# Monetary policy expectation errors

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# 0. Content

# 1. Introduction

## Background & Motivation

- Overnight money market rates are at the heart of the financial system, commonly serve as the policy target of central banks around the globe.
- Forward information from the term structure of money market rates is a common ingredient in central banks’ market monitoring.

- Whether this term structure can be trusted to accurately reflect market participants’ short rate expectations or whether signals are distorted due to the presence of term premia.

# 1. Introduction

## Background & Motivation

- We document that implied future short rates extracted from money market derivatives systematically exceed the actual short rates realized at the maturity of the contracts.
- In other words, FF futures and OIS (overnight index swaps) are biased predictors of future short rates.
- This rejection of the unbiasedness hypothesis has commonly been attributed to the presence of countercyclical risk premia:
  - Business cycle downturns coincide with periods of high expected returns on these contracts.
- Essentially all excess returns stem from expectation errors, while the contribution of term premia is economically small and even slightly negative.

# 1. Introduction

## Background & Motivation

- What is term premium?
- For example: Fed funds futures and overnight index swaps

$$rx_{t+n}^{(n)} = f_t^{(n)} - i_{t+n}$$

- Where $f_t^{(n)}$ denote the fixed rate on FF futures as observed on the last business day of month $t$, $rx(n)_{t+n}^{(n)}$ denotes the excess return and $i_{t+n}$ is the short rate over month $t+n$.

$$f_t^{(n)} = \underbrace{E_t[rx_{t+n}^{(n)}]}_{\text{term premium}} + \underbrace{E_t[i_{t+n}]}_{\text{EH term}},$$

