Central Bank Information Shocks

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Background

- We study empirically the impact of central bank policy announcements on the economy.

- Key data: movements of financial markets within 30 minutes of a policy announcement (**surprises**)

  – surprises as proxies for **monetary policy shocks**, track their effect on the economy, see e.g. Kuttner (2001), Gürkaynak, Sack and Swanson (2005), Gertler and Karadi (2015)

  – We will improve the proxy by separating it from a contemporaneous shock that biases its estimated impact.

Example of a policy announcement: January 22, 2008, 2pm

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Press Release

For immediate release

The Federal Open Market Committee has decided to lower its target
for the federal funds rate 75 basis points to 3-1/2 percent.

The Committee took this action in view of a weakening of the
economic outlook and increasing downside risks to growth.  ...
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surprise: change in financial asset prices between 1:50pm and 2:20pm

Economics 101: stock prices increase after a surprise cut of the fed funds rate

- After news about interest rates, stock prices should always move in the *opposite* direction to the interest rate
  - *lower* fed funds rate:

$\rightarrow$ cheaper credit, demand stimulus $\rightarrow$ higher future dividends

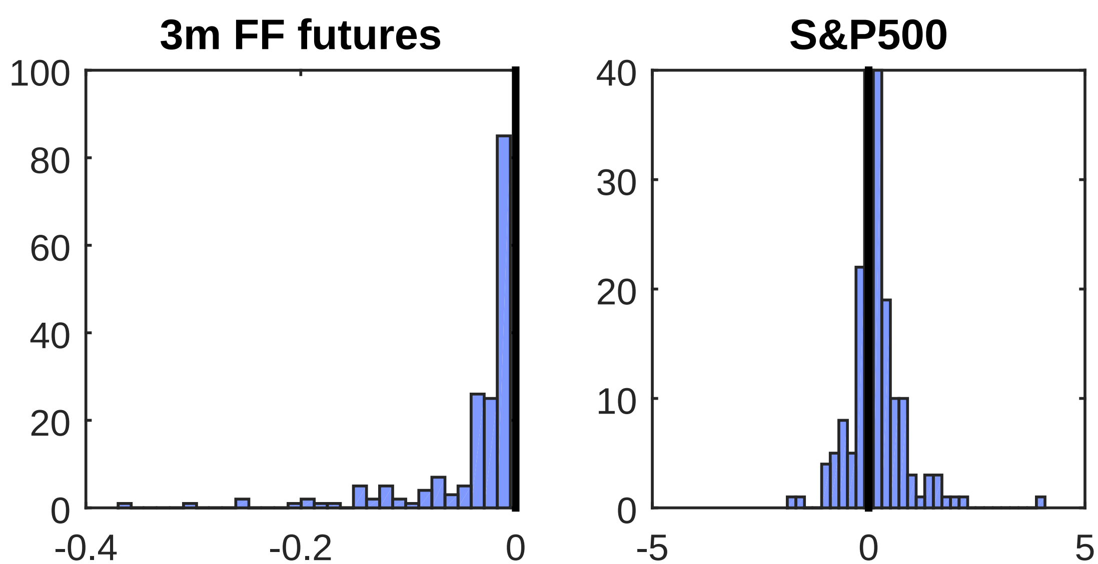
$\rightarrow$ lower discount rate

$\Rightarrow$ present discounted value of dividends rises = stock price *rises*

An intriguing fact that motivates this paper: stock prices often do not increase after a surprise interest rate cuts (or vice-versa)

Histogram of the surprises

. Interest rate | Stock prices



percent | percent

How to account for the stock price surprises that go in the wrong direction?

- Two possibilities:

  1. Stock prices are noisy

  2. Another shock (another piece of news) arrives often during the same half-hour window

What we do in this paper

- We partition **monetary policy surprises** into two components
  - **monetary policy shock**: temporary deviation from interest rate rule
  - **central bank information shock**: CB private info on the economy
- We measure the effect of each component on the economy
- We use a Structural VAR with a mix of *high-frequency identification* and *sign restrictions*. We study the United States and the euro area.
- Interpret the results through the lens of a macroeconomic model.

New findings

- Monetary policy surprises $\neq$ monetary policy shocks
  - They are a mix of monetary policy shocks and central bank information shocks
- These two shocks have *very* different effects on the macroeconomy
- Pure monetary policy shocks cause a more vigorous price decline than in the literature, price puzzles don't appear
- Central bank information shocks look like demand shocks

Plan of this presentation

- Data
- VAR, identification
- Results: IRFs
- A structural DSGE interpretation

Data: surprises

Updated Gürkaynak, Sack and Swanson (2005) dataset

- 241 announcements of the Federal Open Market Committee (FOMC) from 1990 to 2016, each with the exact date/time t
- High-frequency data on fed funds futures (1,3,6 months), benchmark Treasury bond yields (2,5,10 years), log of the S&P500 stock market index (also NASDAQ and Wilshire 5000), dollar/euro exchange rate
- We compute **surprises**: change of the price of instrument X between $t - 10$min and $t + 20$min
- We aggregate these surprises at the monthly frequency - m_t

Data - low frequency

Monthly data on y_t:

