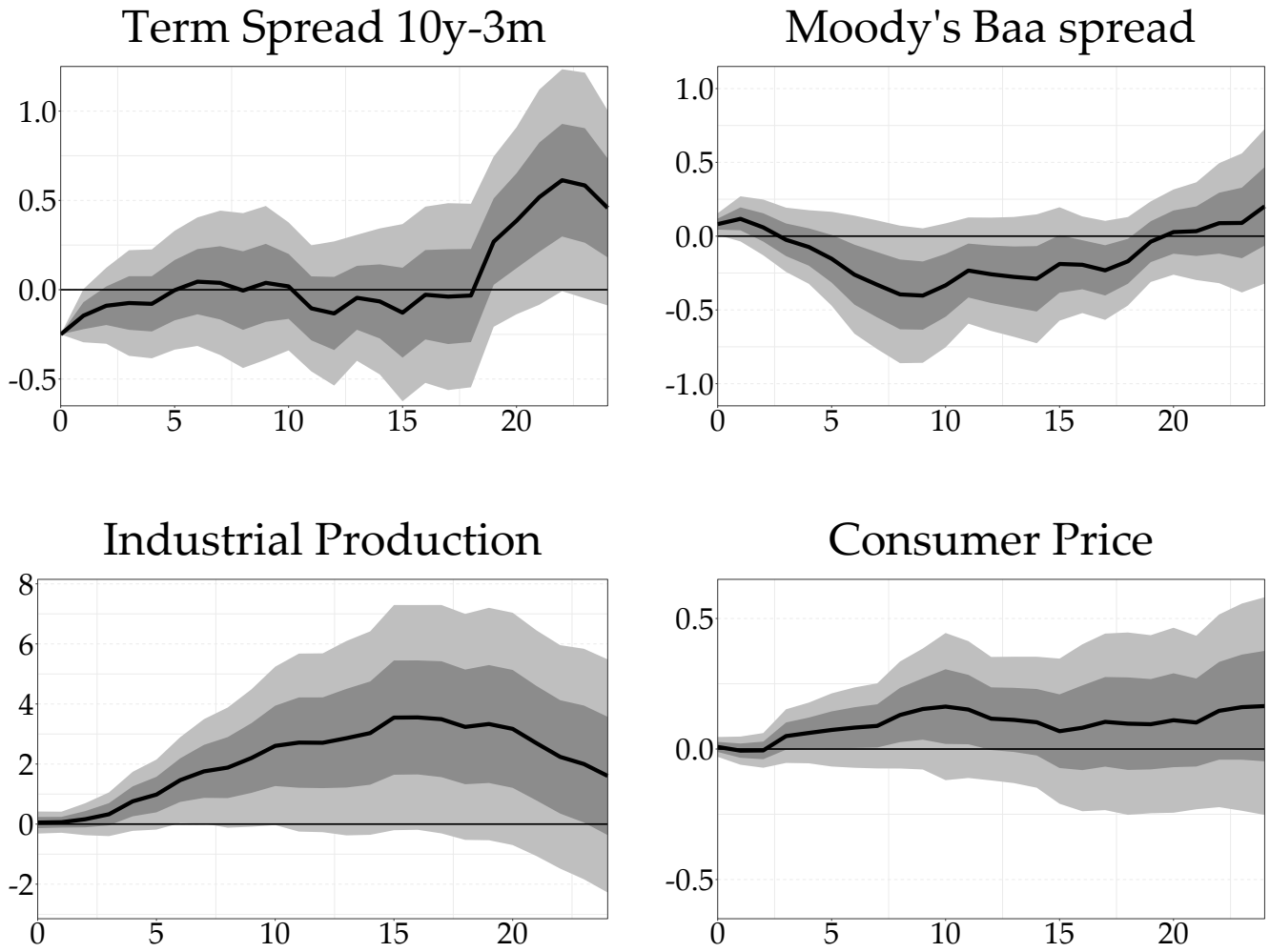
- Variables $Y_{i,t}$: Policy indicator (FFR, 10-Year-3-Month term spread, or 5-Year nominal term premium), ΔIP, ΔCPI, Moody's Baa spread on 10-Year Treasury, (5-Year Treasury Rate, Consensus Forecasts …)
- IV: $m_{j,t}$ as instrument for policy indicator $Y_{1,t}$
- Controls W_t: 6 lags of $Y_{i,t}$, 4 PCs from the FRED-MD data set, other shock measures $m_{k,t}, k \neq j$, and 3 leads of $m_{j,t}$
- Monthly data, July 1991 - September 2017

LP-IV: Target shock (F=35.2)



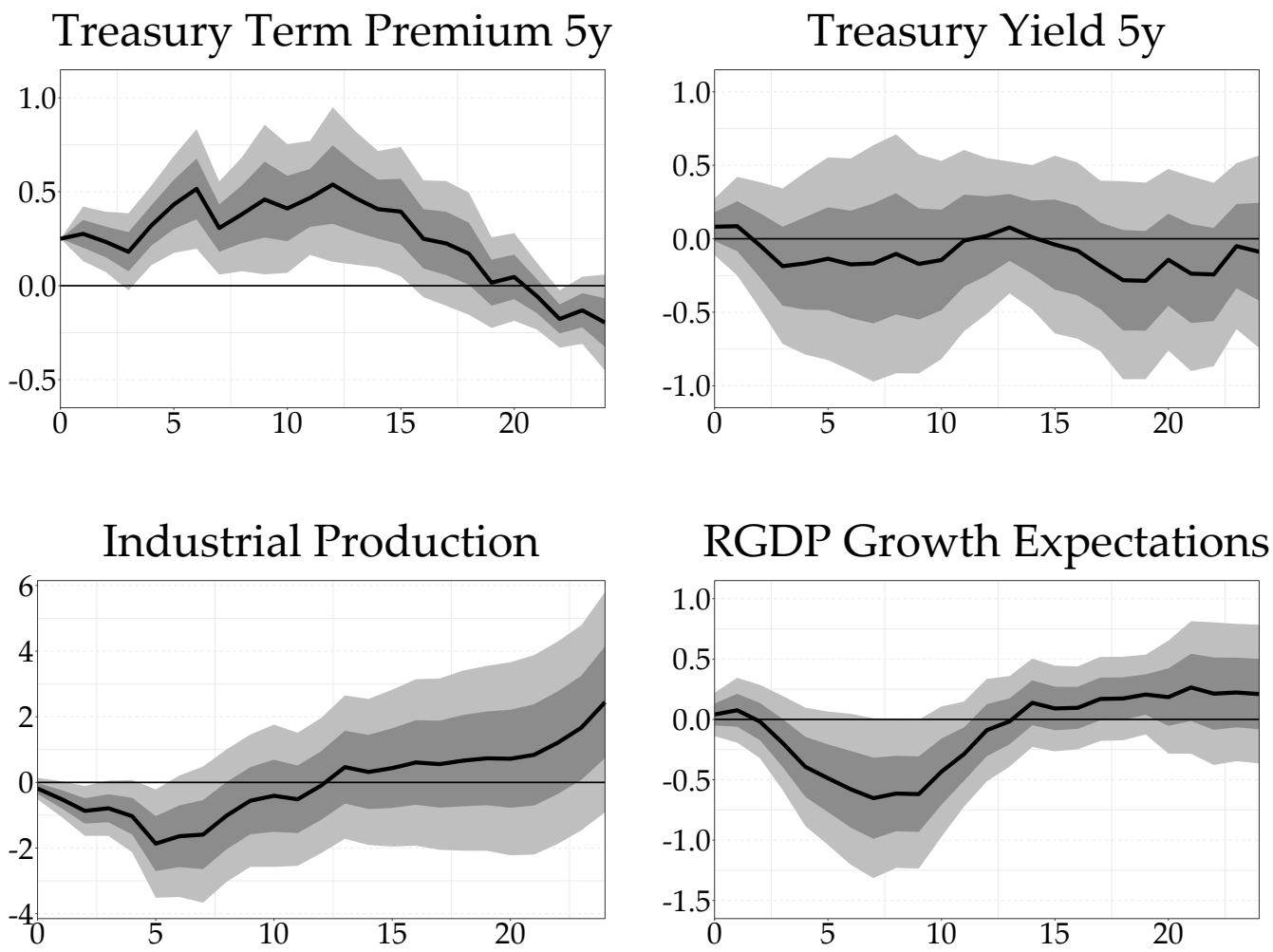
Note: Figures show responses to an expansionary monetary policy shock that lowers the Federal Funds Rate by 25 Bp on impact. 68% and 95% confidence intervals; sample period: 07/1991 - 09/2017

