Market Reactions to the Fed's Balance Sheet Normalization Plans

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Talk based on joint work Francesco Bianchi and Sai Ma

Discussion Outline

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1. **High-frequency event study** of major Fed communications pertaining to its **balance sheet normalization** plans: **"QT events"**.

   ▶ **14 QT events**: includes both *tapering* news and *tightening* news

   ▶ **News events span May 22, 2013 to March 20, 2019** taken from:

      ▶ FOMC press releases

      ▶ Fed Chair press conferences

      ▶ Fed Chair congressional testimony

   ▶ **HF event windows**: 10 min before beginning of QT event to close of stock market

   ▶ **Focus on stock market**

Stock Market Reactions to "QT" Announcements

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2. **Use structural model** to make inferences on *why* the market reacted.

   ▶ **Methodology**: from work with Francesco Bianchi and Sai Ma (**BLM** hereafter).

   ▶ **BLM approach**: integrate a high-frequency monetary event study into a mixed-frequency macro-finance model and structural estimation.
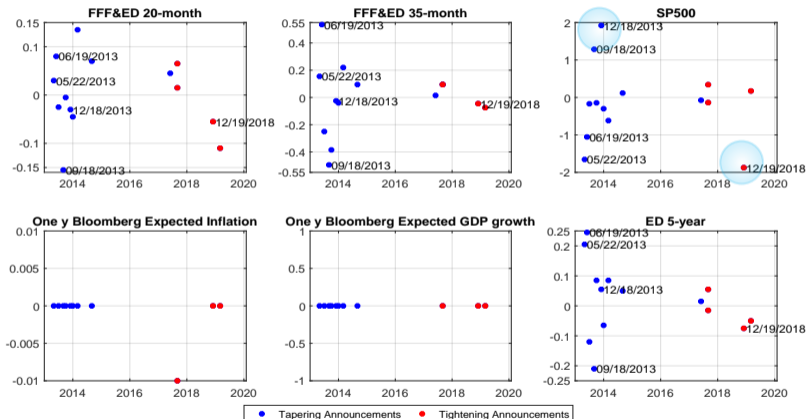
Jumps in Market Variables Around QT Events
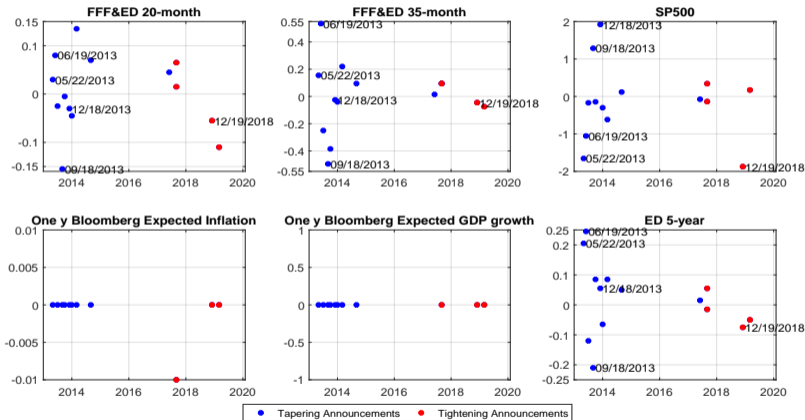
The figure displays, for each Fed QT announcement, the log change in the observed variables from 10 min. before the announcement to the end of the stock market trading day, except for Bloomberg forecasts which are measured on day before and day after. Labeled dates are the 5 most quantitatively important announcements based on changes in the SP500. The full sample has 14 balance sheet normalization events spanning 5/22/2013-3/30/2019. For the following dates, the 12-qtr. (36-mon.) Eurodollar rate is used in place of missing 35-month FFF data: 05/22/2013, 12/18/2013, 09/17/2014, 06/14/2017, 12/19/2018, and 03/20/2019.
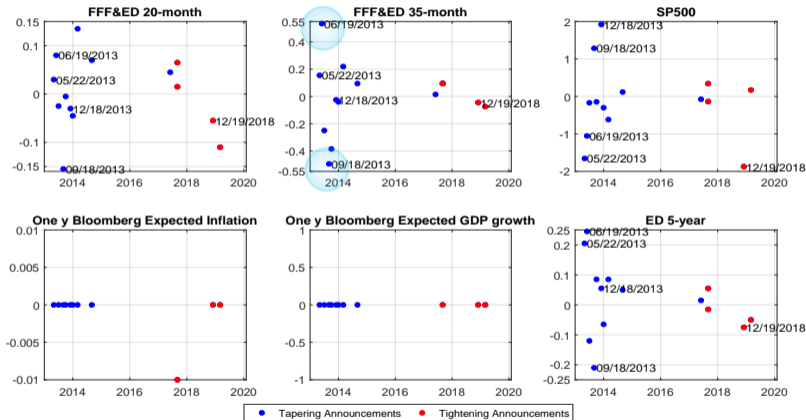
Jumps in Market Variables Around QT Events

▶ Large jumps in the **stock market** (top 5 dates labeled)

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Jumps in Market Variables Around QT Events

▶ Distant **FF futures** too

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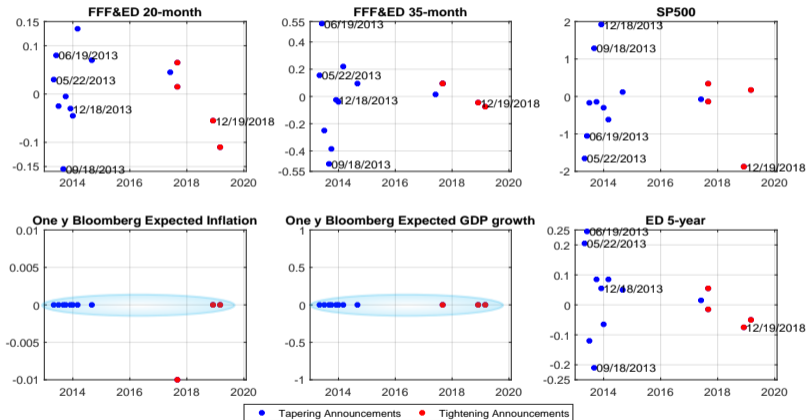# Jumps in Market Variables Around QT Events

▶ **QT events do** *nothing* **to change expectations of inflation, GDP growth**. Differs from other FOMC news events studied by BLM, mostly not about QE/QT.

