Information Acquisition and the Pre-Announcement Drift

Hengjie Ai[1] Ravi Bansal [2] Leyla Han[3]

[1]University of Wisconsin-Madison

[2]Duke University and NBER

[3]Boston University

NBER Summer Institute 2022, Capital Markets

Introduction: the Question

- Since 1994, about 80% of the equity market risk premium is realized 24 hours *ahead* of FOMC announcements (Lucca and Moench, 2015)
- Realized volatility is lower during the pre-announcement period than on non-announcement days
- Challenge to asset pricing research:
  - Risk premium realizes ahead of announcements?
- Challenge to policy makers:
  - Information leakage prior to FOMC announcements?

Introduction: Difficulty of a Leakage Story

- A theory of pre-FOMC drift that does not rely on information leakage
- Definition: the arrival of new information about the upcoming announcement that is *not publicly available*
- Intuition:
  - arrival of new information triggers a high realized volatility
  - empirically, realized vol during the drift period is low

Introduction: A Noisy Rational Expectations Model

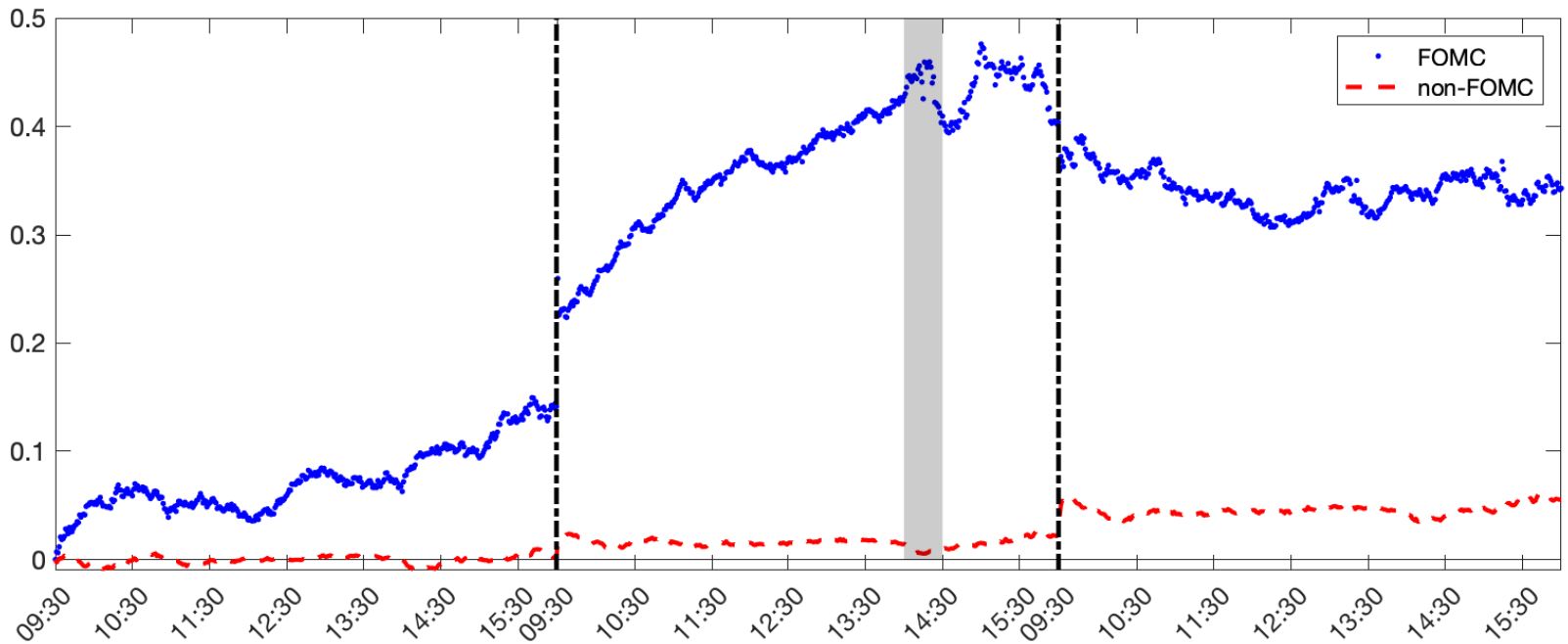
- This paper: a NREE model with information acquisition
  - Satisfies generalized risk sensitivity in preferences (GRS) $\Rightarrow$ announcement premium (Ai and Bansal, 2018)
  - Information acquisition $\Rightarrow$ pre-announcement drift
  - Asymmetric information $\Rightarrow$ low volatility during drift period