LP-IV: Forward guidance (F=11.1)



Note: Figures show responses to an expansionary forward guidance shock that lowers the term spread by 25 Bp on impact. 68% and 95% confidence intervals; sample period: 07/1991 - 09/2017

IRFs: Information effect (F=10.5)



Note: Figures show responses to an information shock that raises the term premium by 25 Bp on impact. 68% and 95% confidence intervals; sample period: 07/1991 - 09/2017

Conclusion

Disentangling the effects of monetary policy announcements
$\Rightarrow$ long-term inflation rate forwards

- Distinct effects on the term structure
  - Information effect reflects nominal risks signaled by announcement $\Rightarrow$ moves term premium
  - Forward guidance reduces term premium
- Reasonable dynamic effects on macro variables
  - Monetary policy has a significant impact on the real economy
  - Information effect lowers actual and expected output $\Rightarrow$ not accounting for non-monetary policy news may lead to quantity puzzle

Thank you.

Literature I

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Appendix

Related Literature

1. **High-frequency identification of monetary policy shocks**

   Kuttner (2001), Gürkaynak et al. (2005), Gertler and Karadi (2015)

   $\Rightarrow$ Interest rate surprises reflect more than MP shocks

2. **Central bank information effect**

   Campbell et al. (2012, 2016), Miranda-Agrippino and Ricco (2018) use survey data to control for private information of central bank

   - Asset price data as Jarociński and Karadi (2019) $\Rightarrow$ entire yield curve and separate forward guidance
   - Information effect alters bond risk premia: Hanson and Stein (2015), Cieslak and Schrimpf (2019) $\Rightarrow$ macro effects

3. **Models of the information channel**

   Nakamura and Steinsson (2018), Melosi (2017)

back

Identifying Assumption: Literature

Identifying assumption:

- Monetary policy does not affect long-run inflation expectations

Jarociński and Karadi (2019)

- Co-movement between interest rates and stock prices: negative for monetary policy shocks and positive for information effect
  - $\Rightarrow$ No differentiation between target shock and monetary policy path
  - $\Rightarrow$ Stocks are driven by fundamentals

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Andrade and Ferroni (2016)

- Comovement between interest rates and medium run inflation rates: negative for monetary policy shocks and positive for information effect
  - $\Rightarrow$ Market based measures of inflation *compensation* $\Rightarrow$ expected inflation and inflation risk premia
  - $\Rightarrow$ Announcements may signal both demand and supply shocks

back

Table: Variance of Monetary Policy Shocks explained by Factors

	Exogenous innovation to the policy rate		
1^{st} Factor	**0.26*****	**0.26*****	**0.26*****
	(0.07)	(0.06)	(0.06)
2^{nd} Factor		−0.15	**-0.16****
		(0.10)	(0.06)
3^{rd} Factor			**0.31*****
			(0.07)
Observations	216	216	216
R^2	0.06	0.08	0.17
Adjusted R^2	0.06	0.07	0.16
F Statistic	14.36	9.61	14.34

Note: Monetary policy innovation computed from a SVAR including industrial production, producer prices, unemployment, Federal Funds Rate/Shadow Rate (Wu and Xia, 2016), Moody's credit spread indicator (in that order; Cholesky decomposition). Constants are not presented for brevity. Robust standard errors reported in brackets, * p < 0.1, ** p < 0.05,*** p < 0.01.

back

Forward guidance as commitment to a policy path?

- Theory: yes (Eggertsson and Woodford, 2003)
- Practice: central banks provide a conditional forecast of the path of its policy rate

Institutional Feature of IT Central Banks

Forward guidance as commitment to a policy path?

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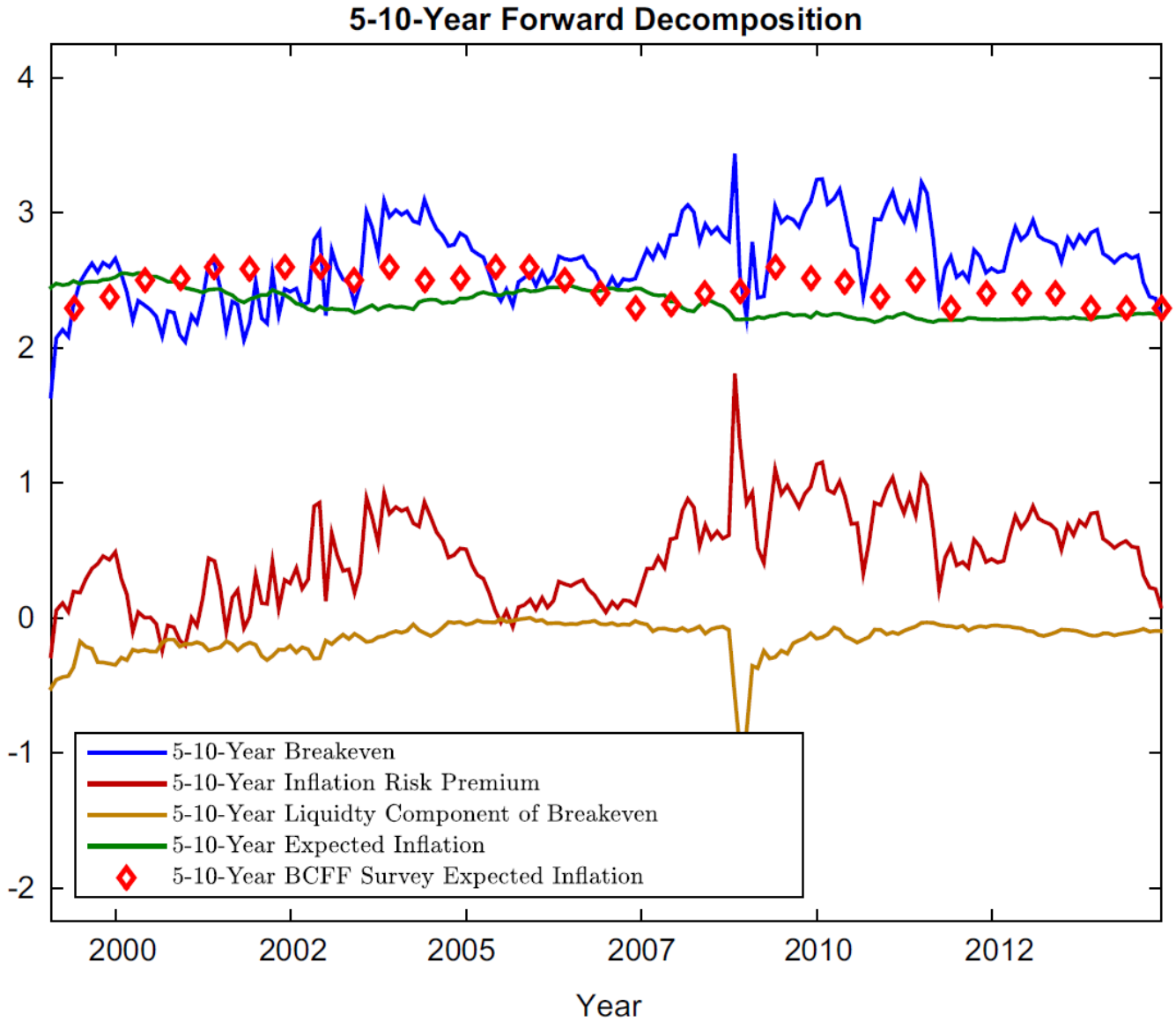
- Practice: central banks provide a conditional forecast of the path of its policy rate

Inflation targeting central banks

- Central banks have an (implicit) inflation target $\Rightarrow$ anchor for market participants' long-run inflation expectations
- 5-Year, 5-Year forward breakeven inflation rate common indicator in the literature (Nautz et al. 2017)

back

Abrahams et al. (2016)