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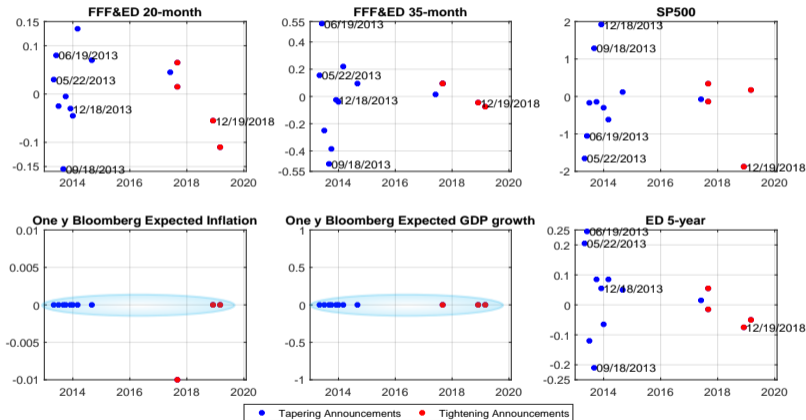
Jumps in Market Variables Around QT Events

▶ So **big jumps** in financial **markets**; **little impact** on expectations about *broader economy*.

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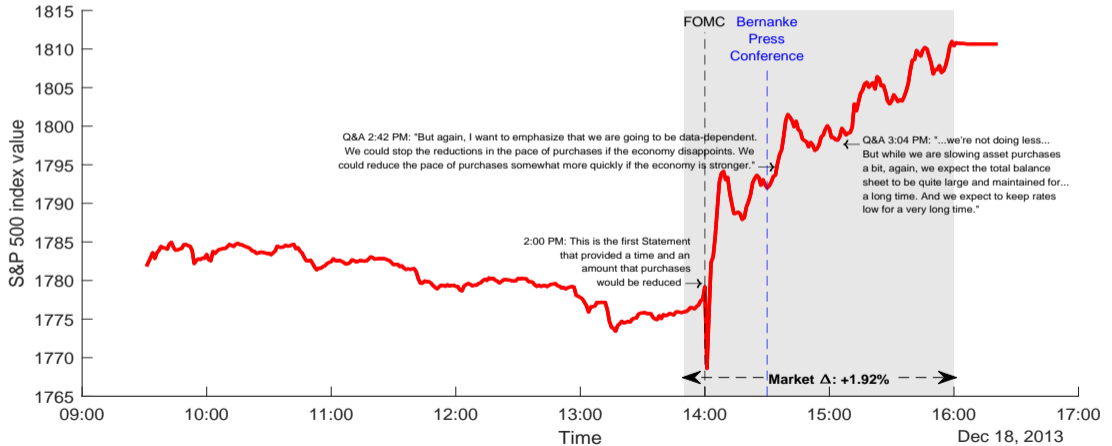
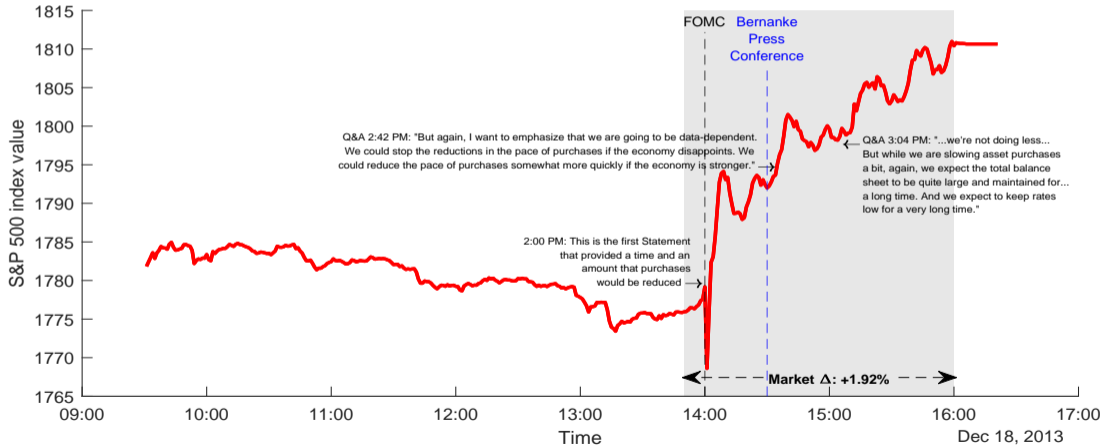# S&P 500 Intraday Moves: December 18, 2013

Note: The gray shaded areas represent the event window used for the high-frequency structural event study.

S&P 500 Intraday Moves: December 18, 2013

▶ First Statement outlining *time and pace* of **tapering**

▶ **Bernanke**: tapering *"data-dependent"*

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S&P 500 Intraday Moves: December 19, 2018

▶ **Powell**: runoff on *"automatic pilot"*

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S&P 500 Intraday Moves: May 22, 2013