Literature

- Macroeconomic announcement premium
  - Savor and Wilson (2013, 2014); Ai and Bansal (2018); Ernst, Gilbert, and Hrdlicka (2019); Wachter and Zhu (2020).
- FOMC announcement premium
  - Lucca and Moench (2015); Mueller, Tahbaz-Salehi and Vedolin (2017); Boguth, Gregoire, and Martineau (2018); Bollerslev, Li, and Xue (2018); Cieslak, Morse, and Vissing-Jorgensen (2019); Morse and Vissing-Jorgensen (2020); Cocoma (2020); Fisher, Martineau, and Sheng (2020); Hu, Pan, Wang, and Zhu (2020), Liu, Tang, Zhou (2020).
- Noisy rational expectations
  - Grossman and Stiglitz (1980); Grossman (1981), and Hellwig (1980); Wang (1993, 1994); Breon-Drish (2015); Bond and Goldstein (2015); Banerjee and Green (2015); Avdis (2016), Goldstein and Yang (2017); Andrei and Cujean (2017); Andrei, Cujean, and Wilson (2018), Sockin (2019); Buffa, Vayanos, and Woolley (2019); Detemple, Rindisbacher and Robertson (2020); Han (2021).

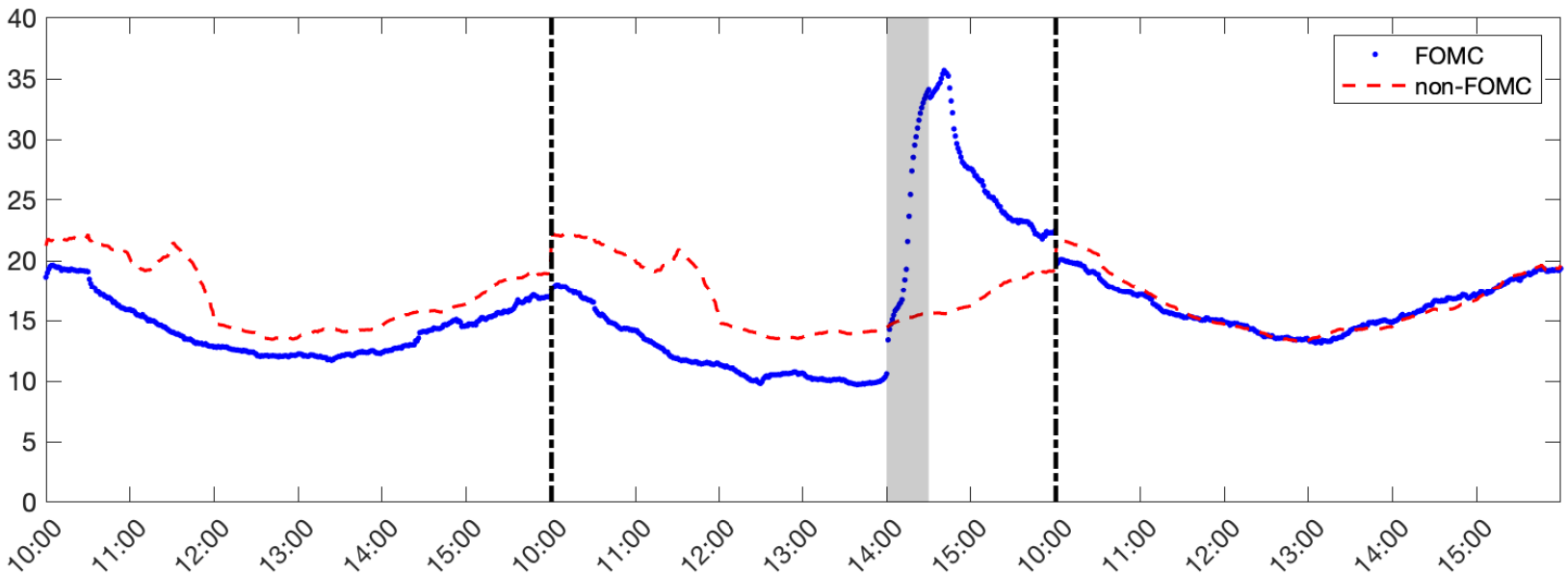
Motivating Facts: Pre-Announcement Drift