- government bond yields
- stock market index S&P500
- real GDP and GDP deflator (interpolated using Kalman filter, Stock and Watson 2010) *or* industrial production, consumer prices
- Excess bond premium (Gilchrist and Zakrajsek, 2012 - fin.conditions)
- VIX (uncertainty); GDP and CPI expectations by professional forecasters; dividends on S&P500

VAR with surprises

m_t - surprises (monthly), y_t - macroeconomic variables (monthly)

Specification A, unrestricted:

$$\begin{pmatrix} m_t \\ y_t \end{pmatrix} = \sum_{p=1}^{P} \begin{pmatrix} B_{MM}^p & B_{MY}^p \\ B_{YM}^p & B_{YY}^p \end{pmatrix} \begin{pmatrix} m_{t-p} \\ y_{t-p} \end{pmatrix} + \begin{pmatrix} c_m \\ c_y \end{pmatrix} + \begin{pmatrix} u_t^m \\ u_t^y \end{pmatrix}.$$

Specification B, m_t are i.i.d.:

$$\begin{pmatrix} m_t \\ y_t \end{pmatrix} = \sum_{p=1}^{P} \begin{pmatrix} 0 & 0 \\ B_{YM}^p & B_{YY}^p \end{pmatrix} \begin{pmatrix} m_{t-p} \\ y_{t-p} \end{pmatrix} + \begin{pmatrix} 0 \\ c_y \end{pmatrix} + \begin{pmatrix} u_t^m \\ u_t^y \end{pmatrix}.$$

One can test A vs B using the Bayes Factor of Jarociński and Maćkowiak (2017 REStat).

Bayesian estimation

- Minnesota prior on the nonzero coefficients B_{YM}, B_{YY} and $\mathbf{\Sigma}$ $\left(\equiv \text{var}\begin{pmatrix} u_t^m \\ u_t^y \end{pmatrix}\right)$
  - Independent, Normal on Bs, Inverted Wishart on $\mathbf{\Sigma}$
  - Standard hyperparameter values (Sims and Zha, 1998)
- Gibbs sampler
- We also draw the missing observations on m_t

Identification: combine two elements

- High-frequency: only monetary policy and central bank information shocks affect m_t

- Sign restrictions: disentangle monetary policy and central bank information shocks based on the comovement of the interest rates and stock prices

Identification: sign restrictions

We distinguish the two shocks based on the response of the stock market to the CB communication *in the half-hour window*.

- Contractionary monetary policy shock: (*interest rates increase*)
    - Downturn $\rightarrow$ lower dividends; higher interest rate $\rightarrow$ lower present value of dividends $\Rightarrow$ *stock prices drop*
- Positive CB information shock: (*interest rates increase*)
    - Reveals a boom: higher dividends. Monetary policy tightens to partially contain it: somewhat higher discount rate $\Rightarrow$ *stock prices increase*