▶ **Taper tantrum**: hints of possible tapering

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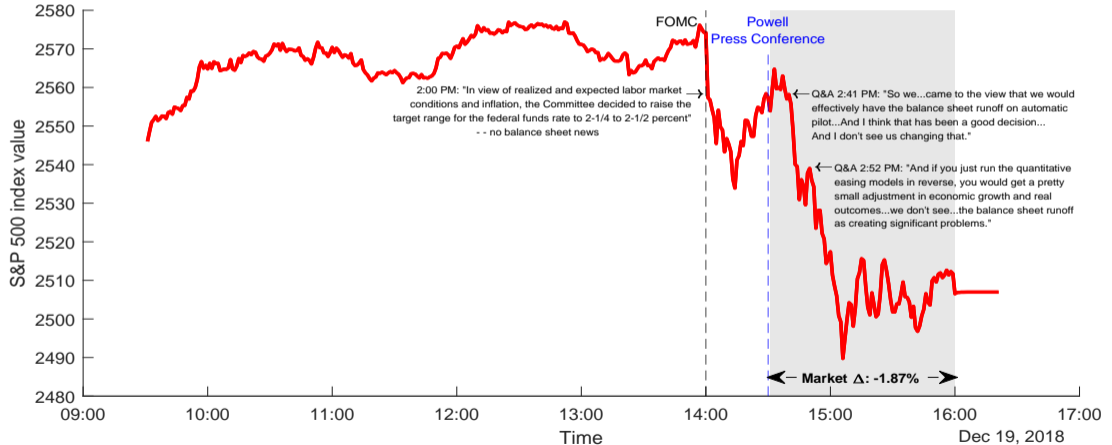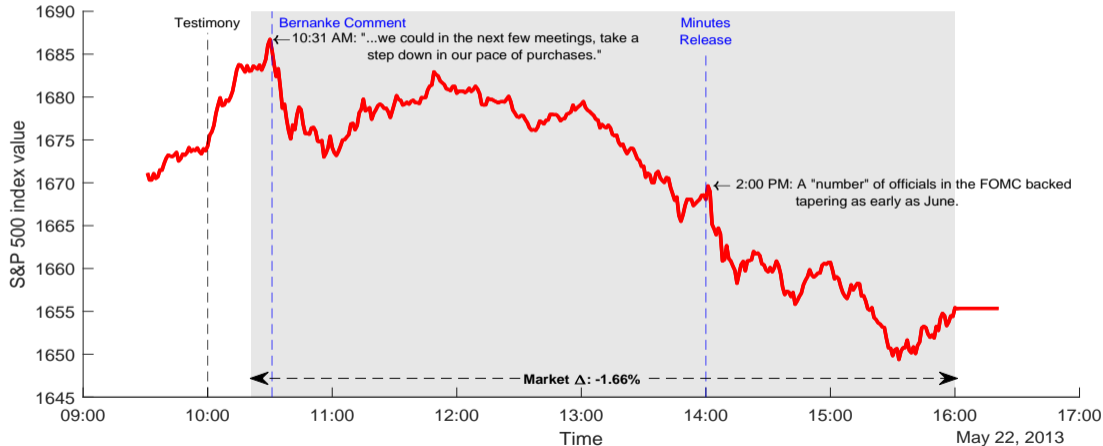
▶ **Integrate high-frequency monetary event study** into a **mixed-frequency macro-finance model** and structural estimation

Why Did the Market React? BLM Approach

- **Integrate high-frequency monetary event study** into a **mixed-frequency macro-finance model** and structural estimation
- **Two-agent model w/ NK macro dynamics** & **heterogenous beliefs**
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- **2 Assets-stock mkt and nom bond-& 6 primitive Gaussian shocks**:
    1. Aggregate demand shock in HH Euler eq
    2. Monetary policy shock in MP rule
    3. Trend growth shock–moves supply side
    4. Markup shock in Phillips curve
    5. Earnings share shock (purely redistributive btw **workers & investors**)
    6. "Liquidity premium" shock: time-varying preference for risk-free nominal debt over equity

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- **Numerous forward looking series at mixed frequencies** to map theoretical implications for beliefs, markets, & economy into data, estimating all parameters and latent states

Channels of QE/QT Transmission in Model & Estimates

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MP Rule w/ regime changes

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Perceived Equity Premium

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▶ **Inflation Expect channel**: QE (QT) manifest via higher (lower) $\pi_{\xi_t}^T$, a parameter that may **not equal the stated long-term inflation target** of the central bank; *implicit* time t target

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  3. **Information effect channel**: jumps in investor nowcasts of broader economic activity ("Fed info effect")

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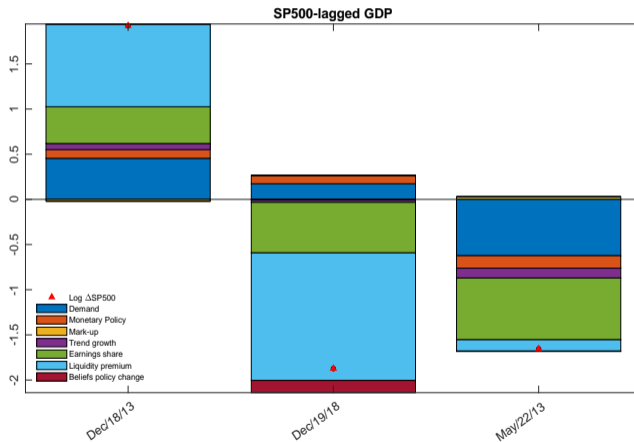
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3. **Information effect channel**: jumps in investor nowcasts of broader economic activity ("Fed info effect")
4. **Dist. info channel**: jumps in investor nowcasts of *share* of rewards to equityholders

Channels of QE/QT Transmission in Model & Estimates

$$i_t - \left(r_{ss} + \pi_{\xi_t}^T\right) = (1 - \rho_{i,\xi_t}) \left[\psi_{\pi,\xi_t} \left(\pi_t - \pi_{\xi_t}^T\right) + \psi_{\Delta y,\xi_t} \left(y_t - y_{t-1}\right) \right]$$
$$+ \rho_{i,\xi_t} \left[i_{t-1} - \left(r_{ss} + \pi_{\xi_{t-1}}^T\right) \right] + \sigma_i \varepsilon_{i,t}, \ \varepsilon_i \sim N(0,1)$$

MP Rule w/ regime changes

$$\underbrace{\mathbb{E}_t^b \left[r_{t+1}^D\right] - \left(i_t - \mathbb{E}_t^b \left[\pi_{t+1}\right]\right)}_{\text{subj. equity premium}} = \underbrace{\left[\begin{array}{c} -.5\mathbb{V}_t^b \left[r_{t+1}^D\right] - \mathbf{COV}_t^b \left[m_{t+1}, r_{t+1}^D\right] \\ +.5\mathbb{V}_t^b \left[\pi_{t+1}\right] - \mathbf{COV}_t^b \left[m_{t+1}, \pi_{t+1}\right] \end{array}\right]}_{\text{subj. risk premium}} + \underbrace{lp_t}_{\text{liquidity premium}},$$

Perceived Equity Premium

- ▶ **MP summarized by rule** (no explicit Fed buying of LT Treasuries, agency debt, or agency MBS)
- ▶ **Inflation Expect channel**: QE/QT/FwG can $\triangle \pi_{\xi_t}^T$ b/c these interventions can *in theory* change π^e and thus **real rates** even if i_t unchanged. *In practice* HH π^e adjusts **very slowly** to $\triangle$ in $\pi_{\xi_t}^T$
- ▶ **Even if IE channel is muted**, **QE/QT news** can affect *financial markets* via other channels:
  1. **Risk premium channel**: jumps in beliefs about **MP regime** $\triangle$ affect the perceived *quantity* of risk
  2. **Liquidity premium channel**: exog catchall for all other sources variation in subj EP, e.g. a perceived $\triangle$ in liquidity/safety attrib of bonds, $\triangle$ in risk aversion, flight to quality, jump in sentiment
  3. **Information effect channel**: jumps in investor nowcasts of broader economic activity ("Fed info effect")
  4. **Dist. info channel**: jumps in investor nowcasts of *share* of rewards to equityholders
- ▶ **Unless QE/QT $\rightarrow \triangle$ RIR**, above just => **volatility in financial markets**, with broader economy *unaffected*.