Note: Decomposition of BEI rates into model-implied expected inflation, the inflation risk premium and the liquidity component. (Source: Abrahams et al., 2016)

back

Information effect factor

Partitioning of U

$$f_t = U\tilde{f}_t = U_{12}\begin{bmatrix}\tilde{f}_{1,t}\\ \tilde{f}_{2,t}\end{bmatrix} + U_3\tilde{f}^*_{3,t}$$

External instrument variable m_t: change in 5-Year, 5-Year forward breakeven inflation rate on announcement days

$$\mathbb{E}\left(m_t\begin{bmatrix}\tilde{f}_{1,t}\\ \tilde{f}_{2,t}\end{bmatrix}'\right) = 0$$

$$\mathbb{E}(m_t\tilde{f}^*_{3,t}) = \phi$$

Thus:

$$\begin{aligned}\mathbb{E}(m_t f_t) &= \mathbb{E}\left(m_t(U_{12}\begin{bmatrix}\tilde{f}_{1,t}\\ \tilde{f}_{2,t}\end{bmatrix} + U_3\tilde{f}^*_{3,t})'\right)\\ &= U_{12}\mathbb{E}\left(m_t\begin{bmatrix}\tilde{f}_{1,t}\\ \tilde{f}_{2,t}\end{bmatrix}'\right) + U_3\mathbb{E}(m_t\tilde{f}^*_{3,t})\\ &= U_3\phi\end{aligned}$$

Identification of the instruments II

Forward guidance factor

- Should not load into the current-month Federal funds futures rate
- Should be orthogonal to the information effect factor

$$\begin{bmatrix} \Lambda_1' \\ U_3' \end{bmatrix} U_2 = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

Target factor

- Should be orthogonal to the other two factors

$$\begin{bmatrix} U_2' \\ U_3' \end{bmatrix} U_1 = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

Rotation matrix U

- All column vectors rescaled to have a unit length (preserves unit variance normalization of F)
- U uniquely solved up to a sign convention

back

Table: Estimated Factor Loadings (Sample Period: 1991-2017)

	Target Factor	Forward Guidance Factor	Information Effect Factor
FF1	−1.00	0.00	0.00
FF2	−0.61	−0.57	−0.39
EDF2	−0.64	−0.72	−0.15
EDF3	−0.53	−0.80	−0.12
EDF4	−0.44	−0.87	−0.04
2y-TR	−0.46	−0.83	0.09
5y-TR	−0.29	−0.86	0.39
10y-TR	−0.16	−0.81	0.52

Note: FF1 and FF2 denote the current-month and three-month-ahead Federal funds futures contracts, EDF2 to EDF4 denote the two-, three-, and four-quarter-ahead Eurodollar futures contracts, and the two-, five-, and ten-year Treasury yields are denoted as 2y-TR to 10y-TR.

Regression back

Table: Estimated Factor Loadings: Regression

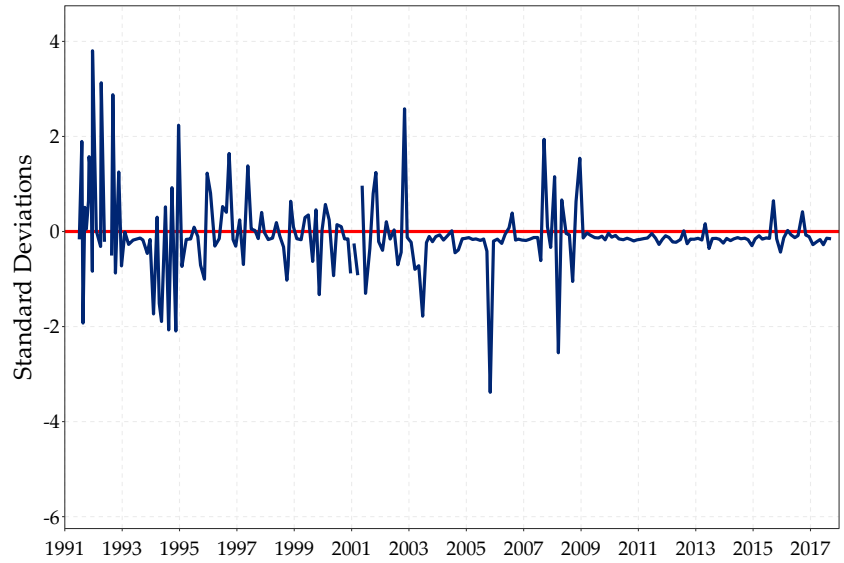
	Target shock		Forward guidance		Information effect	
FF1	-1.00^{***}	(0.00)	-0.00	(0.00)	0.00	(0.00)
FF2	-0.63^{***}	(0.04)	-0.46^{***}	(0.03)	-0.39^{***}	(0.04)
EDF2	-0.71^{***}	(0.03)	-0.62^{***}	(0.03)	-0.16^{***}	(0.03)
EDF3	-0.66^{***}	(0.02)	-0.77^{***}	(0.02)	-0.15^{***}	(0.03)
EDF4	-0.56^{***}	(0.02)	-0.87^{***}	(0.02)	-0.05^{**}	(0.02)
2y-TR	-0.48^{***}	(0.03)	-0.67^{***}	(0.03)	0.09^{***}	(0.03)
5y-TR	-0.33^{***}	(0.01)	-0.78^{***}	(0.01)	0.44^{***}	(0.02)
10y-TR	-0.16^{***}	(0.02)	-0.66^{***}	(0.02)	0.52^{***}	(0.03)

Note: FF1 and FF2 denote the current-month and three-month-ahead Federal funds futures contracts, EDF2 to EDF4 denote the two-, three-, and four-quarter-ahead Eurodollar futures contracts, and the two-, five-, and ten-year Treasury yields are denoted as 2y-TR to 10y-TR.

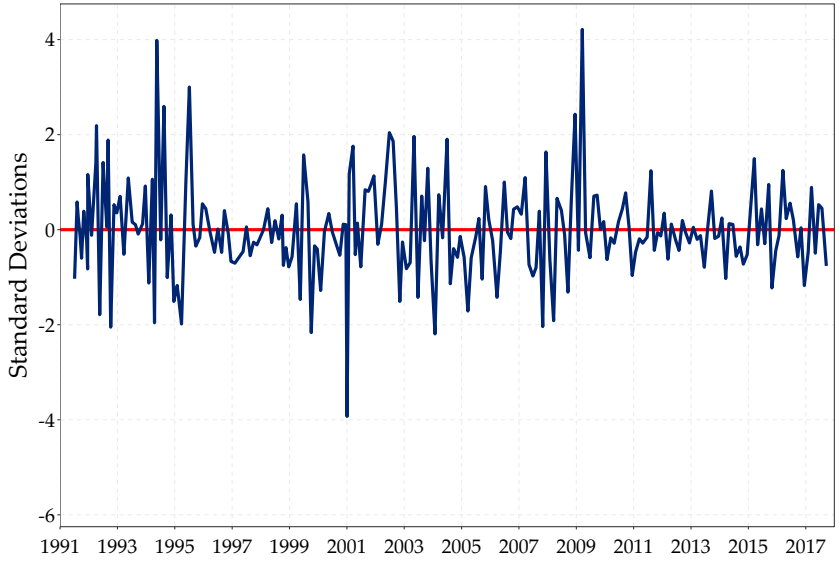
back

Estimated Factors

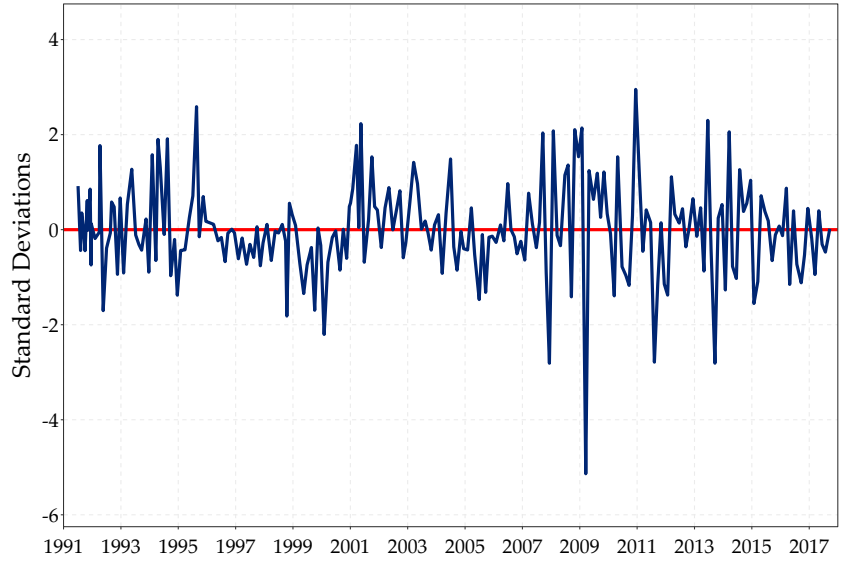
Target shock



Forward guidance shock



Information effect



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Identification: LSAP?

