Information Sharing in Financial Markets

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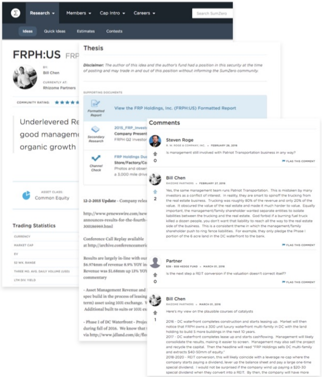
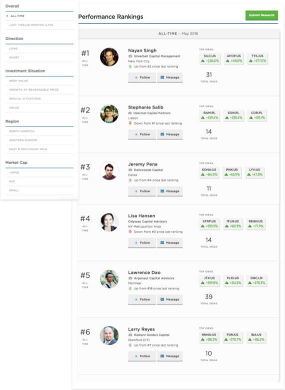
Info sharing is prevalent in financial markets

Professional investors share info among each other

- Shiller and Pound (1989) survey
- Hong, Kubik and Stein (2005), Pool, Stoffman, and Yonker (2015)
- Private investment communities: SumZero, Value Investors Club

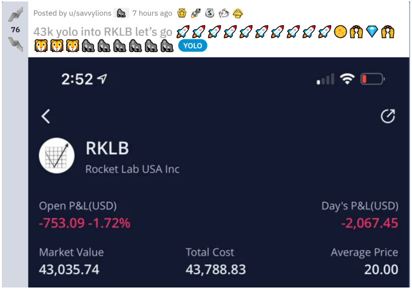




Info sharing is prevalent in financial markets

Normal folks also share their investment ideas

- Twitter, Seeking Alpha, StockTwits, Reddit/ Wallstreetbets (WSB)



Info sharing is prevalent in financial markets

> *Word-of-mouth transmission of ideas appears to be an important contributor to day-to-day or hour-to-hour stock market fluctuations.*
> *—— Shiller (2015, p.180)*

Research questions:

1. Why do investors want to voluntarily share information?
2. Who shares information with whom?

What do we do?

We consider a classic Kyle model to study info sharing in financial markets

Provide one rational theory of info sharing:

1. The coarsely informed investors have a strategic motive to share their info: "trading against order flow"/"trading against error"
   - Unique info flow: less informed $\Rightarrow$ more informed
2. After info sharing,
   - sender profit $\uparrow$ but receiver profit $\downarrow$
   - liquidity $\downarrow$, price efficiency $\uparrow$, and trading volume may $\uparrow$ or $\downarrow$

Literature

1. Info sharing
   - Manipulation: Benabou and Laroque (1992)
   - Price correction acceleration: Ljungqqvist and Qian (2016), Kovbasyuk and Pagano (2015), Liu (2017), Schmidt (2019)
   - Commitment to aggressive trading: Indjejikian, Lu and Yang (2014)
   - Advantage over uninformed followers: Van Bommel (2003)
   - "Talk for her book": Pasquariello and Wang (2016)
   - Disagreement: Balasubramaniam (2020)

Our complementary explanation: info from less informed to more informed

2. Noise/supply info in financial markets:
   - Ganguli and Yang (2009), Marmora and Rytchkov (2018), Farboodi and Veldkamp (2020)

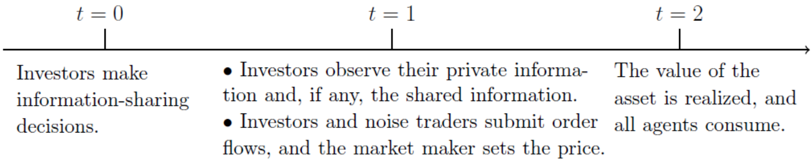
Our focus: noise in investor's info/sentiment; who shares with whom

Model Setup

Model setup: Key departures

Two key departures from Kyle (1985)