Why Did the Market React?

- Up next: **our estimate** of contribution of **revisions in investors' perceptions about economic state and beliefs about future policy** to jumps in the SM in **tight windows** around QT events.

- **Novelty of mixed-frequency structural approach**: **granular detail** on *why* markets respond to Fed news (or any news), with a decomposition of responses into the primitive economic sources of risk responsible for observed revisions in numerous forward-looking series.

- **Filtering algorithm + structural estimation** allows us to **infer investor updating** not only of economic state, but also *which shocks they perceive are hitting* the economy.

Top Three Fed QT Events for the SP500

SP500-lagged GDP

Legend:
▲ Log ΔSP500
■ Demand
■ Monetary Policy
■ Mark-up
■ Trend growth
■ Earnings share
■ Liquidity premium
■ Beliefs policy change

x-axis labels: Dec/18/13, Dec/19/18, May/22/13

The figure reports a decomposition of movements in the S&P 500-lagged GDP ratio in tight windows around QT news events into sources attributable to revisions in the perceived shocks hitting the economy and to jumps in beliefs about near-term MP regime change for the 3 most quantitatively important Fed QT events. The red triangles denote both the observed jump in the stock market and the model-implied jump in response to the QT news.

Top Three Fed QT Events for the SP500

▶ **Dec/18/13 subjective EP** ↘ (*lp*) & higher nowcasts of earnings share & agg demand
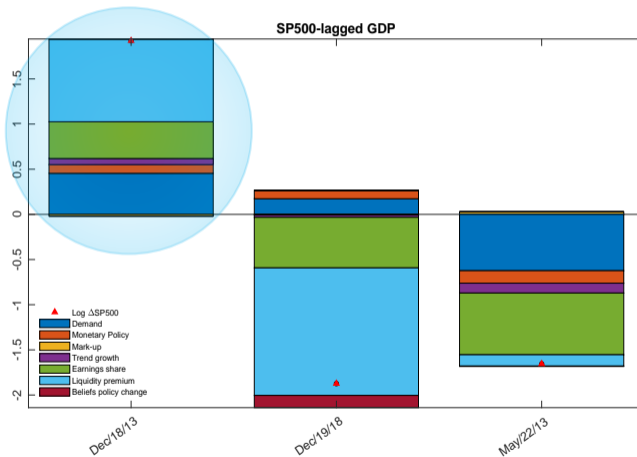
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Top Three Fed QT Events for the SP500

▶ **Dec/19/18 subjective EP** ↗ (*lp* but also beliefs about MP regime change) & lower nowcast for earnings share
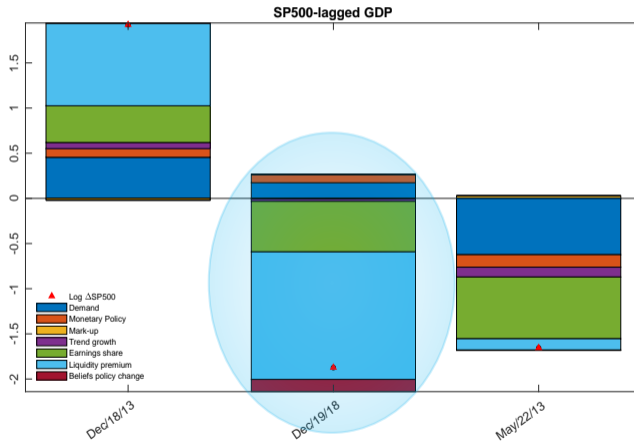
The figure reports a decomposition of movements in the S&P 500-lagged GDP ratio in tight windows around QT news events into sources attributable to revisions in the perceived shocks hitting the economy and to jumps in beliefs about near-term MP regime change for the 3 most quantitatively important Fed QT events. The red triangles denote both the observed jump in the stock market and the model-implied jump in response to the QT news.

Jumps in Risk Perceptions, Short Rates, and Earnings

▶ Top events for revisions in investor **beliefs about MP regime change**
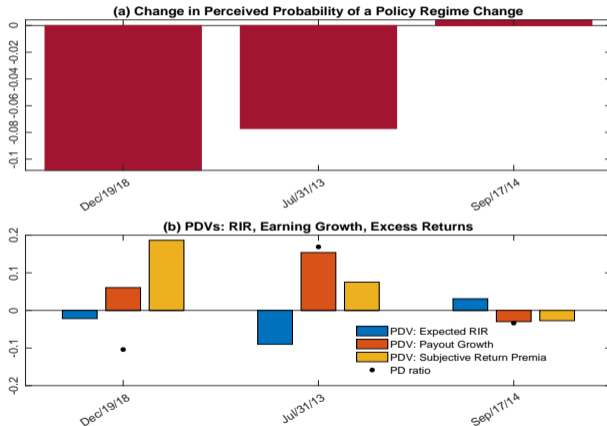
Panel (a) shows the pre-/post-QT event change in the perceived probability that financial markets assign to a switch in the monetary policy rule occurring within one year. Panel (b) shows a decomposition of the fluctuations in the log price-payout ratio $pd = pdv_t(\Delta d) - pdv_t(r^{ex}) - pdv_t(rir)$ in tight windows around these events driven by variation in $pdv_t(r^{ex})$ (yellow bar), $pdv_t(rir)$ (blue bar), and $pdv_t(\Delta d)$ (red bar).