Transmission channel

- Woodford (2012) and Bauer and Rudebusch (2014): signaling channel of asset purchases
- LSAP and forward guidance may interfere empirically $\Rightarrow$ subsumed as forward guidance

Identification strategy

- Approach could be adjusted to explicitly differentiate between LSAP and forward guidance $\Rightarrow$ Swanson (2017) and Altavilla et al. (2019)

back

Private Information of the Fed

$$mps_t^i = \alpha + \sum_{h=0}^{3} \beta_h (\hat{X}_{t+h|t}^{GB} - \hat{X}_{t+h|t}^{SPF}) + \epsilon_t$$

	Target		Forward		Information	
$\hat{X}$	shock		guidance		effect	
Δy_t	**-0.14***	(0.08)	**-0.18***	(0.11)	**0.17***	(0.10)
Δy_{t+1}	-0.05	(0.13)	0.06	(0.20)	**-0.43*****	(0.16)
Δy_{t+2}	-0.16	(0.16)	-0.08	(0.24)	-0.08	(0.15)
Δy_{t+3}	0.15	(0.15)	-0.16	(0.22)	0.31	(0.19)
π_t	-0.06	(0.08)	0.02	(0.15)	-0.08	(0.17)
π_{t+1}	0.21	(0.16)	-0.05	(0.17)	0.07	(0.15)
π_{t+2}	0.01	(0.21)	-0.05	(0.30)	-0.13	(0.32)
π_{t+3}	0.06	(0.17)	-0.10	(0.29)	**-0.63***	(0.38)
u_t	-0.21	(0.35)	0.26	(0.47)	**1.17****	(0.51)
R^2	0.07		0.07		0.18	
F	1.33		1.24		**3.94*****	

Note: Sample period: 04/1992 - 12/2012. Robust standard errors

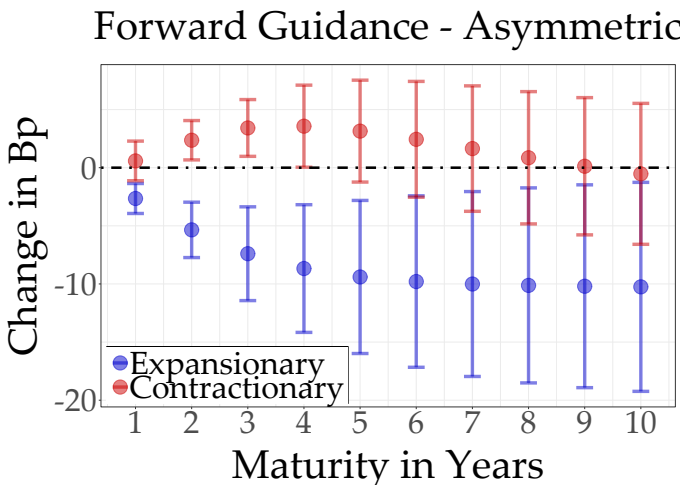
back

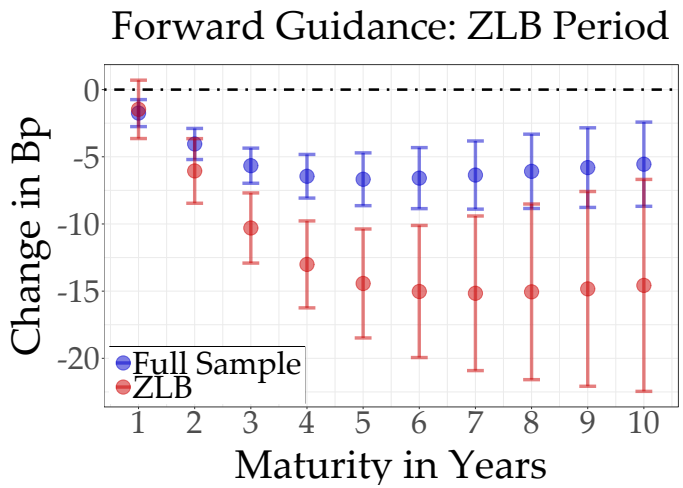
Non-linear Effects on Treasury Yields

Test for non-linearities:

$$\Delta i_t^m = \alpha + \beta_{\mathbf{1}}^{\mathbf{m}} I_t mps_t^i + \beta_{\mathbf{2}}^{\mathbf{m}} (1 - I_t) mps_t^i + \epsilon_t$$

Term Premium



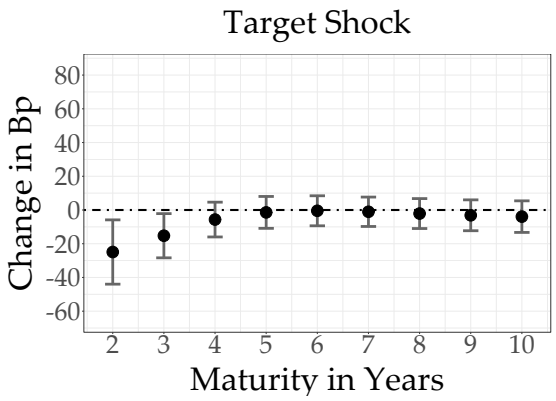


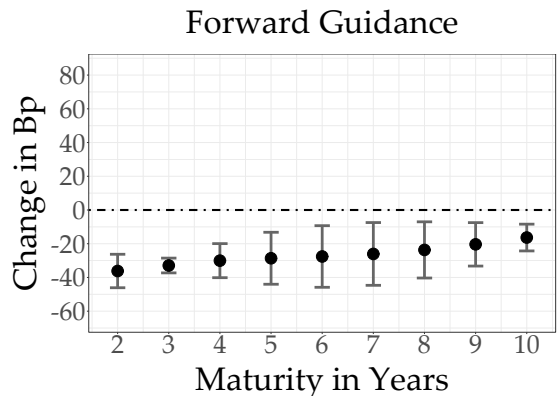
- Forward guidance reduces uncertainty about the future policy path $\Rightarrow$ term premium decreases
- Effects of forward guidance on term premia are higher at the zero lower bound

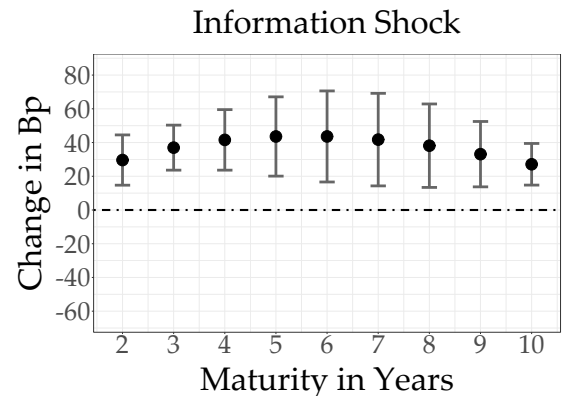
back

TIPS Term Structure (Gürkaynak et al. 2010)