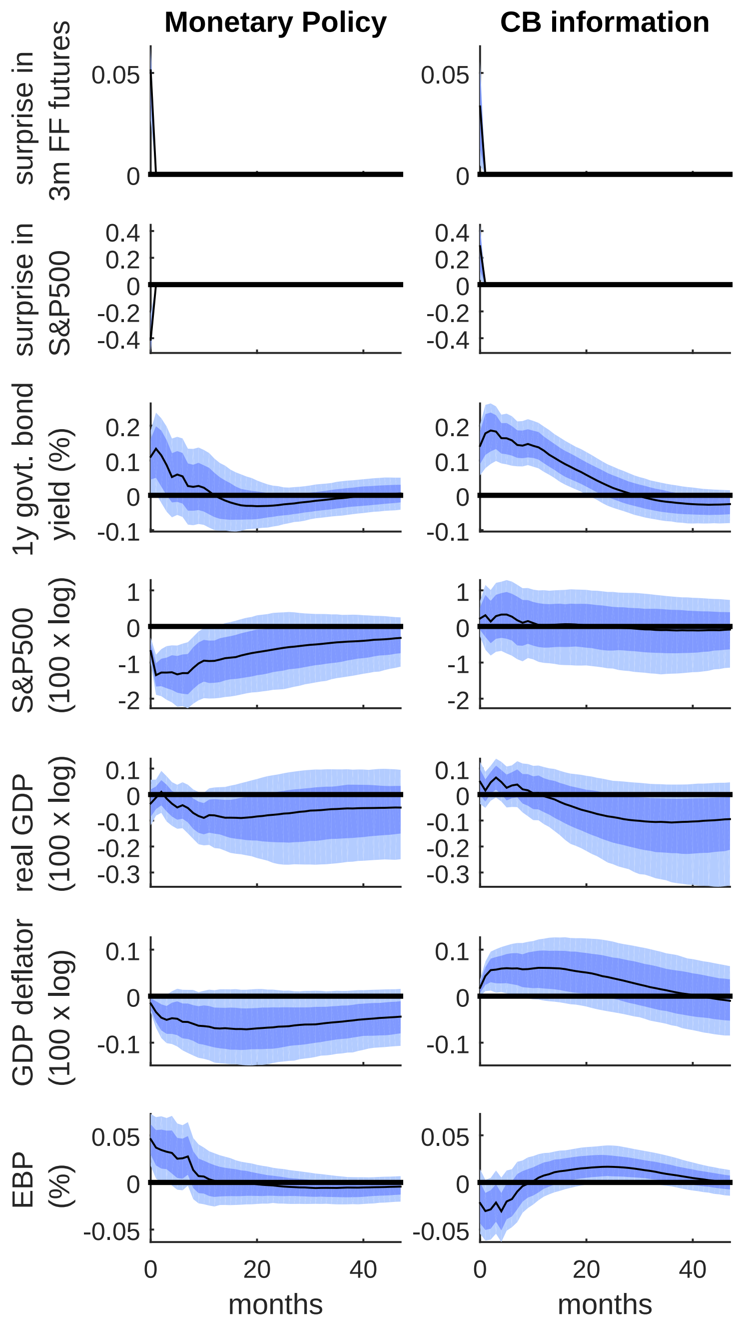
Identification

	variable	shock Monetary Policy	 Central Bank Information	 all other
m (high frequency)	interest rate	$+$	$+$	0
	stock index	$-$	$+$	0
y (low frequency)	...	$\bullet$	$\bullet$	$\bullet$

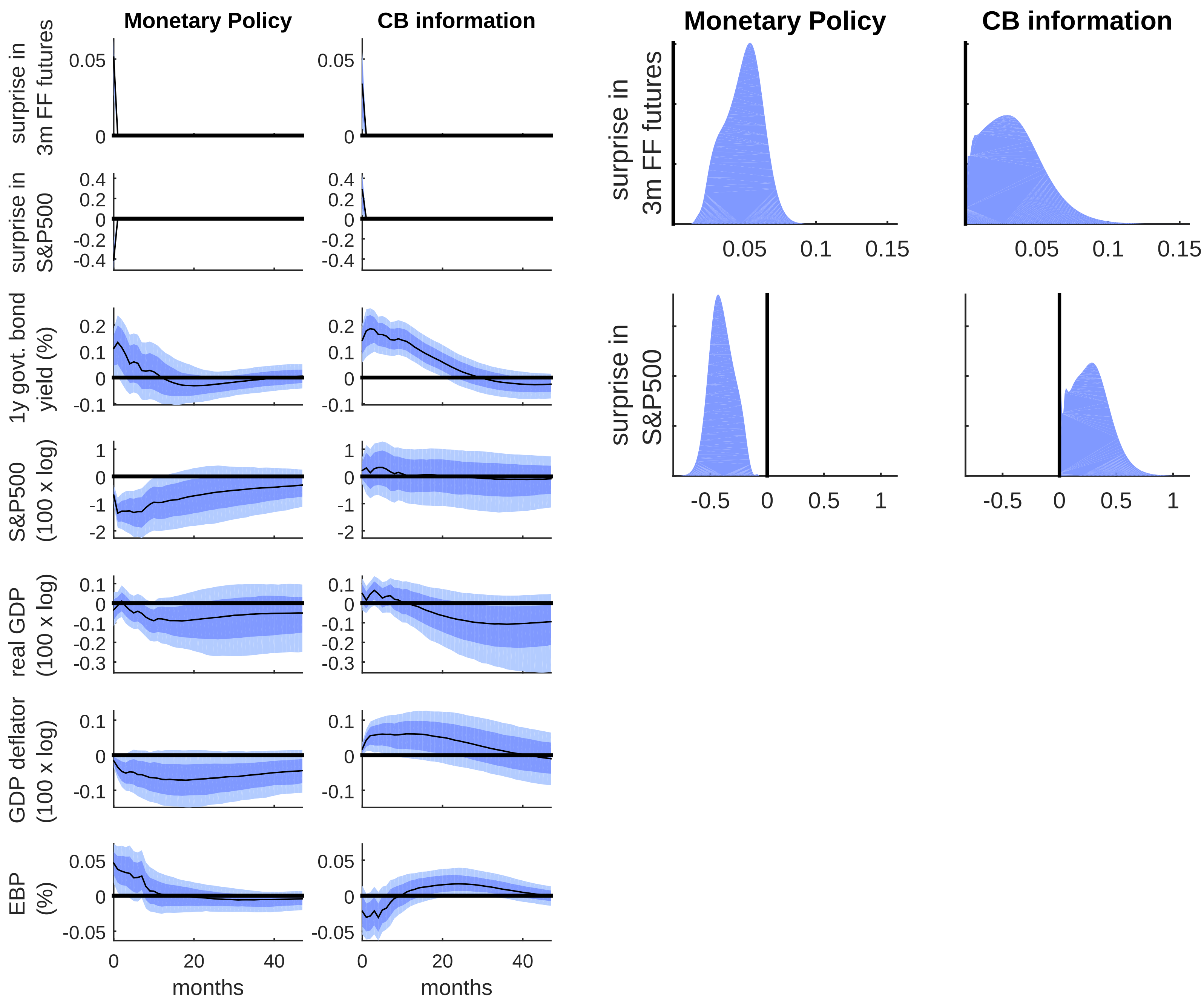
For comparison: Choleski*

	variable $\downarrow$ shock $\rightarrow$	mon.pol.	all other
m	interest rate	$+$	0
y	...	$\bullet$	$\bullet$