# Jumps in Risk Perceptions, Short Rates, and Earnings

▶ **Dec/19/18 big ↘ perceived prob of MP regime change** within next year.
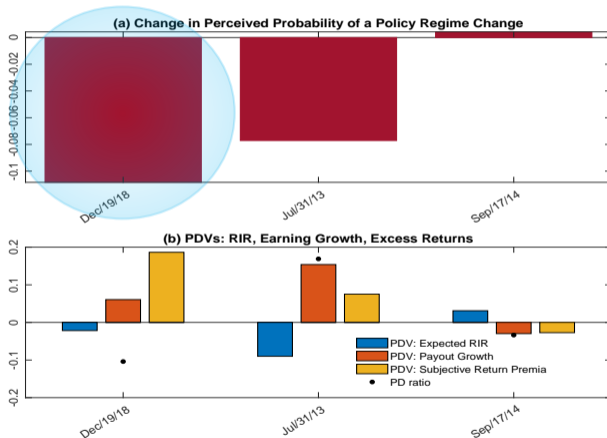
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Jumps in Risk Perceptions, Short Rates, and Earnings

▶ *pd* ↘ **b/c subj return premia** ↗ in part b/c **beliefs** about future MP changed: *decline in perceived probability* of switching to a more *active* MP regime
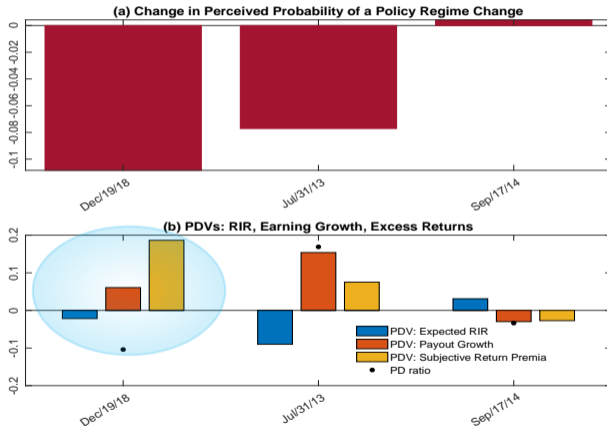
(a) Change in Perceived Probability of a Policy Regime Change

(b) PDVs: RIR, Earning Growth, Excess Returns

Legend:
- PDV: Expected RIR
- PDV: Payout Growth
- PDV: Subjective Return Premia
- • PD ratio

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Jumps in Risk Perceptions, Short Rates, and Earnings

▶ Less activism in stabilizing output growth ↗ expected volatility and the perceived quantity of risk
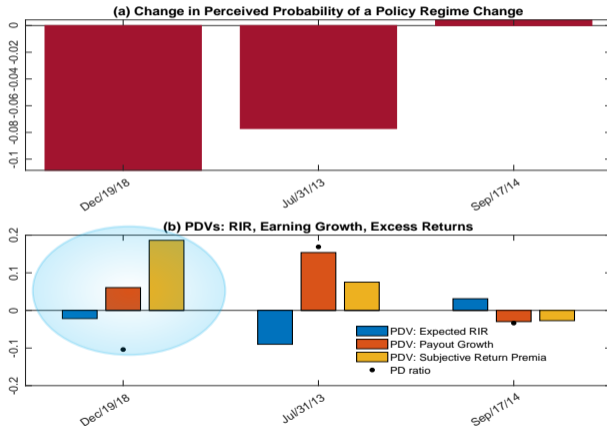
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Jumps in Risk Perceptions, Short Rates, and Earnings

▶ This is the **structural interpretation** of Powell's "autopilot runoff", seen through **lens of this model**.
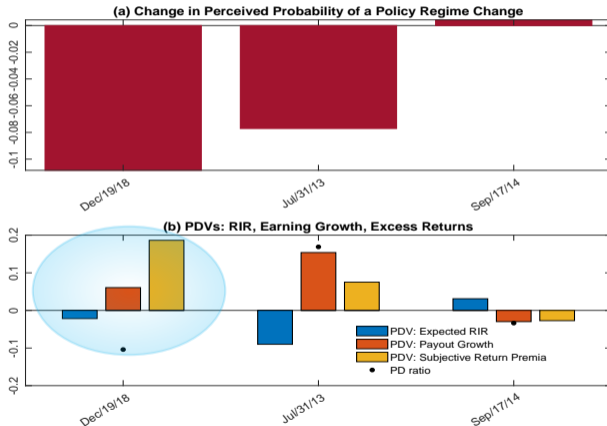
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▶ Whether it's tapering or tightening, **stock market dislikes** perceived *inflexibility*.

Takeaways

- Whether it's tapering or tightening, **stock market dislikes** perceived *inflexibility*.

- Financial markets are **clearly attuned** to news about the Fed's balance sheet.

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  ► Little evidence that **forecasts of π_t or GDP growth change** in response to QT news

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    - No forecaster tantrums

  - **A long literature in asset pricing**: much variation in SM return premia has negligible correlation with macroeconomy at any horizon

  - Earnings share $\triangle$'s here **merely redistribute rewards** w/o affecting the size of rewards

References I

BIANCHI, F., S. C. LUDVIGSON, AND S. MA (2022): "Monetary-Based Asset Pricing: A Mixed-Frequency Structural Approach," Discussion paper, National Bureau of Economic Research.

LAUBACH, T., AND J. C. WILLIAMS (2003): "Measuring the natural rate of interest," *Review of Economics and Statistics*, 85(4), 1063–1070.

APPENDIX

S&P 500 Intraday Moves: September 18, 2013

- Fed surprises market by not tapering at *this* meeting
- FOMC: *no preset course* for asset purchases
- Bernanke: tapering not on "fixed calendar-schedule"
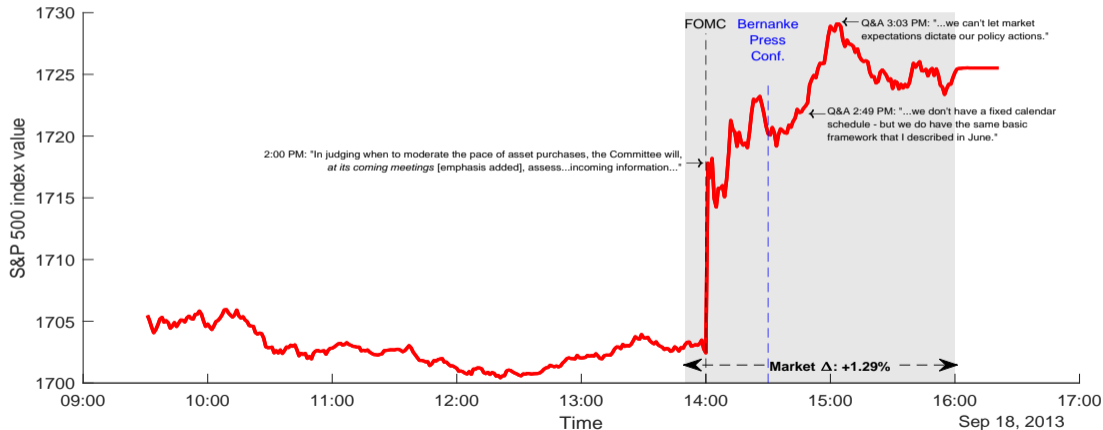
Note: The gray shaded areas represent the event window used for the high-frequency structural event study.