1. Two rational investors with info of different precision;
2. Info can be shared between them.



Model setup: Specifics

- A risky asset with date-2 value $\tilde{v} \sim N(0,1)$.
- Two risk-neutral rational investors with different-quality info
  - H observes $\tilde{v}$
  - L observes

$$\tilde{y} = \tilde{v} + \tilde{e}, \text{ with } \tilde{e} \sim N(0, \rho^{-1}) \text{ and } \rho \in (0, \infty)$$

  - At $t = 0$, info-sharing decisions: $A_i \in \{\text{Share}, \text{Not share}\}$
  - Investor i places order $\tilde{x}_i$ to maximize expected profits

$$E[\tilde{x}_i(\tilde{v} - \tilde{p}) | \mathcal{F}_i]$$

  For instance, if L shares but H does not, $\mathcal{F}_H = \{\tilde{v}, \tilde{y}\}$ and $\mathcal{F}_L = \{\tilde{y}\}$

- Trading. Noise traders $\tilde{u} \sim N(0, \sigma_u^2)$ and market makers set pricing rule

$$\tilde{p} = E\left(\tilde{v} | \tilde{\omega}\right), \text{ with } \tilde{\omega} = \tilde{x}_H + \tilde{x}_L + \tilde{u}$$

Results

Equilibrium at the trading stage

Subgames at the trading stage

- **Subgame 1**: Neither investors shares info: $A_L = \varnothing$ and $A_H = \varnothing$
  - Info sets: $\mathcal{F}_L = \{\tilde{y}\}$ and $\mathcal{F}_H = \{\tilde{v}\}$
  - Trading strategies: $\tilde{x}_L = \beta_y^{\varnothing\varnothing}\tilde{y}$ and $\tilde{x}_H = \alpha_v^{\varnothing\varnothing}\tilde{v}$, where

$$\beta_y^{\varnothing\varnothing} = \frac{\rho\sigma_u}{\sqrt{4+\rho(5+2\rho)}} \text{ and } \alpha_v^{\varnothing\varnothing} = \frac{(2+\rho)\sigma_u}{\sqrt{4+\rho(5+2\rho)}}$$

  - Pricing rule $\tilde{p} = \lambda^{\varnothing\varnothing}\tilde{\omega}$, where

$$\lambda^{\varnothing\varnothing} = \frac{\sqrt{4+\rho(5+2\rho)}}{(4+3\rho)\sigma_u}$$

Equilibrium at the trading stage

- **Subgame 2**: L shares but H does not: $A_L = S$ and $A_H = \varnothing$
  - Info sets: $\mathcal{F}_L = \{\tilde{y}\}$ and $\mathcal{F}_H = \{\tilde{v}, \tilde{y}\}$
  - Trading strategies: $\tilde{x}_L = \beta_y^{S\varnothing}\tilde{y}$ and $\tilde{x}_H = \alpha_v^{S\varnothing}\tilde{v} + \alpha_y^{S\varnothing}\tilde{y}$, where

$$\beta_y^{S\varnothing} = \frac{2\rho\sigma_u}{\sqrt{(1+\rho)(9+8\rho)}}, \ \alpha_v^{S\varnothing} = \frac{3\sigma_u\sqrt{1+\rho}}{\sqrt{9+8\rho}},$$

$$\text{and } \alpha_y^{S\varnothing} = -\frac{\rho\sigma_u}{\sqrt{(1+\rho)(9+8\rho)}}$$

  - Pricing rule $\tilde{p} = \lambda^{S\varnothing}\tilde{\omega}$, where

$$\lambda^{S\varnothing} = \frac{\sqrt{9+8\rho}}{6\sigma_u\sqrt{1+\rho}}.$$

H trades against the information shared by L: $\alpha_y^{S\varnothing} < 0$!

Why $\alpha_y^{S\varnothing} < 0$?