# 1. Introduction

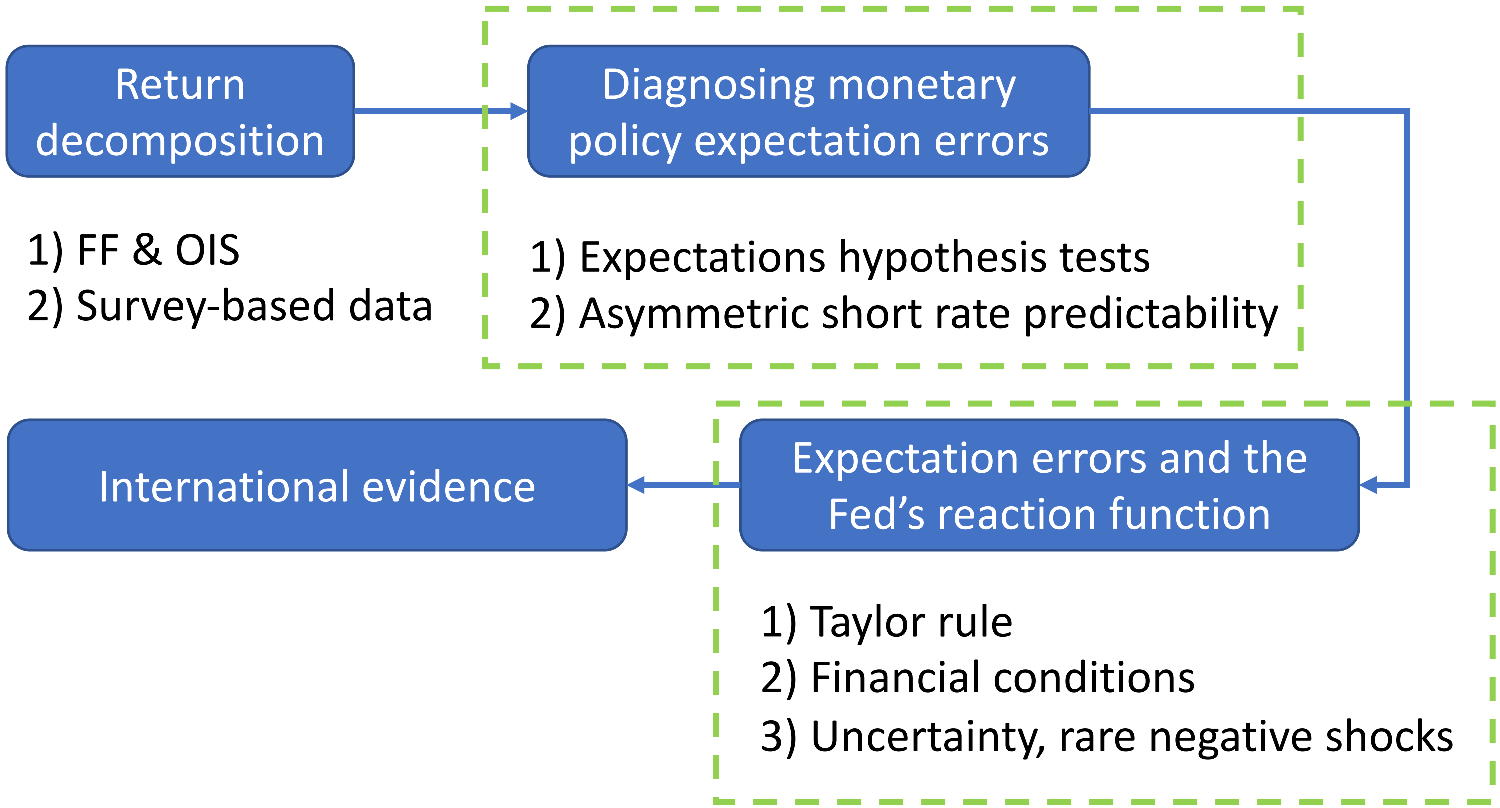
## Question

- Whether term structure can be trusted to accurately reflect market participants’ short rate expectations?
- No, the contribution of term premia is economically small and even slightly negative.

- Why market participants have been prone to “monetary policy expectation errors” that did not average out over time?
- Conservatism

# 1. Introduction

## Research contents



# 1.Introduction

## Related Literatures

- Our paper adds to the nascent literature that challenges the predominant view on the role of term premia in fixed-income markets and instead stresses errors in investor expectations.
  - *Cieslak (2018) , Bauer and Rudebusch (2020).*
- The results of this paper also speak to the broader literature that uses survey data to decompose asset returns.
  - *Froot (1989), Froot and Frankel (1989), Gourinchas and Tornell (2004), Bacchetta et al. (2009), De la O and Myers (2022)*
- Our findings also contribute to the literature on the expectations hypothesis (EH) of the term structure of interest rates.
  - *Longstaff (2000), Della Corte et al. (2008)*

# 1.Introduction

## Contribution

- First, from an asset pricing perspective, our finding that FF futures and OIS emerge as more reliable gauges of monetary policy expectations than previously appreciated in the literature.
- Second, our results have implications for the broader literature on monetary policy and macroeconomics in that they provide support for models featuring strong asymmetries,
- Third, they have implications for communication strategies by central banks, for example, giving more explicit information about the conduct of monetary policy.

# 3. Main results

## 1) Decomposing Excess Returns on FF Futures and OIS

- FF futures: An investor who has taken a long position in FF futures receives fixed payments known at $t$ and pays a floating rate at $t + n$ depending on the realization of the EFFR.
- OIS: An investor who has taken a long position in OIS will receive payments based on a fixed swap rate known at $t$ and make payments based on the short rate that is realized over the contract's maturity

$$rx_{t+n}^{(n)} = f_t^{(n)} - i_{t+n}, \quad f_t^{(n)} = \underbrace{E_t[rx_{t+n}^{(n)}]}_{\text{term premium}} + \underbrace{E_t[i_{t+n}]}_{\text{EH term}},$$

- Diff: 1) path of the short rate; 2) more granularly hedge;

# 3. Main results

## 2) Decomposing excess returns

$$rx_{t+n}^{(n)} = f_t^{(n)} - i_{t+n}, \quad f_t^{(n)} = \underbrace{E_t[rx_{t+n}^{(n)}]}_{\text{term premium}} + \underbrace{E_t[i_{t+n}]}_{\text{EH term}},$$

$$\begin{aligned} rx_{t+n}^{(n)} &= \underbrace{\left(E_t[rx_{t+n}^{(n)}] + E_t[i_{t+n}]\right)}_{f_t^{(n)}} - i_{t+n} \\ &= \underbrace{E_t[rx_{t+n}^{(n)}]}_{\text{term premium}} + \underbrace{\left(E_t[i_{t+n}] - i_{t+n}\right)}_{\text{expectation error}}. \end{aligned}$$

- Under the FIRE assumption, market participants do not make systematic errors in their forecast of the short rate.
- If ex-post realized excess returns differ from what was required ex-ante, this must be driven by expectation error.