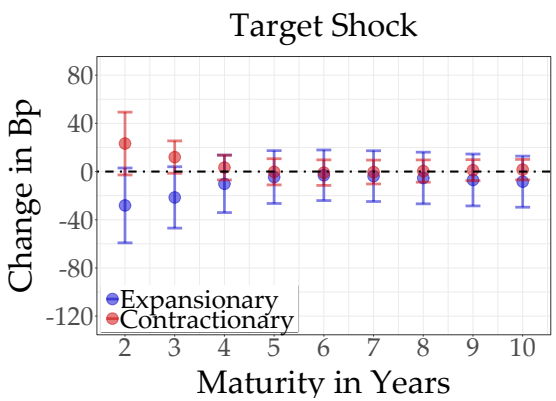
Real forward rates

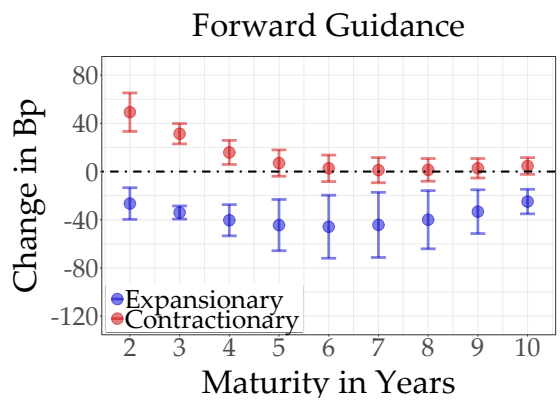


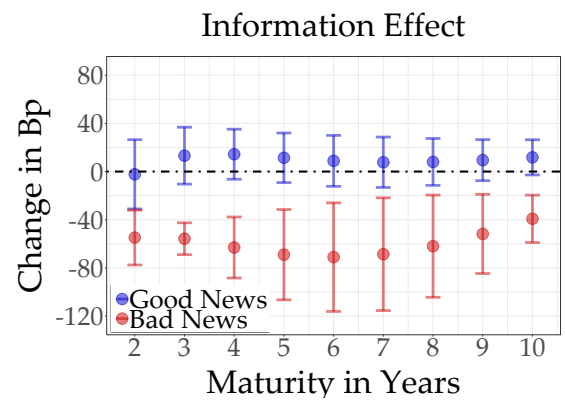




Asymmetric responses







Notes: Estimated coefficients and 95% robust confidence intervals (bars) from regressions of daily changes in real forward rates across different maturities on the identified shocks. Sample period: 01/2004 - 09/2017

Persistence back

Open-ended vs. Contingent Forward Guidance

Forward Guidance Types following Ehrmann et al. (2019)

1. Open-ended guidance: FOMC 12/2008 - 06/2011 and 03/2014 - 09/2017

   […] the Committee anticipates that weak economic conditions are likely to warrant exceptionally low levels of the federal funds rate ***for some time****.*

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   The Committee currently anticipates that economic conditions […] are likely to warrant exceptionally low levels for the federal funds rate ***at least through mid-2013****.*

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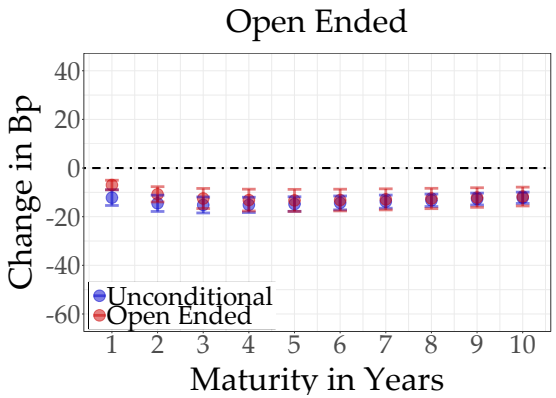
   The Committee currently anticipates that economic conditions […] are likely to warrant exceptionally low levels for the federal funds rate ***at least through mid-2013****.*

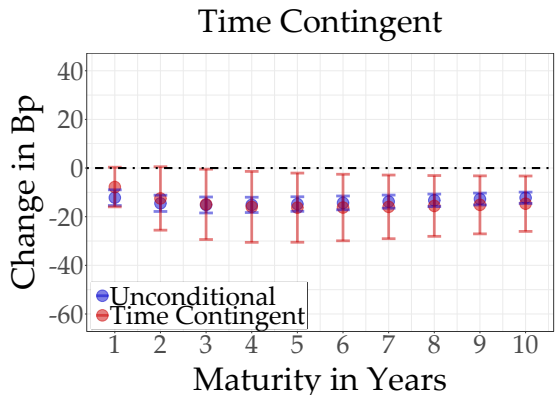
3. State-contingent guidance: FOMC 12/2012 - 01/2014

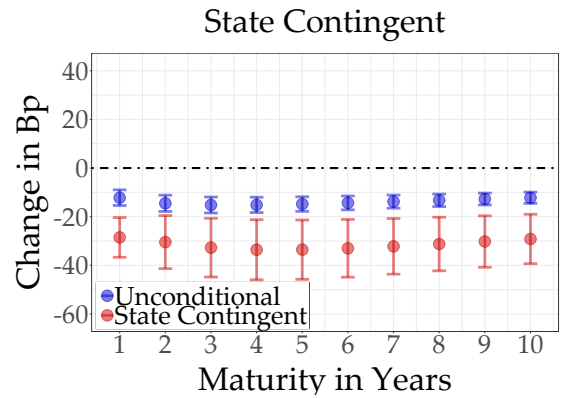
   […] the Committee […] currently anticipates that this exceptionally low range for the federal funds rate will be appropriate at least as long as the ***unemployment rate remains above 6-1/2 percent****, inflation between one and two years ahead is projected to be no more than a half percentage point above the Committee's 2 percent long-run goal, and* ***longer-term inflation expectations continue to be well anchored****.*

Forward Guidance

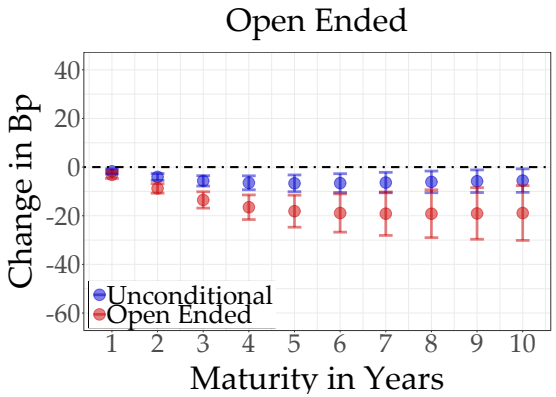
Expected average level of short-term interest rates