S&P 500 Intraday Moves: June 19, 2013

▶ **Bernanke: purchases could end** by first half of **next year**.
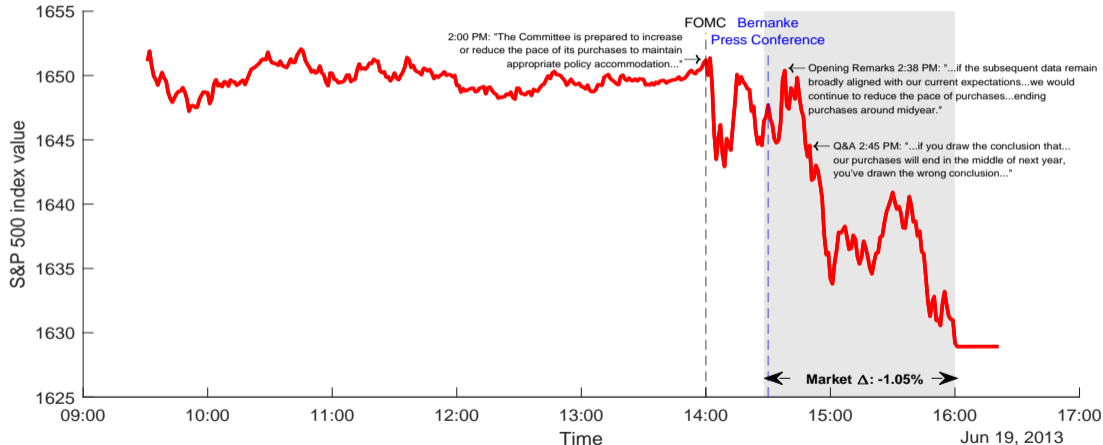
Note: The gray shaded areas represent the event window used for the high-frequency structural event study.

Real interest rate and Monetary Policy Spread (*mps*)
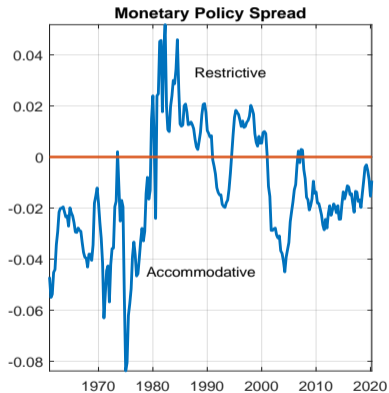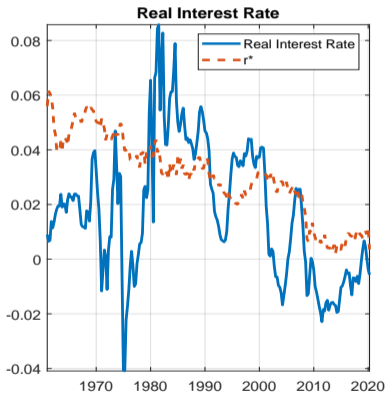
▶ Define: $mps_t \equiv FFR_t - Expected\ Inflation_t - r_t^*$

Real Interest Rate

Monetary Policy Spread

The real interest rate is the difference between the nominal federal funds rate (*FFR*) and expected inflation, where expected inflation is computed as a four quarter moving average of inflation. The monetary policy spread is defined as $mps_t \equiv FFR_t - Expected\ Inflation_t - r_t^*$, where r_t^* is the natural rate of interest from Laubach and Williams (2003). The sample spans the period 1961:Q1-2020:Q2.

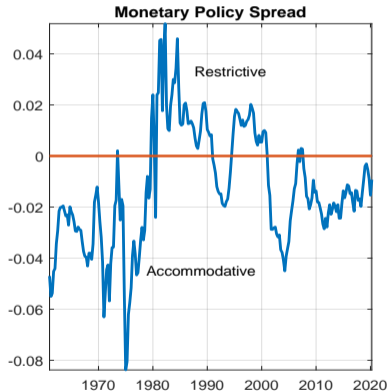# Real interest rate and Monetary Policy Spread (*mps*)

▶ Deviations of mps_t from 0 last *decades*
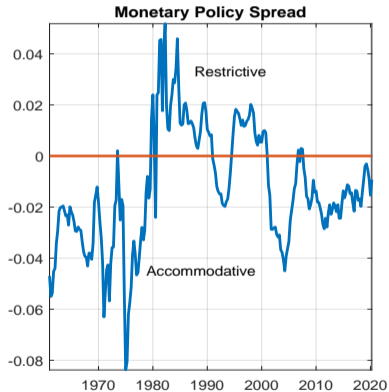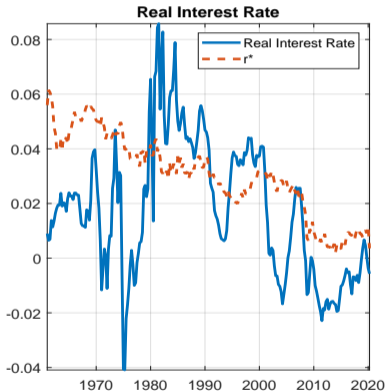
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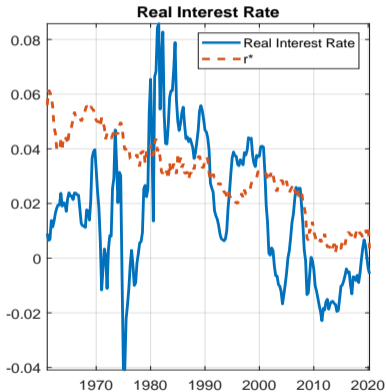# Real interest rate and Monetary Policy Spread (*mps*)