# 3. Main results

3) Survey-based decomposition

- To measure short rate expectations, we use interest rate forecasts from the Blue Chip Financial Forecasts survey.
- From the survey, we obtain fixed-horizon short rate expectations for $n$ = 3, 6, 9, and 12 months, denoted $S_t^{(n)}$.

$$rx_{t+n}^{(n)} = \underbrace{f_t^{(n)} - S_t^{(n)}}_{\mathrm{TP}_t^{(n)}} + \underbrace{S_t^{(n)} - i_{t+n}}_{\mathrm{EE}_{t+n}^{(n)}},$$

- Where TP measures the survey-implied term premium, EE is the expectation error.

# 3. Main results

## 3) Survey-based decomposition

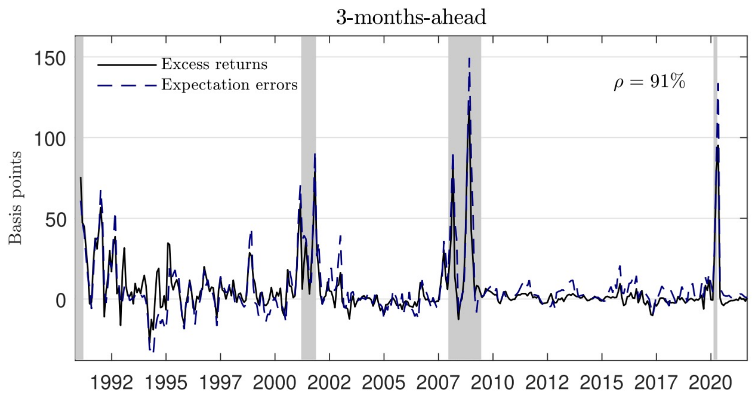
- FF futures: 1990-11 to 2021-09; OIS: 2001-12 to 2021-09.

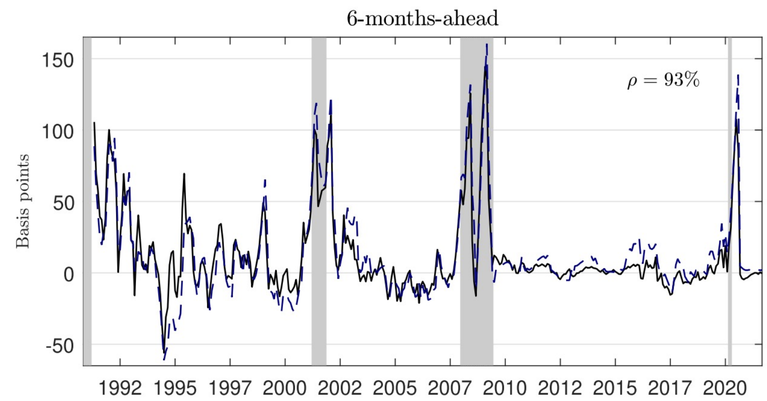
| | FF Futures | | Overnight Index Swaps | | | |
|---|---|---|---|---|---|---|
| $n =$ | 3 | 6 | 3 | 6 | 9 | 12 |
| Panel A: Mean Estimates | | | | | | |
| Excess Returns | 5.91 | 12.19 | 3.54 | 7.55 | 12.37 | 18.25 |
| | (3.82) | (2.98) | (2.15) | (1.74) | (1.73) | (1.75) |
| Expectation Errors | 7.37 | 13.05 | 6.23 | 10.55 | 16.61 | 24.13 |
| | (3.17) | (2.82) | (2.88) | (2.19) | (2.22) | (2.31) |
| Term Premia | -1.45 | -0.86 | -2.69 | -3.00 | -4.24 | -5.88 |
| | (-1.41) | (-0.54) | (-3.56) | (-2.12) | (-2.08) | (-2.20) |
| Panel B: Variance Decomposition | | | | | | |
| Expectation Errors | 1.08 | 1.02 | 1.16 | 1.04 | 1.00 | 0.98 |
| Term Premia | -0.08 | -0.02 | -0.16 | -0.04 | 0.00 | 0.02 |

- While term premia are uncorrelated with excess returns over time, expectation errors account for essentially all of the excess return variation.