- **Fact 1:** Average market return during the 24 hours ahead of FOMC announcement: 32 bps (Lucca and Moench, 2015)



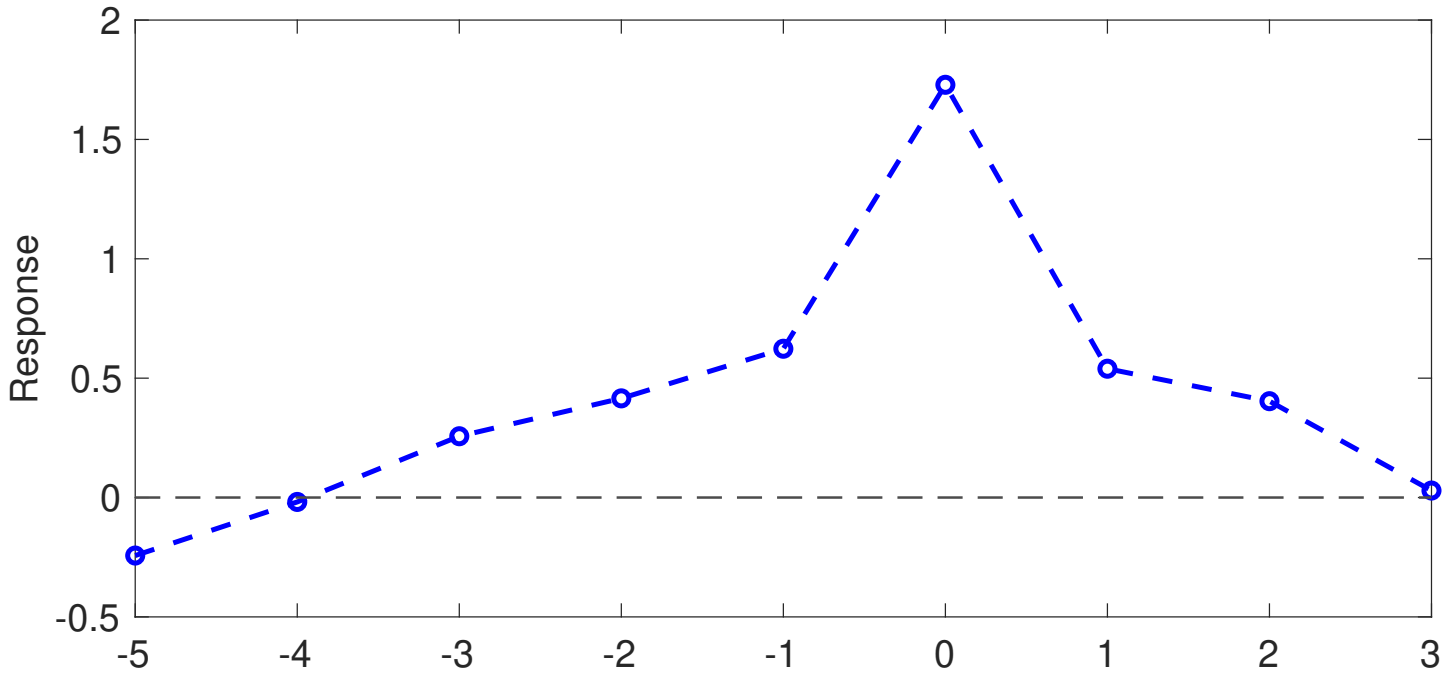
Motivating Facts: Realized Volatility

- **Fact 2:** Realized vol during the pre-announcement period is lower than non-announcement days