- Interpretation 1: Trade against order flow

$$\tilde{x}_H = \underbrace{\frac{1}{2\lambda^{S\varnothing}} E\left(\tilde{v}|\tilde{v},\tilde{y}\right)}_{\text{Forecasting fundamental}} \underbrace{-\frac{1}{2} E\left(\tilde{x}_L|\tilde{v},\tilde{y}\right)}_{\text{Trading against order flow}}$$

  - H has known the fundamental perfectly: $\frac{\partial E(\tilde{v}|\tilde{v},\tilde{y})}{\partial \tilde{y}} = 0$
  - As L always trades on her information ($\beta_y^{S\varnothing} > 0$), $\alpha_y^{S\varnothing} = \frac{\partial}{\partial \tilde{y}} \left[-\frac{1}{2} E\left(\tilde{x}_L|\tilde{v},\tilde{y}\right)\right] = -\frac{\beta_y^{S\varnothing}}{2} < 0$

- Interpretation 2: Trade against error

$$\tilde{x}_H = \alpha_v^{S\varnothing}\tilde{v} + \alpha_y^{S\varnothing}\tilde{y} = \left(\alpha_v^{S\varnothing} + \alpha_y^{S\varnothing}\right)\tilde{v} + \alpha_y^{S\varnothing}\tilde{e}$$

  - L's trading on $\tilde{e}$ is dumb money in the eye of H

Equilibrium at the trading stage

- **Subgame 3**: H shares info: $A_H = S$
  - Info sets: $\mathcal{F}_L = \{\tilde{y}\}$ and $\mathcal{F}_H = \{\tilde{v}\}$ (or $\mathcal{F}_H = \{\tilde{v}, \tilde{y}\}$)
  - Trading strategies: $\tilde{x}_L = \beta_v^{\cdot S}\tilde{v}$ and $\tilde{x}_H = \alpha_v^{\cdot S}\tilde{v}$, where

$$\beta_v^{\cdot S} = \alpha_v^{\cdot S} = \frac{\sigma_u}{\sqrt{2}},$$

  - Pricing rule $\tilde{p} = \lambda^{\varnothing\varnothing}\tilde{\omega}$, where

$$\lambda^{\varnothing\varnothing} = \frac{\sqrt{4 + \rho(5 + 2\rho)}}{(4 + 3\rho)\sigma_u}$$

Equilibrium at the info-sharing stage

Go back to date 0 to analyze investors' info sharing decisions.

		H	
		Not share ($\varnothing$)	Share (S)
L	Not Share ($\varnothing$)	$\frac{\rho(1+\rho)\sigma_u}{(4+3\rho)\sqrt{4+5\rho+2\rho^2}}, \frac{(2+\rho)^2\sigma_u}{(4+3\rho)\sqrt{4+5\rho+2\rho^2}}$	$\frac{\sigma_u}{3\sqrt{2}}, \frac{\sigma_u}{3\sqrt{2}}$
	Share (S)	$\frac{2\rho\sigma_u}{3\sqrt{(1+\rho)(9+8\rho)}}, \frac{(9+4\rho)\sigma_u}{6\sqrt{(1+\rho)(9+8\rho)}}$	$\frac{\sigma_u}{3\sqrt{2}}, \frac{\sigma_u}{3\sqrt{2}}$

Proposition

There exists a unique equilibrium in which L shares her info whereas H does not.

Why does L share info?

Decomposition of L's profit:

$$\underbrace{\pi_L^{S\varnothing} - \pi_L^{\varnothing\varnothing}}_{\text{total effect: } > 0} = \underbrace{\pi_L^{direct} - \pi_L^{\varnothing\varnothing}}_{\text{direct effect: } > 0} + \underbrace{\pi_L^{S\varnothing} - \pi_L^{direct}}_{\text{indirect effect: } > 0}$$

- Direct effect: holding constant L's trading rule and the market maker's pricing rule, H trades against L's info
- Indirect effect: investor L's trading rule and the market maker's pricing rule adjust in response to info sharing