# 3. Main results

## 3) Survey-based decomposition




- There is a steady decrease in the size and variability of excess returns and expectation errors took place during the 1990s.
- Second, excess returns and expectation errors spike in periods of economic downturn.

# 3. Main results

## 4) Expectations hypothesis tests

$$\Delta i_{t+n} = \alpha^{(n)} + \beta^{(n)} \varphi_t^{(n)} + \varepsilon_{t+n}^{(n)}, \qquad rx_{t+n}^{(n)} = \theta^{(n)} + \delta^{(n)} \varphi_t^{(n)} + \eta_{t+n}^{(n)},$$

- where $\Delta i_{t+n} = i_{t+n} - i_t$ is the future change in short rates from $t$ to $t + n$, and $\varphi_t^{(n)} = f_t^{(n)} - i_t$ is the "term spread" based on the FF futures or the OIS curve.
- 1) $\beta^{(n)} \neq 0$, shows that the money market term spread contains important information about future short rates.
- 2) $\alpha^{(n)}, \beta^{(n)} = 0, 1$ shows that the EH holds.
- 3) $\delta(n) \neq 0$, shows that the term spread predicts excess returns.

# 3. Main results

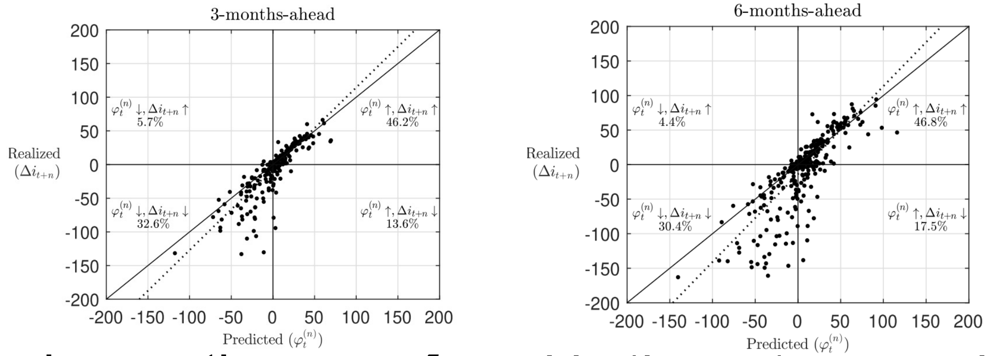
## 4) Expectations hypothesis tests

| | FF Futures | | Overnight Index Swaps | | | |
|---|---|---|---|---|---|---|
| $n =$ | 3 | 6 | 3 | 6 | 9 | 12 |
| Panel A: $\Delta i_{t+n} = \alpha^{(n)} + \beta^{(n)}\varphi_t^{(n)} + \varepsilon_{t+n}^{(n)}$ | | | | | | |
| $\alpha^{(n)}$ | -6.31 | -13.69 | -3.96 | -9.11 | -16.16 | -25.01 |
| $t_{\alpha^{(n)}=0}$ | (-5.00) | (-3.98) | (-2.57) | (-3.10) | (-2.80) | (-2.87) |
| $\beta^{(n)}$ | 1.21 | 1.27 | 1.17 | 1.26 | 1.37 | 1.44 |
| $t_{\beta^{(n)}=0}$ | (21.16) | (13.11) | (14.92) | (11.83) | (9.44) | (7.99) |
| $t_{\beta^{(n)}=1}$ | (3.65) | (2.81) | (2.18) | (2.47) | (2.57) | (2.44) |
| $R^2$ | 0.71 | 0.65 | 0.66 | 0.64 | 0.63 | 0.60 |
| Panel B: $rx_{t+n}^{(n)} = \theta^{(n)} + \delta^{(n)}\varphi_t^{(n)} + \eta_{t+n}^{(n)}$ | | | | | | |
| $\theta^{(n)}$ | 6.31 | 13.69 | 3.96 | 9.11 | 16.16 | 25.01 |
| $t_{\theta^{(n)}=0}$ | (5.00) | (3.96) | (2.63) | (3.13) | (2.72) | (2.84) |
| $\delta^{(n)}$ | -0.21 | -0.27 | -0.17 | -0.26 | -0.37 | -0.44 |
| $t_{\delta^{(n)}=0}$ | (-3.69) | (-2.81) | (-2.20) | (-2.48) | (-2.58) | (-2.42) |
| $R^2$ | 0.07 | 0.08 | 0.04 | 0.07 | 0.11 | 0.12 |

- The fact that the slope coefficients exceed unity shows that market participants tend to underestimate future short rate changes.