▶ RIR in 2003 ≈ its nadir from 2008-2013 despite massive QE post crisis
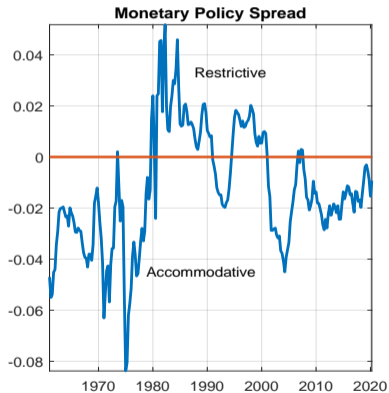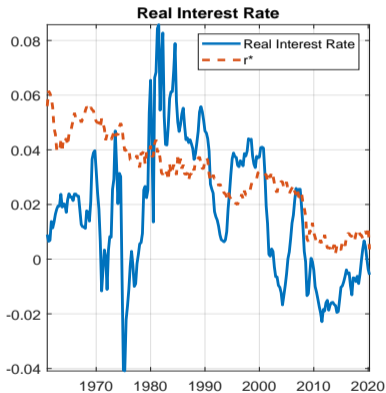
The real interest rate is the difference between the nominal federal funds rate (*FFR*) and expected inflation, where expected inflation is computed as a four quarter moving average of inflation. The monetary policy spread is defined as $mps_t \equiv FFR_t - Expected\ Inflation_t - r_t^*$, where r_t^* is the natural rate of interest from Laubach and Williams (2003). The sample spans the period 1961:Q1-2020:Q2.

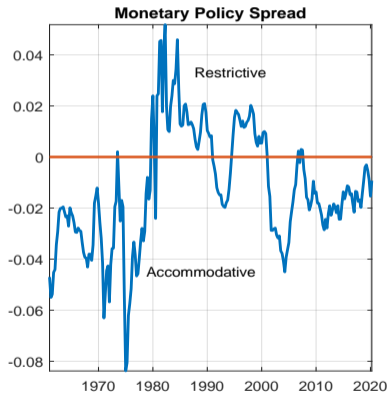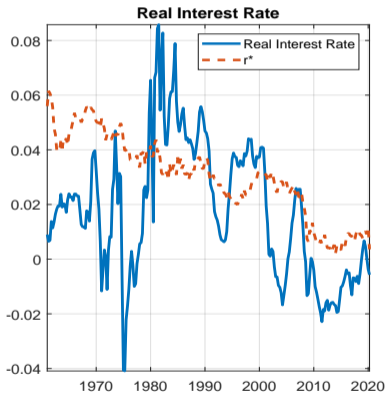# Real interest rate and Monetary Policy Spread (*mps*)

▶ Secular ↘ in r^* → policy *less* accommodative *after* the crisis than in 2003
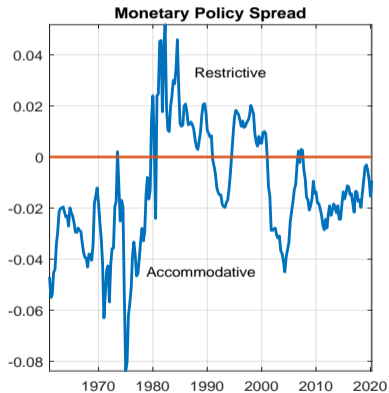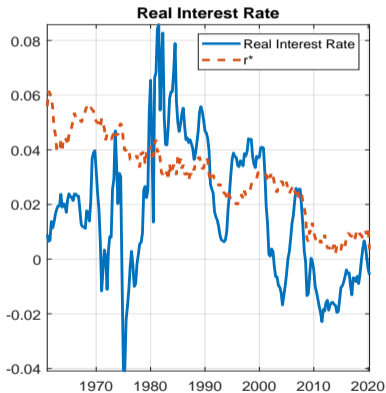
Real Interest Rate

Monetary Policy Spread

Restrictive

Accommodative

The real interest rate is the difference between the nominal federal funds rate (*FFR*) and expected inflation, where expected inflation is computed as a four quarter moving average of inflation. The monetary policy spread is defined as $mps_t \equiv FFR_t - Expected\ Inflation_t - r_t^*$, where r_t^* is the natural rate of interest from Laubach and Williams (2003). The sample spans the period 1961:Q1-2020:Q2.

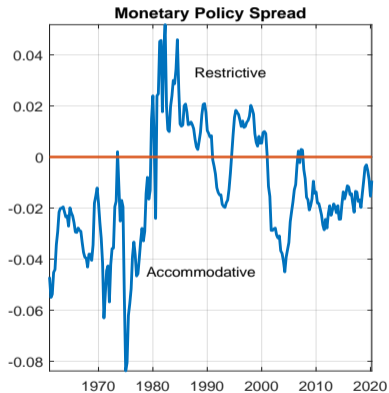# Real interest rate and Monetary Policy Spread (*mps*)

▶ QE: limited ↗ π^e & thus ↘ real rates relative to e.g., 2003, echoing QT events

Real Interest Rate

Monetary Policy Spread

The real interest rate is the difference between the nominal federal funds rate (*FFR*) and expected inflation, where expected inflation is computed as a four quarter moving average of inflation. The monetary policy spread is defined as $mps_t \equiv FFR_t - Expected\ Inflation_t - r_t^*$, where r_t^* is the natural rate of interest from Laubach and Williams (2003). The sample spans the period 1961:Q1-2020:Q2.

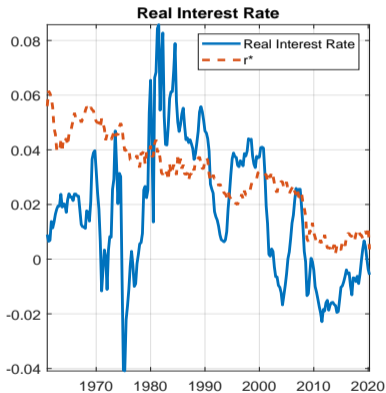# Real interest rate and Monetary Policy Spread (*mps*)

▶ Suggests can't replicate accommodative MP at the ZLB with QE

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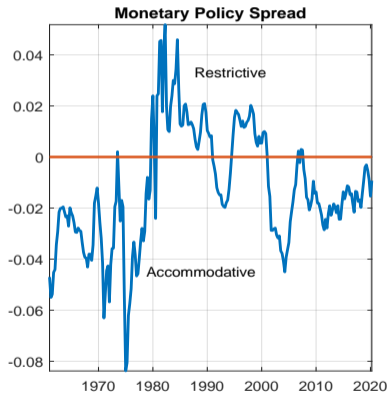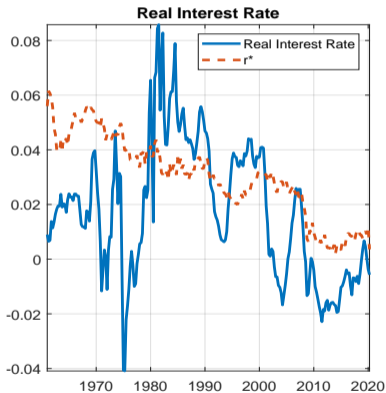# Real interest rate and Monetary Policy Spread (*mps*)

▶ IE channel muted, helping explain why **mps deviations large and persistent**

The real interest rate is the difference between the nominal federal funds rate (*FFR*) and expected inflation, where expected inflation is computed as a four quarter moving average of inflation. The monetary policy spread is defined as $mps_t \equiv FFR_t - Expected\ Inflation_t - r_t^*$, where r_t^* is the natural rate of interest from Laubach and Williams (2003). The sample spans the period 1961:Q1-2020:Q2.