Motivating Facts: Investors' Attention

- **Fact 3:** Investors' attention increases ahead of announcements (Fisher, Martineau, and Sheng, 2022)



Model Setup

Asset Markets

- The stock is claim to the following dividend process:

$$dD_t = (x_t - D_t)\, dt + \sigma_D dB_{D,t}, \tag{1}$$

- Hidden state (Unobservable) that determines dividend flow:

$$dx_t = b\,(\bar{x} - x_t)\, dt + \sigma_x dB_{x,t}, \tag{2}$$

- Total noisy supply of the risky asset:

$$d\theta_t = a\left(\bar{\theta} - \theta_t\right) dt + \sigma_\theta dB_{\theta,t}. \tag{3}$$

- A constant risk-free rate r

Model Setup

Informed and Uninformed Investors

- Noisy signals s_t: publicly available but costly to acquire

$$ds_t = x_t dt + \sigma_s dB_{s,t}$$

- Two groups of investors
  - low cost: always acquire info $\Rightarrow (1-\omega)$ informed investors
  - high cost: acquire optimally $\Rightarrow \omega$ uninformed investors

Model Setup

Investor Beliefs and Asset Prices

- Informed investors' posterior belief: $\hat{x}_t$ and $\hat{q}_t$
- Uninformed investors' posterior belief: $\tilde{x}_t$ and $\tilde{q}_t$
- Equilibrium price:

$$P_t = \phi(t) + \phi_D D_t - \underbrace{\phi_\theta(t)}_{\text{price impact of noisy supply}} \theta_t + \phi_x(t)\hat{x}_t + \phi_\Delta(t)\tilde{x}_t,$$

- True value of x_t is periodically revealed by announcements at time $0,\ T,\ 2T,\ 3T...$

Model Setup
Information Acquisition

- Uninformed do not observe s_t unless pay a cost
  - Paying a fixed cost K to start information acquisition at τ
  - Keep observing the signals requires a flow cost k from τ to T
- After information acquisition: observe $\{s_v\}_{v=-\infty}^{t}$:

$$ds_{u,t} = \hat{x}_t dt + \sigma_u(t) dB_{u,t}, \text{ for } t \in [\tau, T] \tag{4}$$

- They solve an optimal information acquisition problem:
  - Information is costly $\Rightarrow$ start to acquire info only when benefits are large enough

Preference

- Informed investors have expected CARA utility:

$$\hat{V}_t = -e^{-\gamma \hat{C}_t} dt + e^{-\rho dt} \hat{\mathbb{E}} \left[\hat{V}_{t+dt} \right].$$

- Uninformed investors
  - Satisfies generalized risk sensitivity (GRS) (Ai and Bansal, 2018)

$$\tilde{V}_t = -e^{-\gamma \tilde{C}_t} dt + e^{-\rho dt} h^{-1} \left(\tilde{\mathbb{E}} \left[h \left(\tilde{V}_{t+dt} \right) \right] \right). \tag{5}$$

  - GRS: h is concave $\Rightarrow$ announcement premium

$$h\left(\tilde{V}_t\right) = -\frac{1}{1+\kappa} \left(-\tilde{V}_t\right)^{1+\kappa} \tag{6}$$

where κ reflects degree of GRS.