# 3. Main results

## 5) Asymmetric short rate predictability




- Most of the observations are found in these two quadrants.
- A handful of cases when market participants were surprised by short rate hikes (upper-left quadrant)
- A strikingly large proportion of the observations are found in the lower right quadrant, 18%, and denote short rate cuts that were unanticipated six months before they occurred.

# 3. Main results

## 5) Expectation errors and the Fed's reaction function

### I. Taylor rule

$$i_{t+n} = \alpha_{t+n} + \beta_{t+n} u_{t+n} + \gamma_{t+n} \pi_{t+n} + \varepsilon_{t+n},$$

$$\psi_{t+n}^{\text{Taylor}} = \widehat{i}_{t+n} - i_{t+n},$$

| | FF Futures | | Overnight Index Swaps | | | |
|---|---|---|---|---|---|---|
| $n =$ | 3 | 6 | 3 | 6 | 9 | 12 |
| $\rho\left(\psi_{t+n}^{\text{Taylor}}, rx_{t+n}^{(n)}\right)$ | 0.18<br>[0.00] | 0.24<br>[0.00] | 0.08<br>[0.21] | 0.06<br>[0.35] | 0.18<br>[0.01] | 0.22<br>[0.00] |
| $\rho\left(\psi_{t+n}^{\text{Taylor}}, \text{EE}_{t+n}^{(n)}\right)$ | 0.25<br>[0.00] | 0.35<br>[0.00] | 0.15<br>[0.02] | 0.17<br>[0.01] | 0.29<br>[0.00] | 0.31<br>[0.00] |

- Taken together, these results reveal that excess returns and expectation errors arise in periods where the Fed deviated from the Taylor rule.

# 3. Main results

## 5) Expectation errors and the Fed's reaction function

### II. Financial conditions

| | FF Futures | | Overnight Index Swaps | | | |
|---|---|---|---|---|---|---|
| $n =$ | 3 | 6 | 3 | 6 | 9 | 12 |
| Panel A: $rx_{t+n}^{(n)} = \alpha^{(n)} + \beta^{(n)} rx_t^{S\&P500} + \epsilon_{t+n}^{(n)}$ | | | | | | |
| $\beta^{(n)}$ | -0.89 | -1.44 | -0.91 | -1.21 | -1.49 | -1.92 |
| | (-4.58) | (-4.22) | (-3.95) | (-3.10) | (-2.28) | (-2.71) |
| $R^2$ | 0.05 | 0.05 | 0.07 | 0.04 | 0.04 | 0.03 |
| Panel B: $rx_{t+n}^{(n)} = \alpha^{(n)} + \beta^{(n)} rx_t^{S\&P500} + \gamma^{(n)}\text{Employment Growth}_t + \epsilon_{t+n}^{(n)}$ | | | | | | |
| $\beta^{(n)}$ | -0.90 | -1.48 | -0.92 | -1.24 | -1.55 | -2.01 |
| | (-4.64) | (-4.23) | (-4.01) | (-3.14) | (-2.76) | (-2.34) |
| $\gamma^{(n)}$ | -0.32 | -0.89 | -0.18 | -0.32 | -0.97 | -2.07 |
| | (-0.55) | (-0.58) | (-0.35) | (-0.21) | (-0.39) | (-0.60) |
| $R^2$ | 0.06 | 0.05 | 0.07 | 0.05 | 0.04 | 0.04 |

- A plausible explanation in our context could be that Fed reacted preemptively to deteriorating financial conditions that were signaling stress to come, even as hard data on macroeconomic activity were not yet pointing to a slowdown

# 3. Main results

$$rx_{t+n}^{(n)} = \alpha_{POS}^{(n)} 1_{\{rx_t^{S\&P500}>0\}} + \beta_{POS}^{(n)} rx_t^{S\&P500} 1_{\{rx_t^{S\&P500}>0\}} + \alpha_{NEG}^{(n)} 1_{\{rx_t^{S\&P500}\leq 0\}} + \beta_{NEG}^{(n)} rx_t^{S\&P500} 1_{\{rx_t^{S\&P500}\leq 0\}} + \varepsilon_{t+n},$$