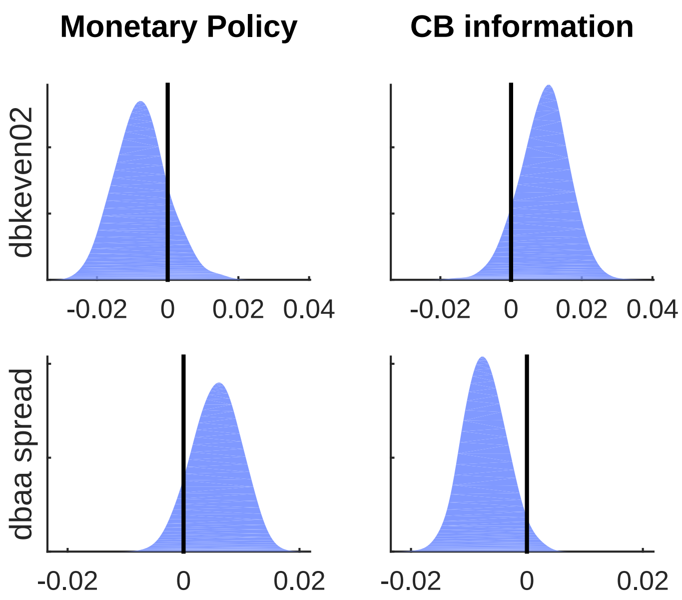
Impulse responses



Impulse responses



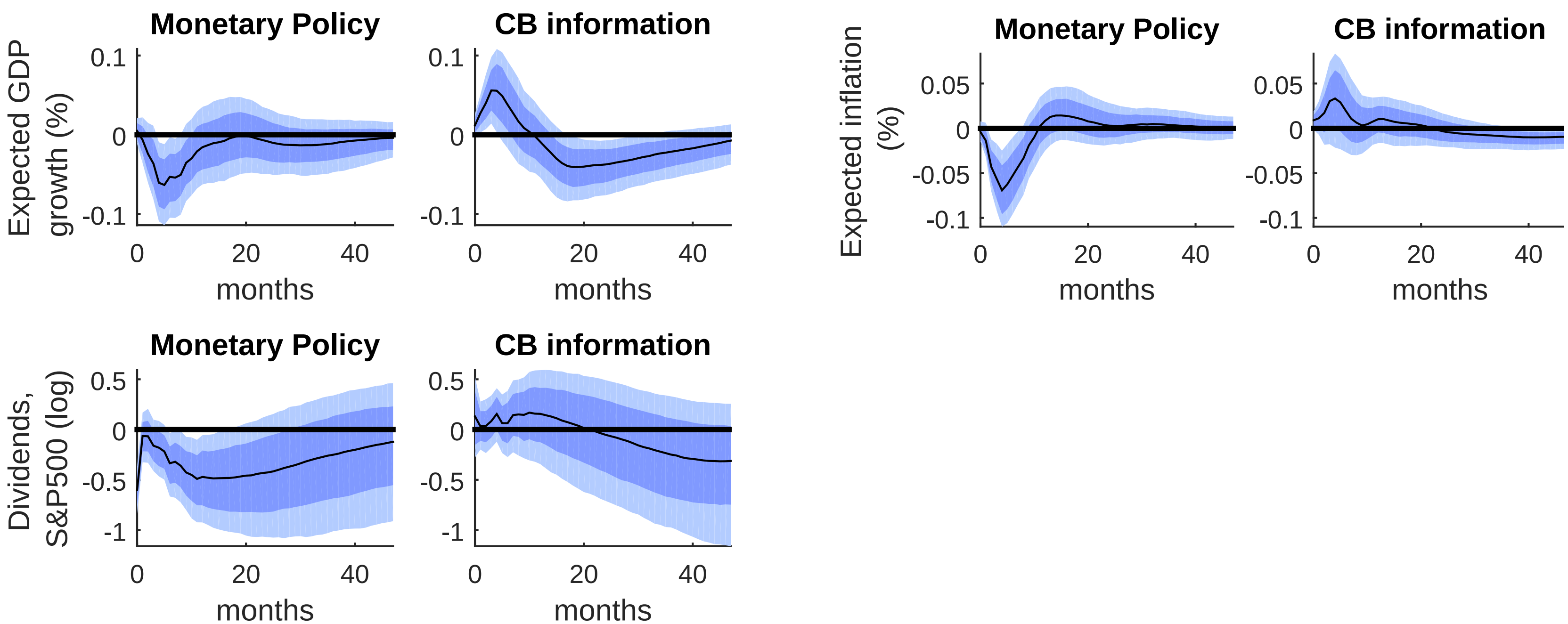
Adding other high frequency variables: breakeven rates and corporate spreads