Uninformed Information Acquisition

- Choose an optimal stopping time τ to start to acquire info:

$$ds_{u,t} = \hat{x}_t dt + \sigma_u(t) dB_{u,t}$$

  - $\sigma_u(t) = \sigma_u$ for $t \in [\tau, T]$ and $\sigma_u(t) = \infty$ otherwise
- Provide sufficient condition for optimal stopping in the paper
- Specify $K(\tilde{\theta})$ so that τ is deterministic
- In our calibration, τ equals to 3 days ahead of the announcement.

Definition of Equilibrium

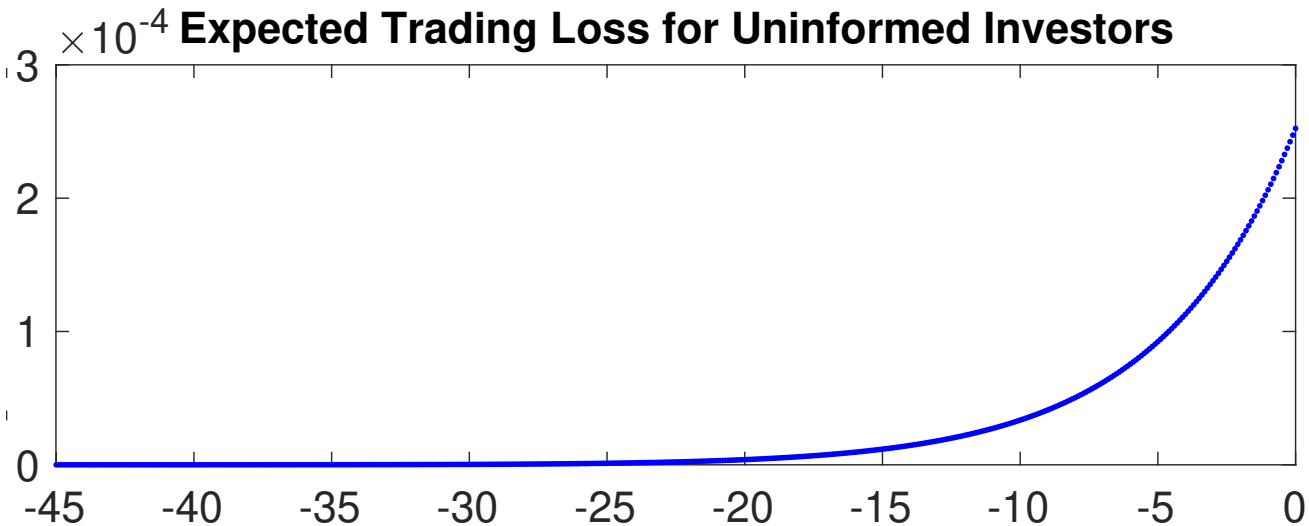
- The equilibrium is a list of prices and quantities that include
  1. a pricing function, P_t, and
  2. consumption $\left\{\hat{C}_t, \tilde{C}_t\right\}$, and portfolio holdings, $\alpha_t^I = \alpha_{0,t}^I + \alpha_{\theta,t}^I \theta_t + \alpha_{\Delta,t}^I (\hat{x}_t - \tilde{x}_t)$ and $\alpha_t^U = \alpha_{0,t}^U + \alpha_{\theta,t}^U \tilde{\theta}_t$,

  such that the following conditions are satisfied:

  1. Uninformed make their optimal information acquisition decisions
  2. Given prices and beliefs, $\left\{\hat{C}_t, \alpha_t^I\right\}$ and $\left\{\tilde{C}_t, \alpha_t^U\right\}$ are optimal
  3. Market clears, i.e.
$$(1-\omega)\alpha_t^I + \omega\alpha_t^U = \theta_t. \tag{7}$$