Implications of info sharing

Proposition

From no info sharing to info sharing:

(1) *L's profit $\uparrow$, H's profit $\downarrow$, and the combined profit $\uparrow$*

- H's profit:

$$\underbrace{\pi_H^{S\varnothing} - \pi_H^{\varnothing\varnothing}}_{\text{total effect: } < 0} = \underbrace{\pi_H^{direct} - \pi_H^{\varnothing\varnothing}}_{\text{direct effect: } > 0} + \underbrace{\pi_H^{S\varnothing} - \pi_H^{direct}}_{\text{indirect effect: } < 0}$$

- Example: if $\rho = 1$ and $\sigma_u = 1$, via info sharing, $\pi_L \uparrow 32.7\%$, $\pi_H \downarrow 4.1\%$, and $\pi_H + \pi_L \uparrow 2.6\%$ (noise traders are harmed)

Implications of info sharing

Proposition

From no info sharing to info sharing:

(1) *L's profit* $\uparrow$*, H's profit* $\downarrow$*, and the combined profit* $\uparrow$

(2) *Market liquidity* $\downarrow$*, and market efficiency* $\uparrow$*. Trading volume* $\uparrow$ *iff L owns imprecise info.*

H trading against error $\Rightarrow$ Less error in the aggregate order flow

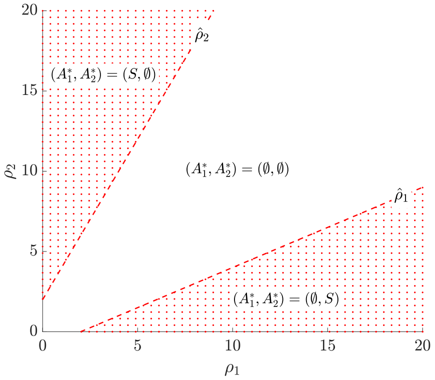
1. Market liquidity λ
2. Price efficiency $Var^{-1}\left(\tilde{v}|\tilde{p}\right)$
3. Trading volume: $TV = \frac{1}{2}\left(E\left[|\tilde{x}_H| + |\tilde{x}_L| + |\tilde{\omega}| + |\tilde{u}|\right]\right)$

Extensions and Variations

Extensions and variations

1. Imperfectly informed H-investor
   - Result: L still shares if H is well informed
2. Ex-post info sharing
   - Result: That L shares information with H is always an equilibrium
3. H: "I am not listening"
   - Result: That all Hs commit not to listen cannot be sustained in equilibrium
4. Publicly shared info
   - Result: L still shares if market makers have low ability to interpret the shared info
5. Other extensions
   - Endogenous info acquisition by L
   - Multiple Hs and Ls
   - Three differentially informed investors

1. Imperfectly informed H-investor



- Investor i's info: $\tilde{y}_i = \tilde{v} + \tilde{e}_i$, $\tilde{e}_i \sim N(0, \rho_i^{-1})$ and $\rho_i \in (0, +\infty]$
- WLOG, assume $\rho_1 \geq \rho_2$ and 2 shares info with 1

$$\tilde{x}_1 = \underbrace{\alpha_y}_{>0} \tilde{y}_1 + \underbrace{\alpha_2}_{<0 \text{ iff } \rho_1 > \hat{\rho}_1 \equiv 2(1+\rho_2)} \tilde{y}_2$$

2. Ex-post info sharing

$t = 0$

~~Investors make info-sharing decisions.~~

$t = 1$

- Investors observe their private information.
- Investors make binary info-sharing decisions.
- Investors and noise traders submit order flows, and market makers set the price.

$t = 2$

The value of the asset is realized, and all agents consume.

Results:

(1) *Neither L nor H shares info in equilibrium?* No, "someone must share info in equilibrium"

(2) *H shares info in equilibrium?* No, "H never shares info in equilibrium"

(3) There exists an equilibrium in which L always shares whereas H does not share.