- 2-year inflation breakeven rates: in line with interpretation

- Daily corporate spreads: as EBP

Adding other low frequency variables: expectations and dividends



- expectations of output and prices comove: looks like demand shocks

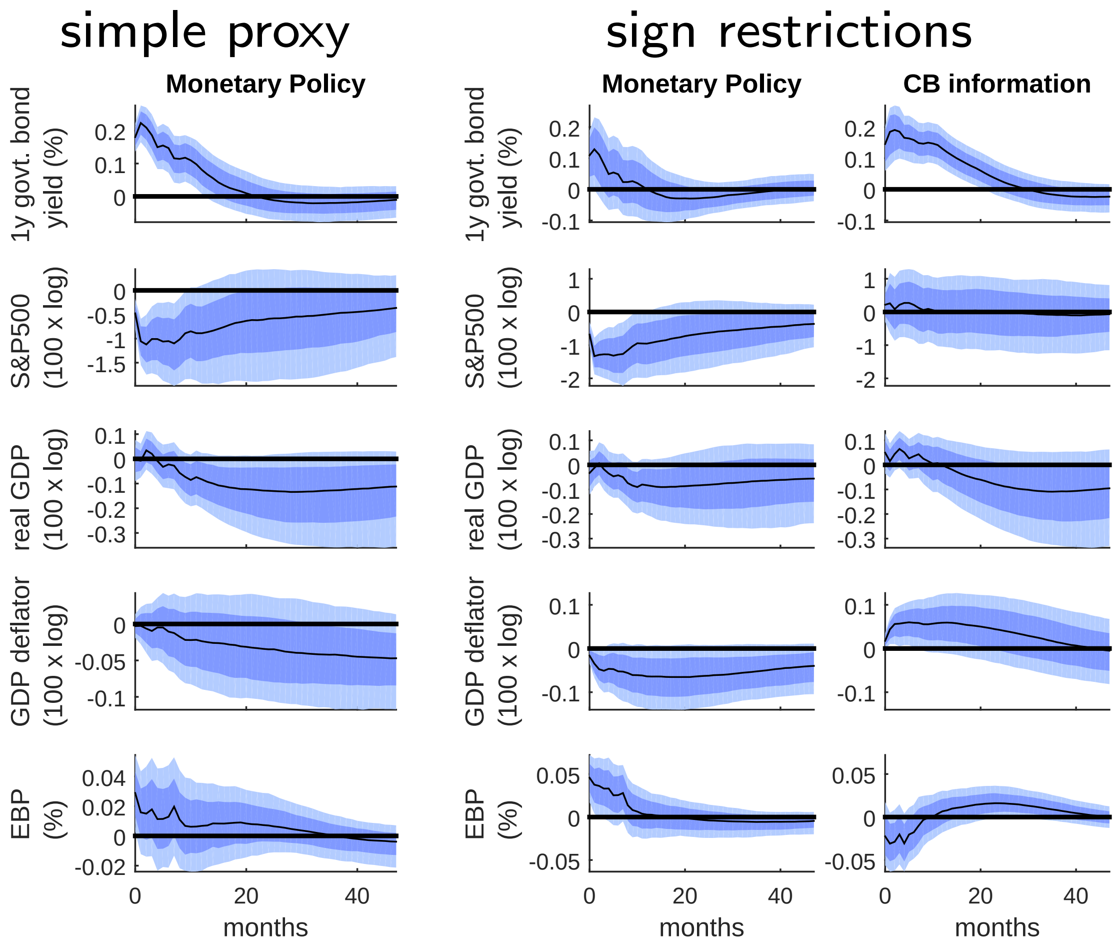
- dividends consistent with stock prices (no surprise)

Comparing with the simple proxy variable identification of monetary policy shocks

Simple proxy variable identification:

	variable ↓ shock →	mon.pol.	all other
m	interest rate	$+$	0
y	...	•	•

Comparison with proxy variable identification



A structural interpretation

- Consistent with a canonical DSGE model with financial frictions (Gertler-Karadi, 2011, 2013)

- For real effects of monetary policy shocks
  - Nominal frictions less important
  - Financial frictions more important

  in the baseline vs. the naive identification.

- Central bank information shock is akin to a (financial) demand shock

Some related literature

- Information channel/shock of monetary policy: Nakamura and Steisson (2016) (see also Donghai Zhang) $\rightarrow$ Estimated theoretical model – no independent communication policy, no VAR evidence

- Does a Central Bank have a private information? Romer and Romer (2000) - Yes, Faust, Swanson and Wright (2002) - No, Barakchian-Crowe (2013), Campbell et. al (2016), Del Negro et.al (2015), Andrade-Ferroni (2016) - Yes

- CB information shocks: Campbell et.al. (2016) - Surprises explained by Fed private info; Hansen and McMahon (2016) - Measure of CB information shock from statements $\rightarrow$ we use the markets.

Conclusions

- We partition **monetary policy surprises** into two components
  - **monetary policy shock**
  - **central bank information shock**
- We measure the effect of each component on the economy
  - Their effects are very different
  - Lessons: Prices are more flexible than in the literature; Central bank information shocks look like (financial) demand shocks

A structural interpretation

- Off-the-shelf macroeconomic model (Gertler-Karadi, 2011) with
  - Nominal rigidities
  - Financial frictions
  - CB ‘communication policy’
- Implications our results for
  - Relevance of nominal rigidities vs. financial frictions
  - Nature of the central bank information shock

Model

- Workhorse New Keynesian model
  - Representative households with habit formation
  - Intermediate good producers with 'working capital' constraint
  - Capital producing firms with investment adjustment costs
  - Retailers with monopolistic competition and staggered price setting
- Balance sheet constrained financial intermediaries
- Central bank

Nominal rigidities

- Nominal Rigidities
  - Monopolistic competition
  - Staggered price setting la Calvo (1983)
  - Partial backward indexation

- New Keynesian Phillips curve

$$\pi_t - \gamma_P \pi_{t-1} = \beta(E_t \{\pi_{t+1}\} - \gamma_P \pi_t) + \frac{(1-\gamma)(1-\beta\gamma)}{\gamma} x_t$$

π_t is inflation, x_t output gap, γ, γ_P and β are structural parameters

Financial frictions

- Firms borrow (S_t) to finance capital ($K_t + 1$)

$$Q_t S_t = Q_t K_{t+1}$$

  where Q_t is the value of capital

- Households lend (S_{ht}) subject to portfolio adjustment costs (κ, as in GK, 2013)

$$S_{ht} = \bar{S}_h + \frac{1}{\kappa} E_t \Lambda_{t,t+1} \left(R_{kt+1} - R_{t+1} \right)$$

  where $\Lambda_{t,t+1}$ is the stochastic discount factor, R_{kt+1} is (gross) capital return, R_{t+1} is (gross) risk-free return, $E_t \Lambda_{t,t+1} \left(R_{kt+1} - R_{t+1} \right)$ is discounted excess premium

Financial frictions, cont.