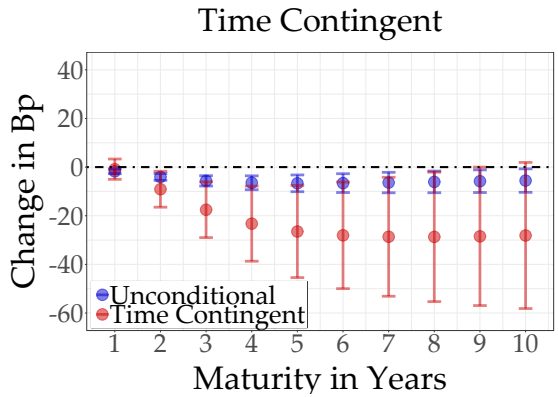


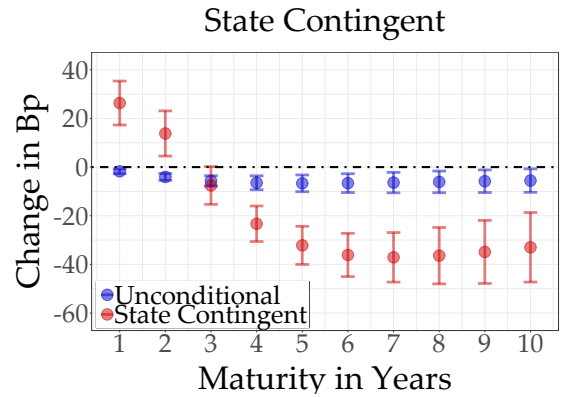




Term premium

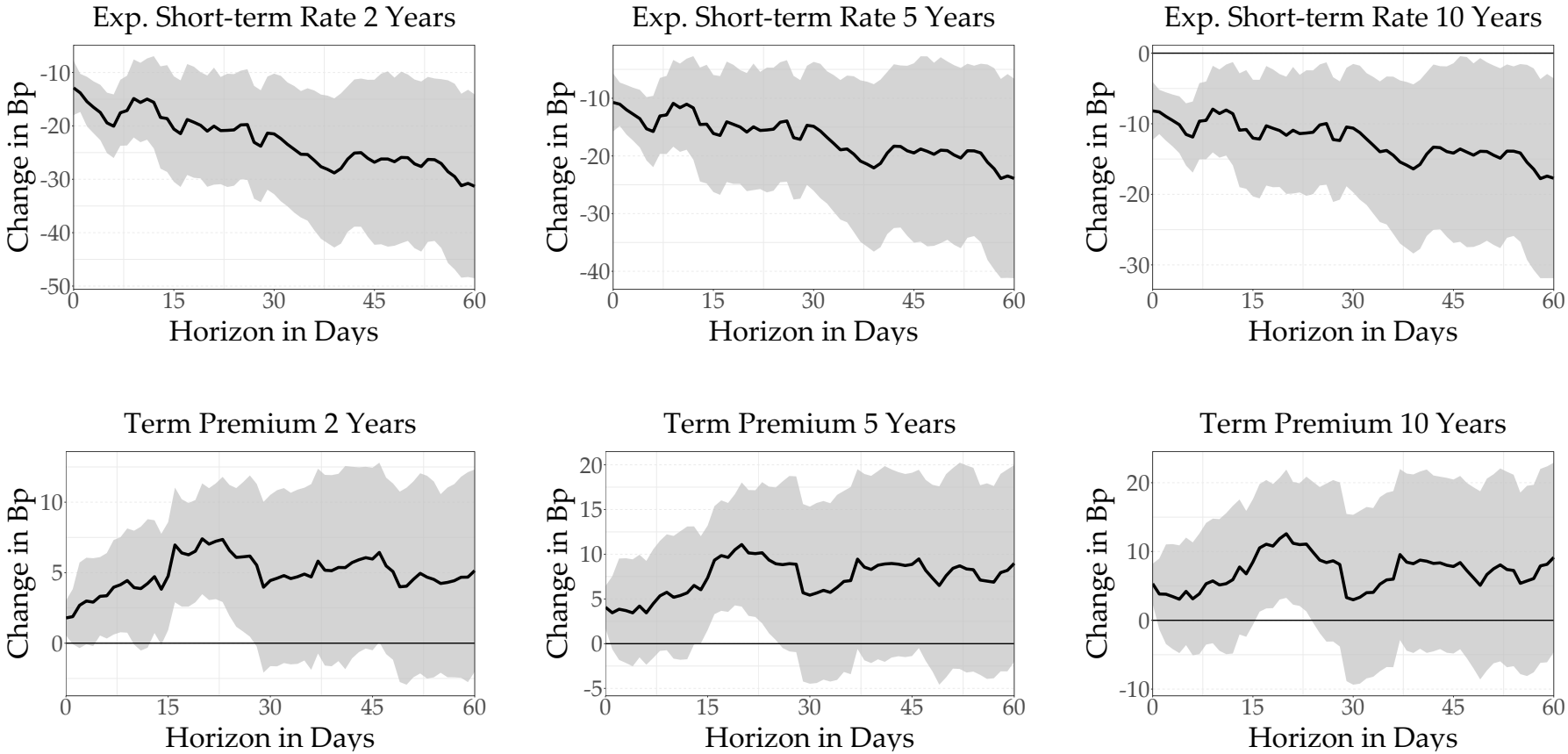






Nominal Term Structure - Persistence

Target Shock



Notes: Figures show estimated coefficients and 95% robust confidence intervals (bars) from regressions of daily changes in the components of nominal yields across different maturities on the identified shocks.

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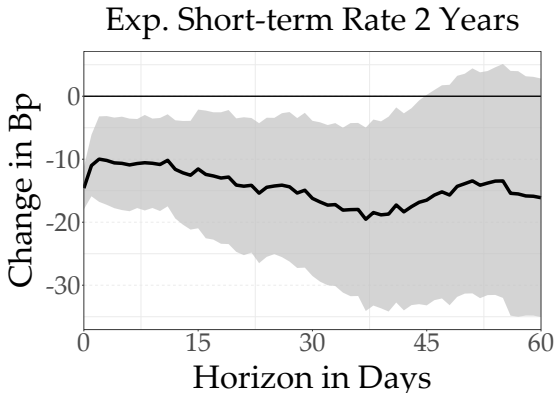
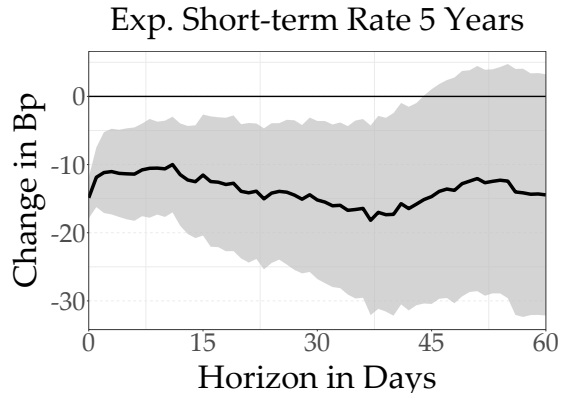
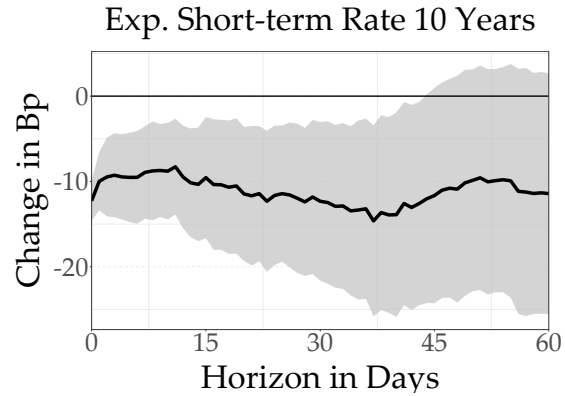
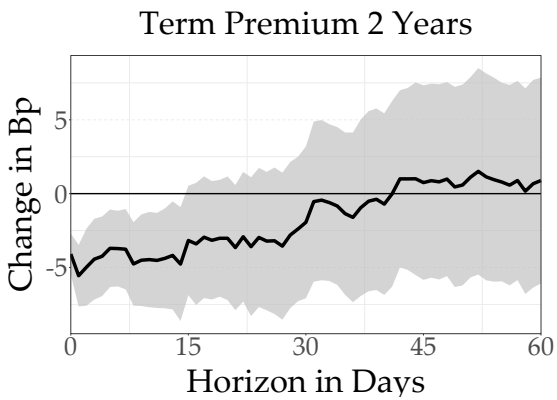
Nominal Term Structure - Persistence