## 5) Expectation errors and the Fed's reaction function

### II. Financial conditions

| | **FF Futures** | | **Overnight Index Swaps** | | | |
|---|---|---|---|---|---|---|
| $n =$ | 3 | 6 | 3 | 6 | 9 | 12 |
| Panel A: Excess Returns | | | | | | |
| $\beta_{\mathrm{POS}}^{(n)}$ | -0.04 | -0.35 | -0.17 | -0.25 | -0.12 | 0.38 |
| | (-0.11) | (-0.38) | (-0.33) | (-0.28) | (-0.09) | (0.19) |
| $\beta_{\mathrm{NEG}}^{(n)}$ | -1.77 | -2.57 | -1.52 | -2.08 | -2.60 | -3.45 |
| | (-3.75) | (-2.75) | (-2.81) | (-2.18) | (-1.68) | (-1.66) |
| $R^2$ | 0.07 | 0.06 | 0.08 | 0.06 | 0.05 | 0.05 |
| Panel B: Expectation Errors | | | | | | |
| $\beta_{\mathrm{POS}}^{(n)}$ | 0.28 | -0.10 | 0.08 | 0.00 | 0.09 | 0.61 |
| | (0.53) | (-0.10) | (0.13) | (0.02) | (0.07) | (0.32) |
| $\beta_{\mathrm{NEG}}^{(n)}$ | -2.88 | -3.80 | -2.79 | -3.22 | -3.64 | -4.38 |
| | (-5.13) | (-3.78) | (-4.27) | (-3.12) | (-2.31) | (-2.01) |
| $R^2$ | 0.11 | 0.08 | 0.14 | 0.10 | 0.08 | 0.08 |

- While positive stock market movements have no relation with future excess returns or expectation errors, negative stock returns contain strong and significant predictive information.

# 3. Main results

| | FF Futures | | Overnight Index Swaps | | | |
|---|---|---|---|---|---|---|
| $n =$ | 3 | 6 | 3 | 6 | 9 | 12 |
| Panel A: $rx_{t+n}^{(n)} = \alpha^{(n)} + \beta^{(n)}\text{Disagreement}_t^{(n)} + \epsilon_{t+n}^{(n)}$ | | | | | | |
| $\beta^{(n)}$ | 0.37 | 0.64 | 0.21 | 0.45 | 0.81 | 1.03 |
| | (3.77) | (3.12) | (1.47) | (1.77) | (2.39) | (2.65) |
| $R^2$ | 0.07 | 0.11 | 0.02 | 0.05 | 0.13 | 0.19 |
| Panel B: $\text{EE}_{t+n}^{(n)} = \alpha^{(n)} + \beta^{(n)}\text{Disagreement}_t^{(n)} + \epsilon_{t+n}^{(n)}$ | | | | | | |
| $\beta^{(n)}$ | 0.45 | 0.59 | 0.51 | 0.61 | 0.87 | 1.03 |
| | (3.08) | (2.41) | (2.85) | (2.11) | (2.26) | (2.42) |
| $R^2$ | 0.07 | 0.08 | 0.07 | 0.07 | 0.13 | 0.17 |

## 5) Expectation errors and the Fed's reaction function

III. Uncertainty, rare negative shocks

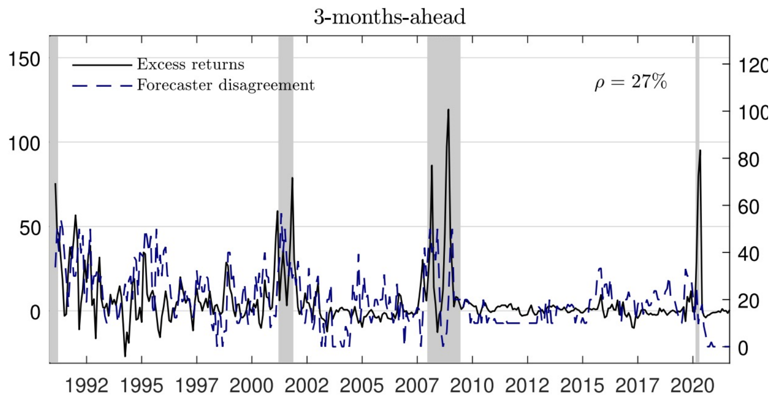
- Disagreement at each time point is computed as the difference between the 90th and the 10th percentile of individual short rate forecasts for horizon n from Blue Chip Financial Forecasts.