- Financial intermediaries face agency friction (can abscond with θ fraction of the assets)

- Depositors set endogenous leverage (ϕ_t) constraint to avoid this

$$Q_t(S_t - S_{ht}) = \phi_t N_t \tag{1}$$

  where N_t is bank net worth

- Financial intermediaries build net worth from retained earnings and exogenous capital injections

$$N_t = \sigma \left[(R_{kt} - R_t)\phi_{t-1} + R_t \right] N_{t-1} + \omega \tag{2}$$

  where σ and ω are parameters

Central bank

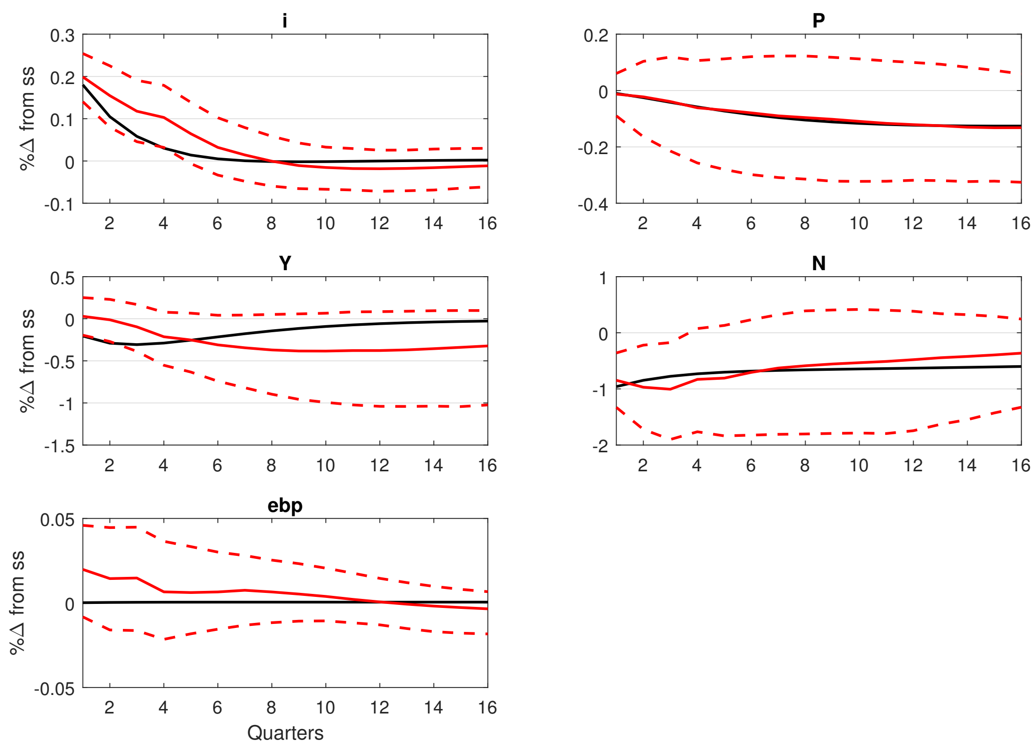
- Central bank
  - Sets interest rates following a Taylor rule without smoothing
  - Communication policy
    - CB has information advantage about shocks
    - It announces them together with interest rate changes
    - The announcement is credible
- Model solved by perturbation around a non-stochastic steady state

Calibration

- Three key parameters
  - Financial friction: HH portfolio adjustment cost $\kappa > 0$. As $\kappa \to 0$, no financial friction.
  - Nominal rigidity: price stickiness parameters: $\gamma \in [0, 1]$ a Calvo parameter and $\gamma_P \in [0, 1]$ the inflation indexation parameter
  - Calibrated to match the impulse responses to a monetary policy shock
- Other parameters as in GK, 2011 and GK, 2013.