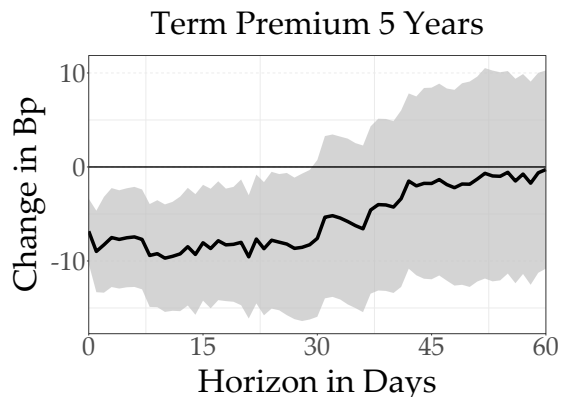
Forward Guidance

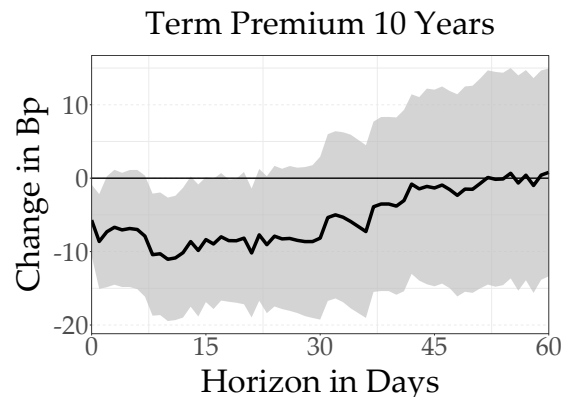








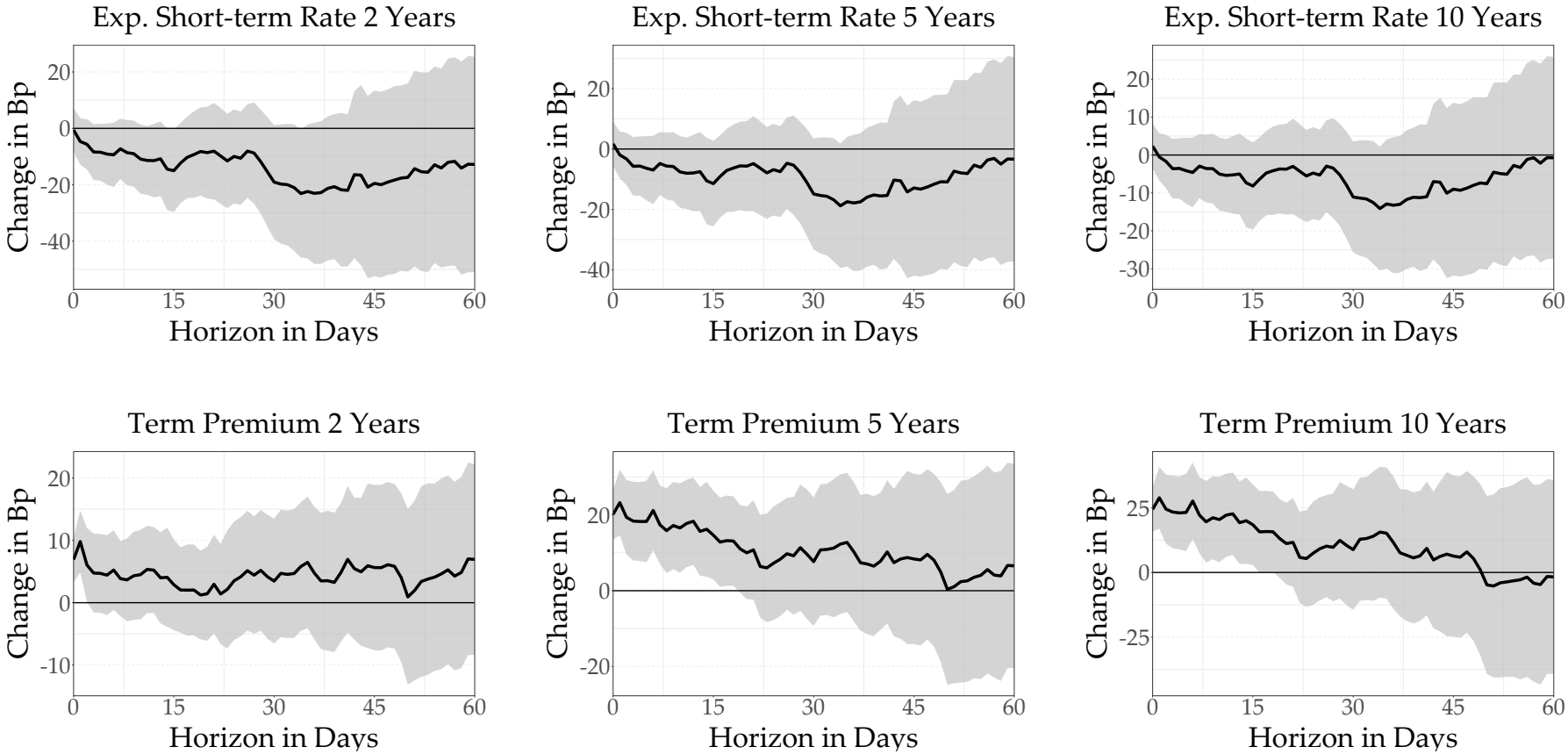




Notes: Figures show estimated coefficients and 95% robust confidence intervals (bars) from regressions of daily changes in the components of nominal yields across different maturities on the identified shocks.

Nominal Term Structure - Persistence

Information Effect



Notes: Figures show estimated coefficients and 95% robust confidence intervals (bars) from regressions of daily changes in the components of nominal yields across different maturities on the identified shocks.

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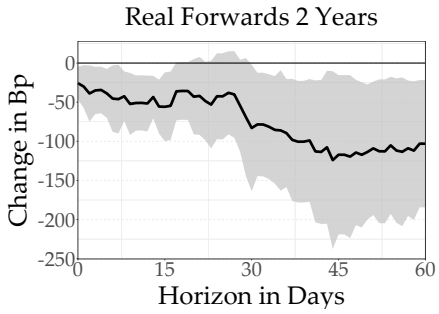
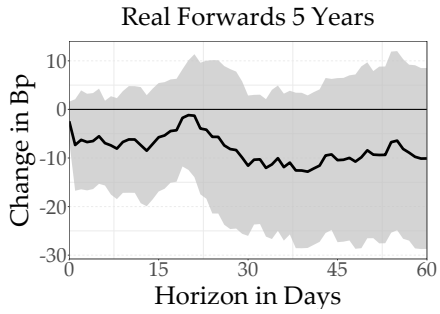
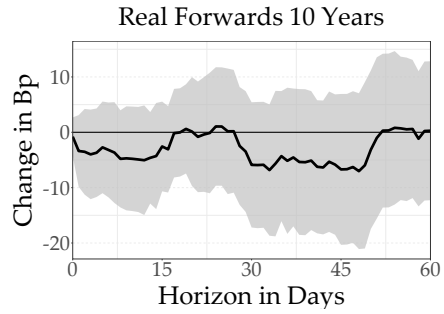
Real Term Structure - Persistence