Model Implications
Timing of Information Acquisition

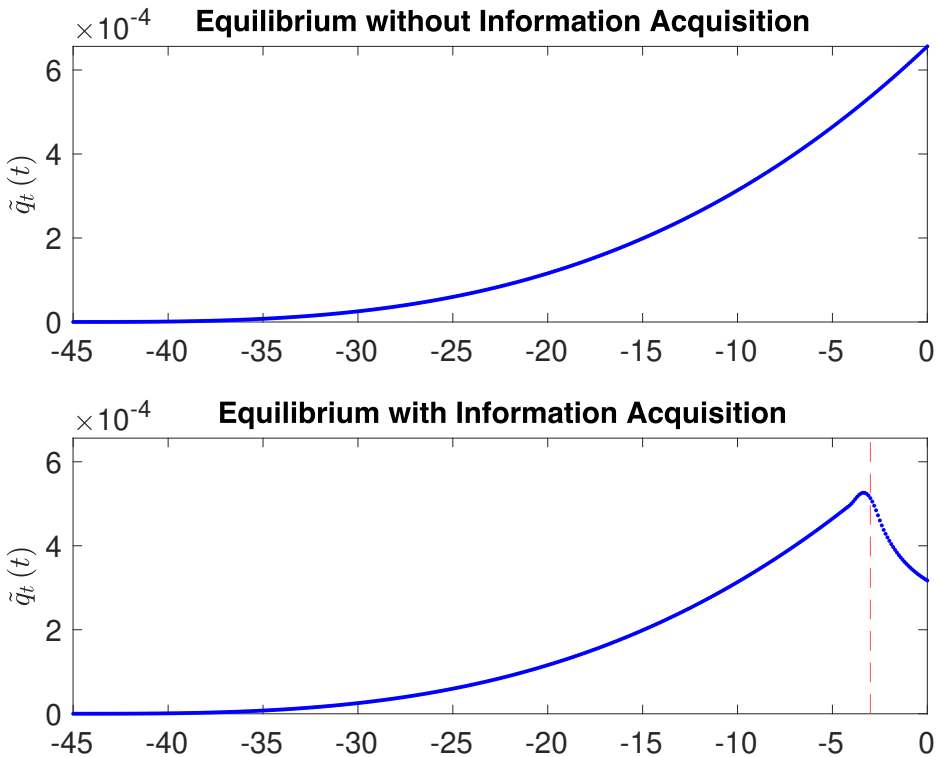
- **Result 1: info acquisition starts days ahead of announcements**
- Reason 1: Due to asymmetric information, the information disadvantage rises over time



- unconditional expectation of trading loss $\mathbb{E}\left[\left[\alpha^U\left(\theta_t\right)-\alpha^U\left(\tilde{\theta}_t\right)\right] dR_t\right]$

Model Implications
Timing of Information Acquisition

- **Result 1: info acquisition starts days ahead of announcements**
- Reason 2: Uncertainty of uninformed investors builds up over time:

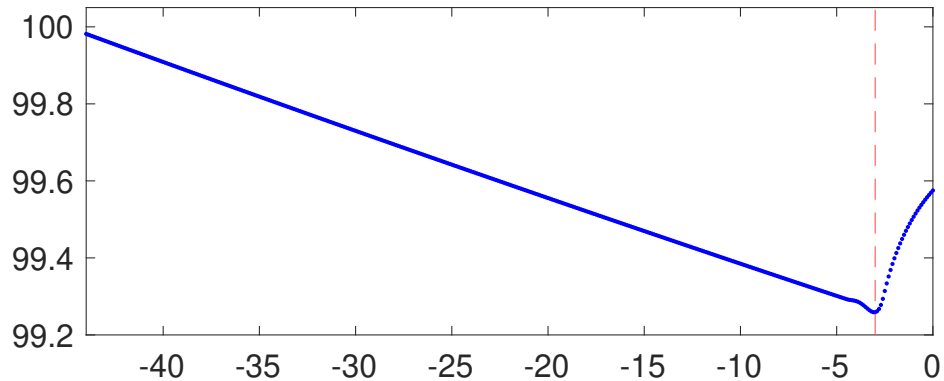


- Uninformed investors' posterior variance $\tilde{q}_t$ (uncertainty) starts to drop
- Investors acquire information 3 days before announcements