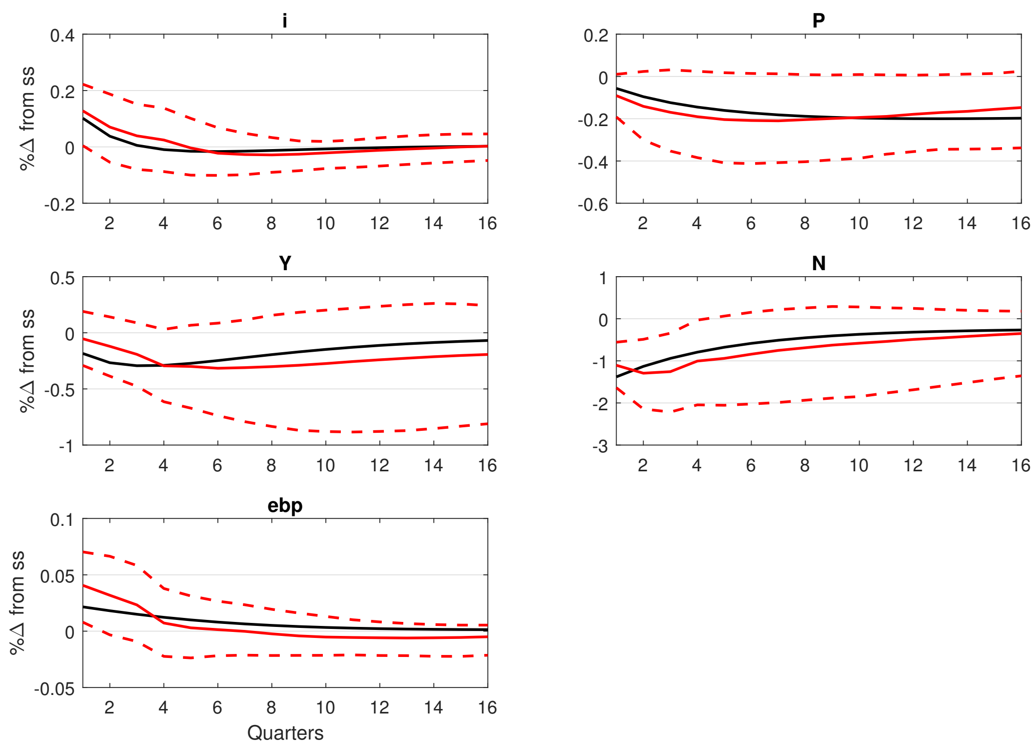
Naive identification: disregarding information shocks

High price stickiness: $\gamma = 0.9$, $\gamma_P = 0.80$, low financial frictions: $\kappa = 0.001$. (Shock parameters: $\sigma_i = 14bps$, $\rho_i = 0.67$)



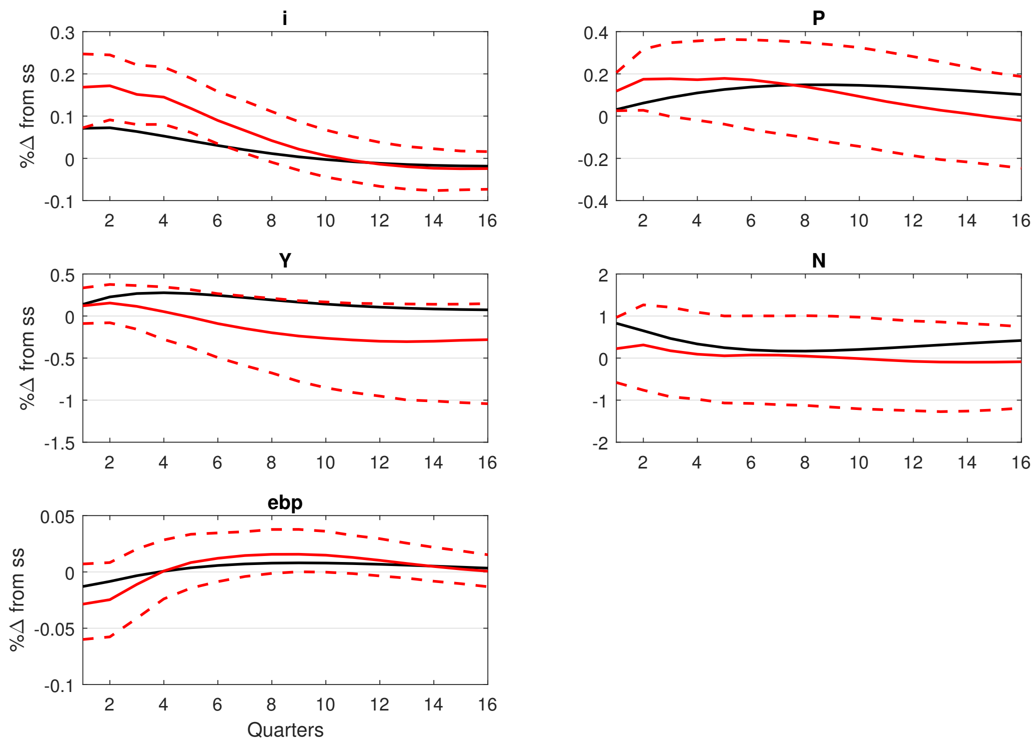
Baseline identification: monetary policy shock

Reasonable price stickiness: $\gamma = 0.72$, $\gamma_P = 0$, sizable financial frictions: $\kappa = 0.13$. (Shock parameters: $\sigma_i = 14bps$, $\rho_i = 0.55$)



Baseline identification: risk shock

Contemporaneous shock to 'capital quality' ($\sigma_{\xi} = 4bps$, $\rho_{\xi} = 0.88$); i.e. 'risk shock'



Results

- Result #1: Baseline identification suggests
  - Nominal frictions less important
  - Financial frictions more important

  to explain the real effects of monetary policy shocks

- Results #2: Central bank information shock is akin to a risk shock

Variance decomposition

	variable	Monetary Policy 1 year	Monetary Policy 2 years	C.B. Information 1 year	C.B. Information 2 years
m	3-month fed funds future	0.65		0.35	
	S&P500	0.66		0.34	
y	1-year govt. bond yield	0.10	0.09	0.27	0.24
	S&P500	0.09	0.08	0.02	0.02
	Real GDP	0.04	0.05	0.02	0.03
	GDP deflator	0.06	0.08	0.06	0.06
	Excess Bond Premium	0.06	0.06	0.04	0.04