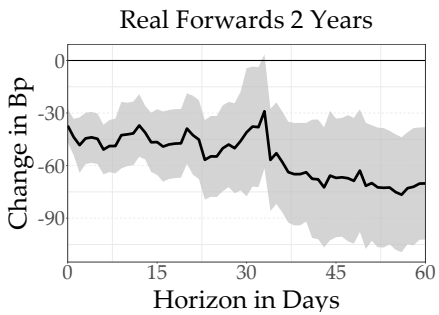
Target Shock

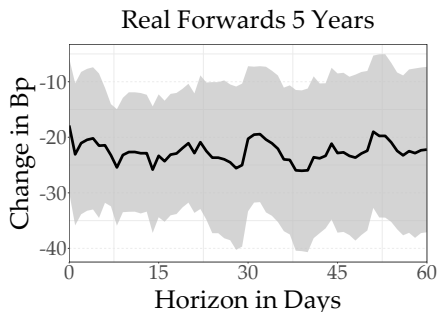


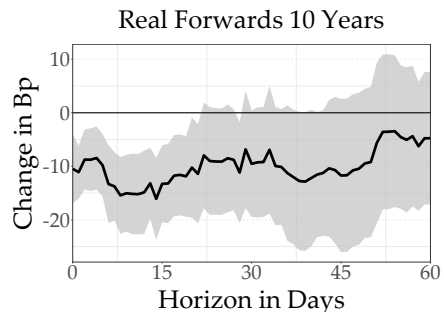




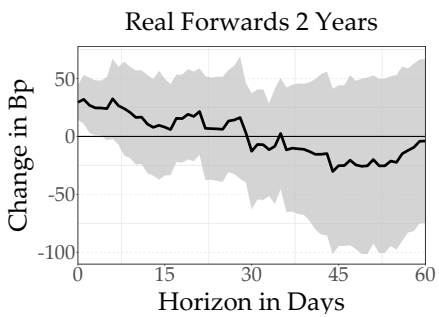
Forward Guidance

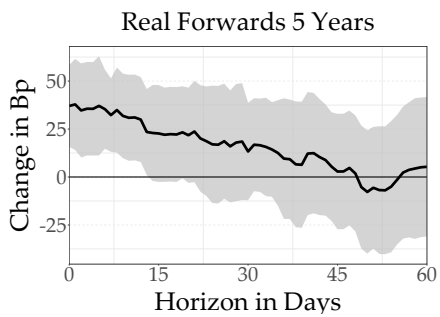


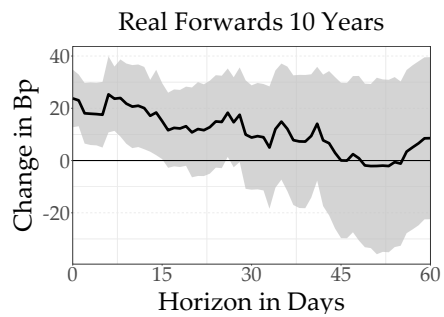




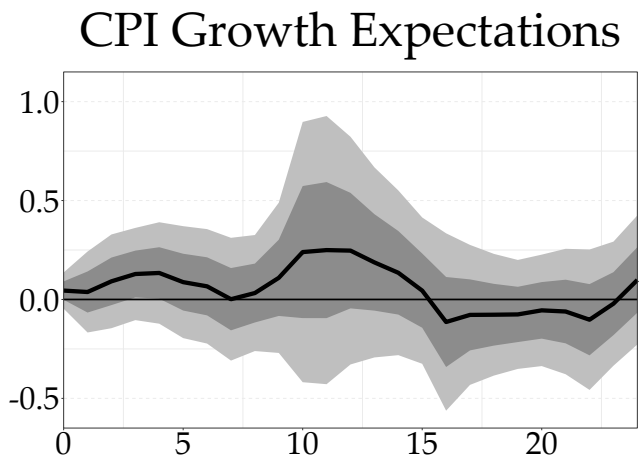
Information Effect

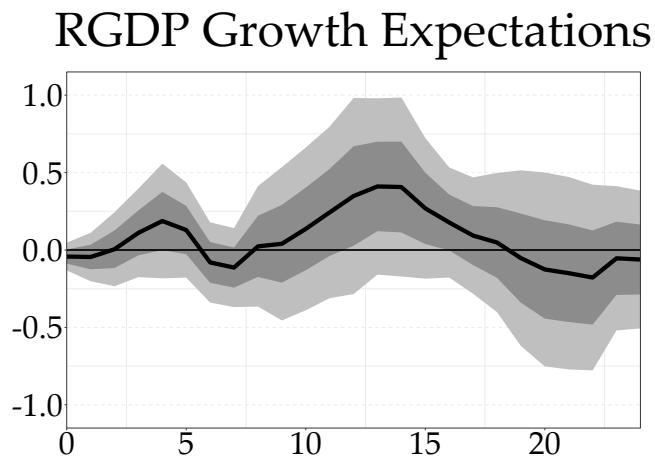






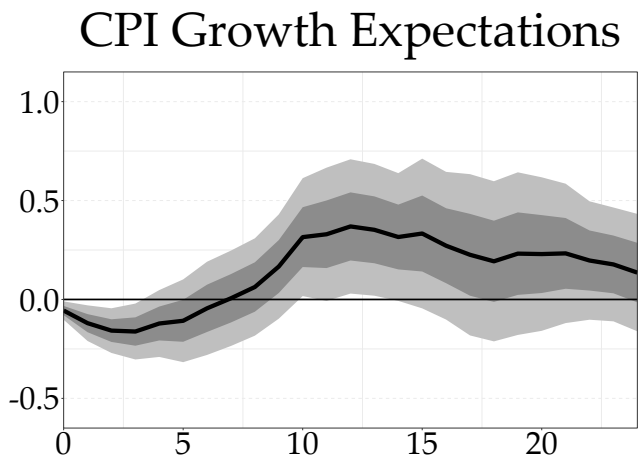
LP-IV: Target shock

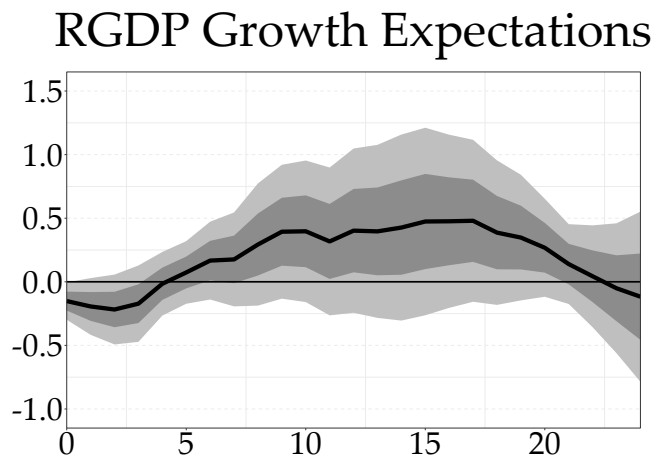




Note: Figures show responses to an expansionary monetary policy shock that decreases the FFR rate by 25 Bp on impact. 68% and 95% confidence intervals; sample period: 07/1991 - 09/2017

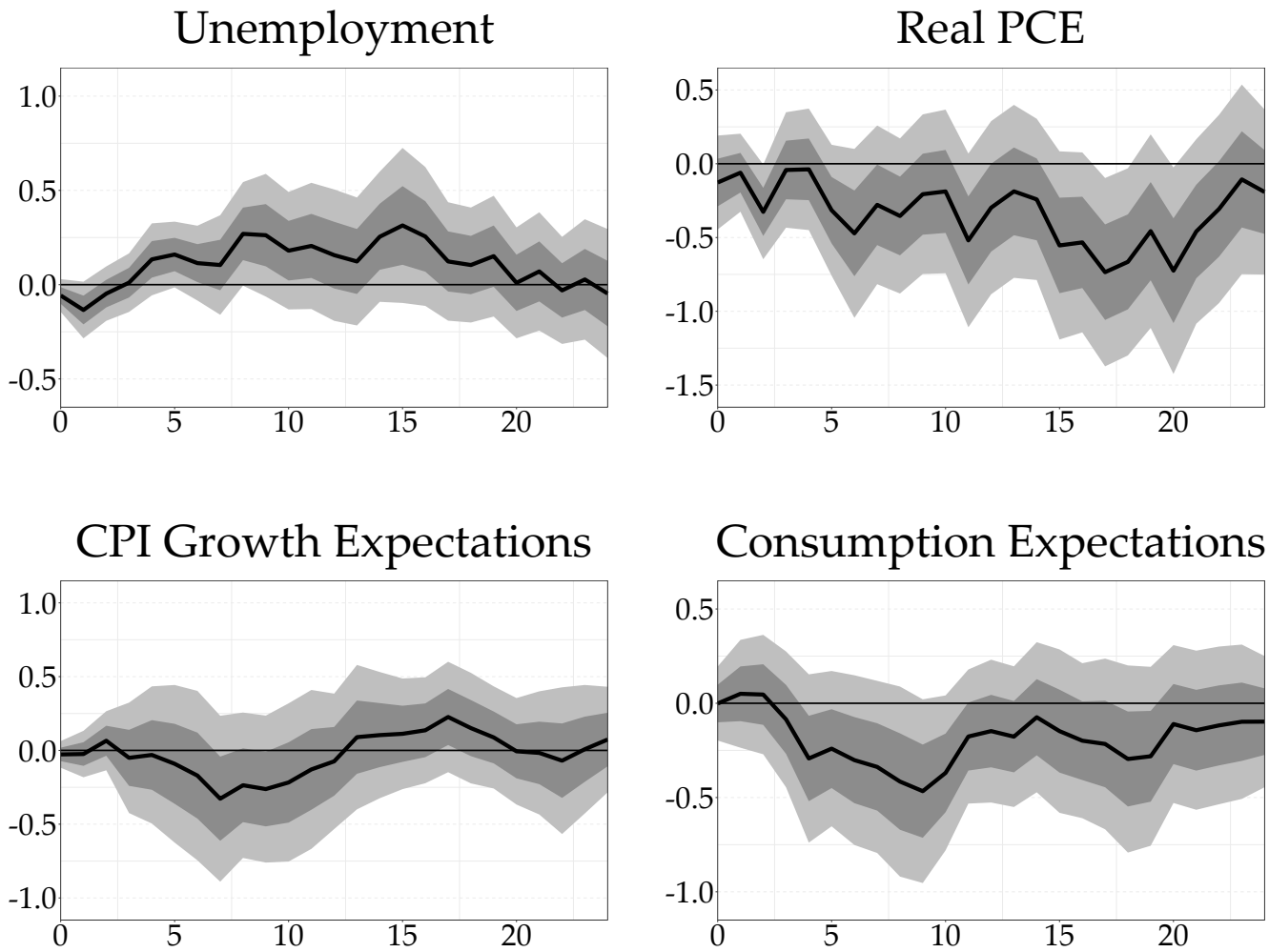
LP-IV: Forward guidance





Note: Figures show responses to an expansionary forward guidance shock that lowers the term spread by 25 Bp on impact. 68% and 95% confidence intervals; sample period: 07/1991 - 09/2017

LP-IV: Information Shock



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