3. H: "I am not listening"

- L observes $\tilde{y}$ and a number M of Hs observe $\tilde{v}$
- Hs can commit not to receiving the shared info

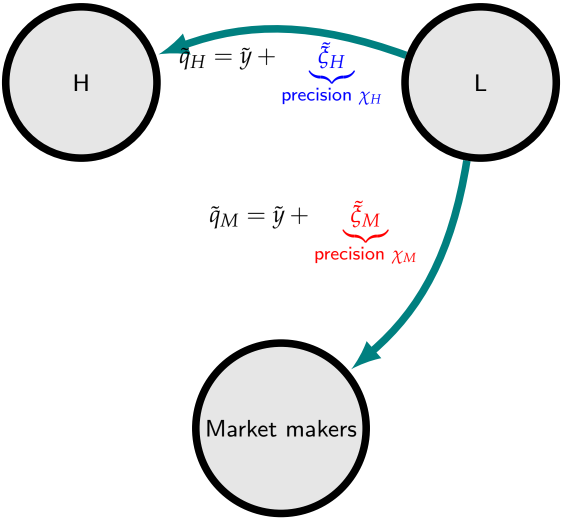
Proposition

(1) *When* $M \geq 3$, ~~*L shares and every H commits not to use the shared info*~~

(2) $\exists \hat{M} > 0$ *such that when* $M > \hat{M}$ *the following equilibrium always exists:*

- *L shares her info and all Hs use L's shared information*
- *Hs' profits would be higher had they all committed not to use the shared info.*

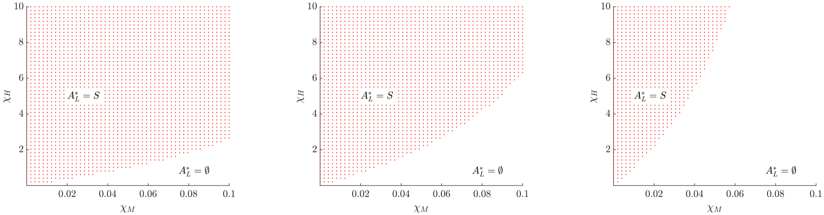
4: Publicly shared information



- Info may be leaked to market makers in the communication process.
- Baseline model: $\chi_H = \infty$ and $\chi_M = 0$

4: Publicly shared information

L's sharing decisions:



(a) $\rho = 3$ (b) $\rho = 5$ (c) $\rho = 10$

Applications

Application 1: Market chatters: private communication among investors

- Private communication/ Market chatters: Zaloom (2003)
  - Shiller and Pound (1986), Hong et al. (2005), Pool et al. (2015)
  - Private investment communities: SumZero, Value Investors Club

- Consistent evidence
  1. Crawford et al. (2017): predominantly small hedge fund managers share in Value Investors Club
     - $\sim$ coarsely informed investors more likely to share
  2. Cowgill and Zitzewitz (2015): more experienced traders trade against optimism bias in Google's prediction markets
     - $\sim$ trade against error

Application 2: Public communication on social media

- Mapping to our model
  - L: representative social media posters
  - H: hedge funds who analyze tweets or r/wallstreetbets
  - MM has low ability to read the public info
- So, social media opinions can be truthful but noisy. We thus explain
  - Why info sharing is so prevalent?
  - Why investment posts contain fundamental info (Chen et al, 2014),
  - but noisy at the same time (Antweiler and Frank, 2004)?
- The merit of sentiment trading strategy? If H is already well informed, trading against social media sentiment can backfire

Conclusion

1. A coarsely informed investor has a strategic incentive to share her info with the well informed.
    - **Trading against order flow/ error**

2. After info sharing, sender profit $\uparrow$ but receiver profit $\downarrow$. Noise traders $\downarrow$.

3. Market liquidity $\downarrow$, price efficiency $\uparrow$, and trading volume may $\uparrow$ or $\downarrow$.