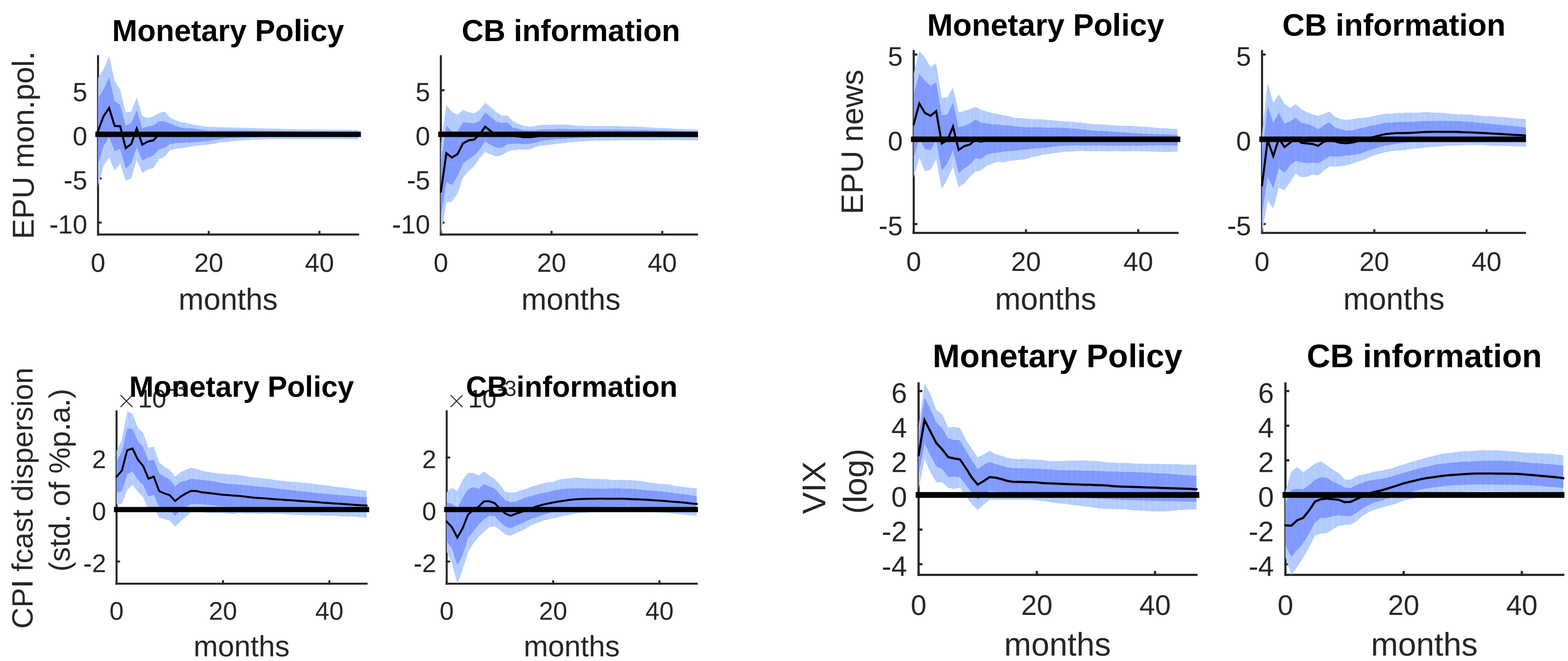
Note: Posterior means. For the i.i.d. variables in m the forecast variance does not depend on the horizon, so for these variables we only report a single number.

Adding other high-frequency surprises: contemporaneous responses to shocks

surprise in:	Monetary Policy		CB information	
	50pct	(5pct, 95pct)	50pct	(5pct, 95pct)
SP500	-0.42(*)	(-0.516, -0.227)	0.28(*)	(0.027, 0.450)
WILSHIRE	-0.44*	(-0.536, -0.265)	0.23	(-0.030, 0.431)
Current month fed funds future	0.06*	(0.032, 0.073)	0.04*	(0.001, 0.061)
3-month fed funds future	0.05(*)	(0.028, 0.065)	0.03(*)	(0.004, 0.056)
2-year bond yield	0.04*	(0.026, 0.046)	0.02	(-0.007, 0.033)
5-year bond yield	0.03*	(0.020, 0.033)	0.00	(-0.011, 0.019)
10-year bond yield	0.02*	(0.010, 0.021)	-0.00	(-0.013, 0.008)
USD per EURO	-0.26*	(-0.329, -0.179)	-0.08	(-0.217, 0.066)
USD per YEN	-0.15*	(-0.205, -0.101)	-0.03	(-0.117, 0.065)

Note: * highlights the cases where 95 or more percent of the posterior density is on the same side of zero. For the 3-month fed funds future the S&P500 this happens by construction (because of the sign restrictions), so we put the asterisk in brackets, (*).

Adding other low frequency variables: uncertainty indicators



- CB information: good news about the economy associated with lower uncertainty