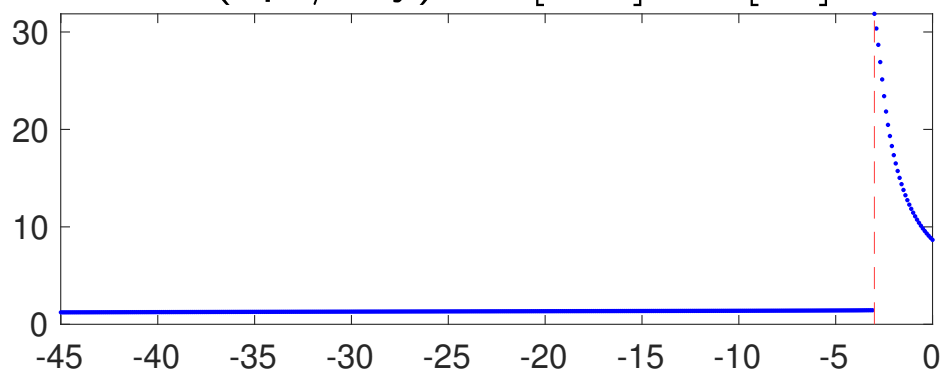
Model Implications

Pre-FOMC Announcement Drift

- **Result 2: price and return drift up as info acquisition starts**
  - Expected price level: $\mathbb{E}[P_t]$



  - Expected excess return (bps/day): $\mathbb{E}[dR_t] / \mathbb{E}[P_t]$

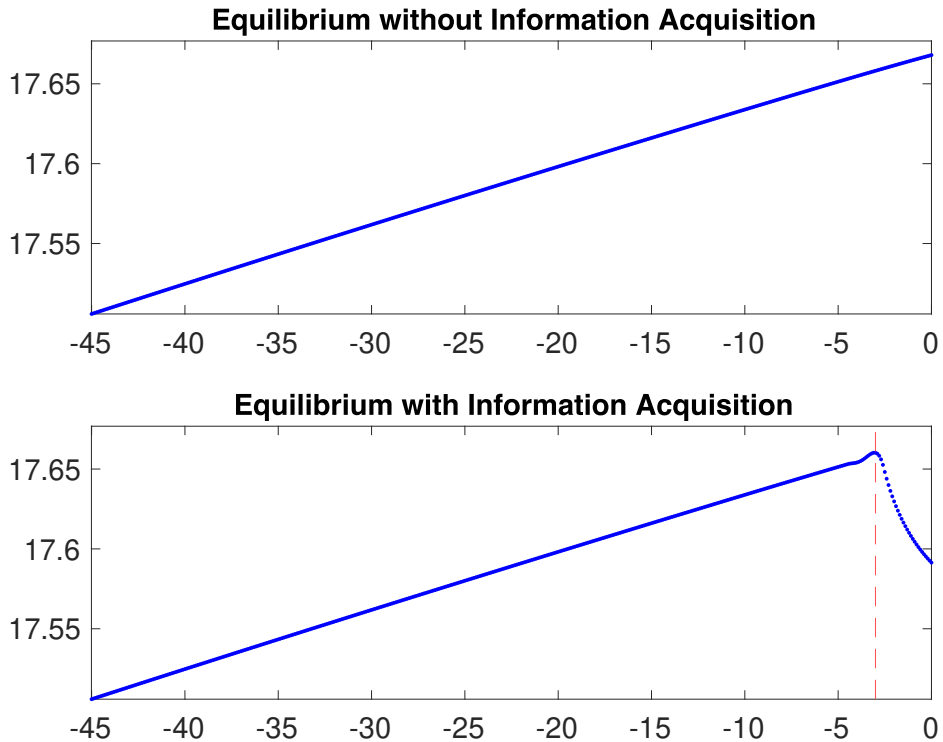


  - Pre-announcement drift due to generalized risk sensitivity (Information triggers co-movement between returns and continuation utility)