Real interest rate and Monetary Policy Spread (*mps*)

▶ Model accounts for this w/ 2-agent structure & slow, adaptive learning by HHs

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Measures of the Real Interest Rate
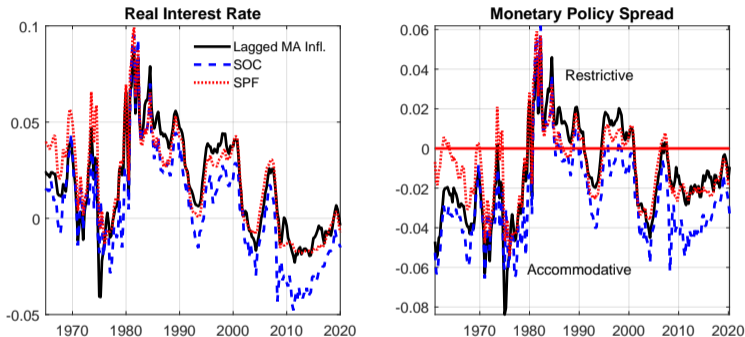
Notes: The real interest rate is measured as the federal funds rate minus a measure of inflation expectation. In the left panel, the black line measures inflation expectation uses a four quarter moving average of inflation. The blue line uses one-year mean forecast of inflation from the Survey of Consumers. The red line uses one-year mean forecast of inflation from the Survey of Professional Forecasters. The right panel plots the monetary policy spread, i.e., the spread between the real interest rate and the Laubach and Williams (2003) natural rate of interest. The sample spans 1961:Q1-2020:Q1.
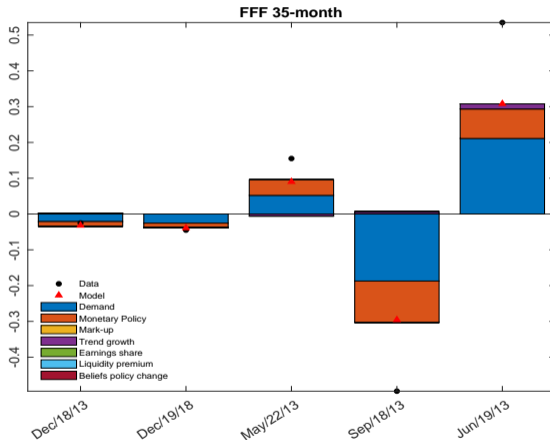
Overview of Model and Approach

1. **MP rule** subject to infrequent "structural breaks".

2. **Two-agent model w/ NK macro dynamics** & **heterogenous beliefs**
   - ▶ **"Investors":** e.g., wealthy HH or large institution; small fraction of pop. but own all of SM. **Takes macro dynamics as given**.
   - ▶ **"Households":** workers invest in bonds only; **beliefs are key drivers of macro expectations**
   - ▶ **Why 2 agents?** survey data → subst. *inertia* in HH expectations; financial markets *react swiftly* to CB communications

3. **Model investor beliefs about breaks in MP rule**: can estimate *current* rule but must form *beliefs* about how long current rule will last, what will follow. Investors form expectations of next **"Alternative" policy rule** and probability of exiting the current rule.

4. **In resp to Fed news** Investors may revise:
   - ▶ **"Nowcasts"** of **economic state**
   - ▶ **Beliefs** about probability of regime change in MP rule
   - ▶ **Perceived risk** in the stock market.

Financial Markets QT Events Decompositions
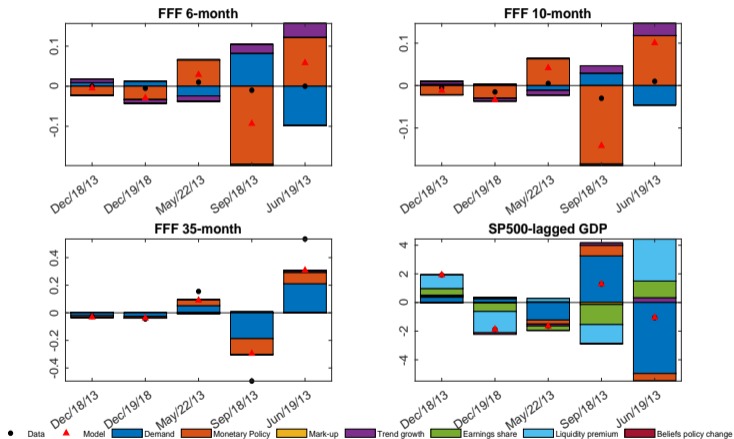
Notes: The figure reports the decomposition of movements in the 6-month FFF rates, the 10-month FFF rates, the 35-month FFF rates, and the stock market attributable to revisions in the perceived shocks hitting the economy and in the belief regimes for the 5 most relevant Fed QT announcements based on changes in the stock market. The full sample has 14 balance sheet normalization events spanning May 22, 2013 to March 20, 2019.

Jumps in 35-month FFF Rate for Top 5 QT Events

FFF 35-month

Legend:
- ● Data
- ▲ Model
- Demand
- Monetary Policy
- Mark-up
- Trend growth
- Earnings share
- Liquidity premium
- Beliefs policy change

X-axis labels: Dec/18/13, Dec/19/18, May/22/13, Sep/18/13, Jun/19/13

Notes: The figure reports the decomposition of movements in the 35-month Fed funds futures (FFF) rate attributable to revisions in the perceived shocks hitting the economy and in the belief regimes for the 5 most quantitatively important Fed announcements (as measured by the absolute magnitude of jumps in the stock market) about balance sheet normalization. The difference between the model-implied series and the observed counterpart is attributable to observation error.