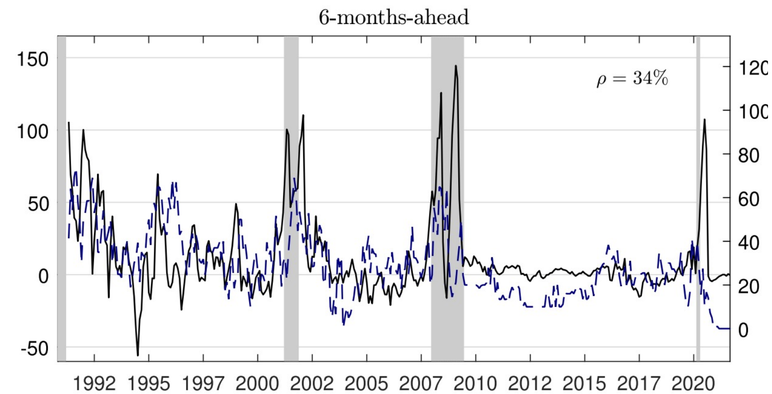
- Importantly, this result does not simply imply that high forecast uncertainty comes along with high subsequent forecast errors but rather that high forecast uncertainty is followed by short rates systematically dropping below what had been previously anticipated.

# 3. Main results

## 5) Expectation errors and the Fed’s reaction function

### III. Uncertainty, rare negative shocks




- Significantly positive excess returns observed in money markets stem from difficulties faced by market participants when learning about the Fed’s reaction to large, but infrequent, negative shocks in real-time.

# 3. Main results

## 5) International evidence

| $n =$ | | Overnight Index Swaps 3 | 6 | 9 | 12 |
|---|---|---|---|---|---|
| | | $rx_{t+n}^{(n)} = \alpha^{(n)} + \beta^{(n)} rx_t^{\text{stock market}} + \epsilon_{t+n}^{(n)}$ | | | |
| Australia | $\beta^{(n)}$ | -0.35 | -0.96 | -1.69 | -2.59 |
| | | (-1.52) | (-1.97) | (-2.27) | (-2.65) |
| | $R^2$ | 0.01 | 0.02 | 0.03 | 0.04 |
| Canada | $\beta^{(n)}$ | -0.70 | -1.25 | -1.63 | -2.17 |
| | | (-3.42) | (-3.30) | (-3.11) | (-2.77) |
| | $R^2$ | 0.06 | 0.06 | 0.05 | 0.04 |
| Euro area | $\beta^{(n)}$ | -0.22 | -0.96 | -1.74 | -2.25 |
| | | (-1.34) | (-3.01) | (-3.02) | (-3.36) |
| | $R^2$ | 0.01 | 0.04 | 0.06 | 0.06 |
| United Kingdom | $\beta^{(n)}$ | -1.49 | -2.29 | -2.85 | -3.49 |
| | | (-5.56) | (-4.77) | (-4.31) | (-4.04) |
| | $R^2$ | 0.11 | 0.09 | 0.07 | 0.07 |
| Japan | $\beta^{(n)}$ | -0.09 | -0.15 | -0.19 | -0.23 |
| | | (-2.26) | (-2.32) | (-1.90) | (-2.05) |
| | $R^2$ | 0.03 | 0.03 | 0.02 | 0.02 |
| Switzerland | $\beta^{(n)}$ | -0.95 | -1.47 | -1.97 | -2.79 |
| | | (-4.29) | (-3.82) | (-3.44) | (-3.34) |
| | $R^2$ | 0.10 | 0.09 | 0.08 | 0.10 |

# 4. Conclusion

- We document that the biased expectations and positive excess returns stem from market participants underestimating the size of the Fed's interest rate cuts in response to large, but infrequent, negative shocks.
- Consequently, we show that a fall in stock returns predicts high excess returns, because market participants underestimate the extent to which the Fed would cut rates in response to these shocks.
- Whereas lower stock prices strongly predict higher excess returns, higher stock prices do not predict unexpected rate hikes and subsequently low excess returns.
- Forecasters' uncertainty about the monetary policy outlook, is systematically followed by higher excess returns and expectation errors.