Model Implications

Return volatility

- **Result 3: return volatility is low during the drift period**

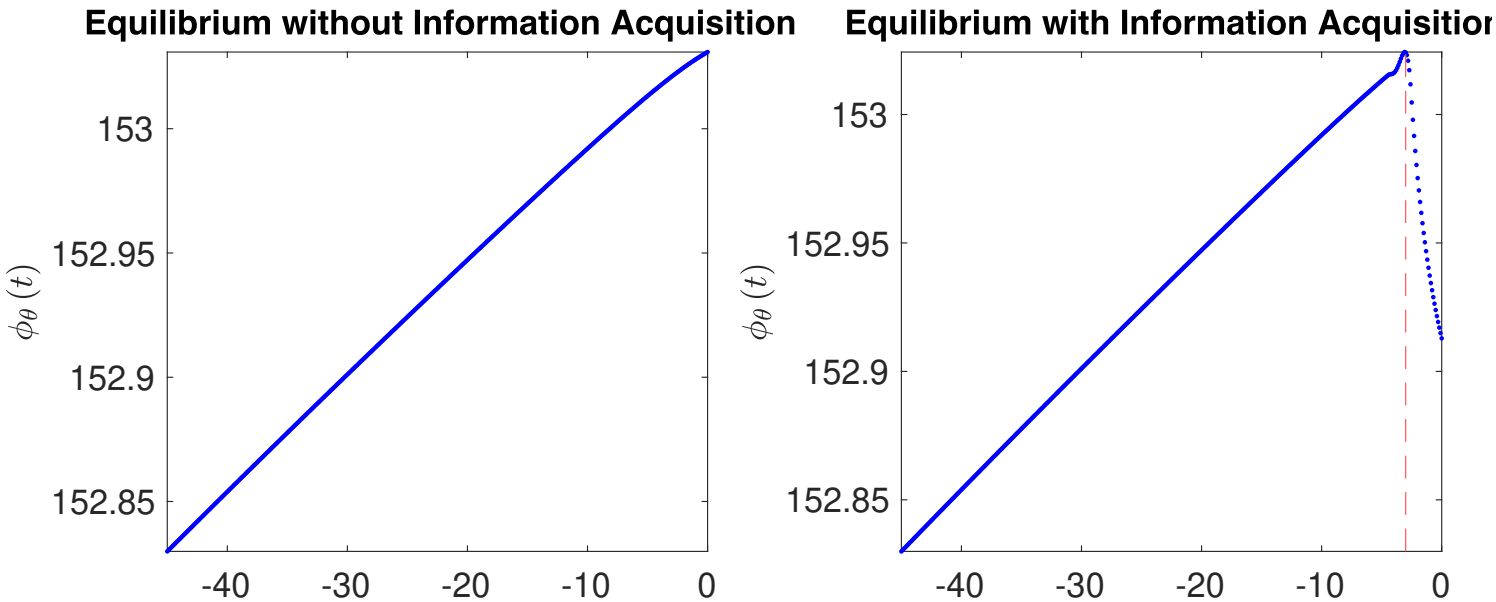


- Low return vol during the drift period is consistent with the data

Model Implications

Return volatility

- **Intuition 1:** acquired info is already contained in prices
- Equilibrium price: $P_t = \phi(t) + \phi_D D_t - \phi_\theta(t)\theta_t + \phi_x(t)\hat{x}_t + \phi_\Delta(t)\tilde{x}_t$



- **Intuition 2:** info acquisition reduces the asymmetric info, thus price impact of noisy supply $\phi_\theta(t)$ (Han, 2021)

Conclusion

- A NREE model of pre-FOMC announcement drift
  - Generalized risk sensitivity generates the announcement premium
  - Information acquisition gives rise to pre-announcement drift
  - Asymmetric info reconciles volatility dynamics
- Key message: compensation for generalized risk sensitivity; does not rely on leakage of information