

## Discussion

# (In)efficiency in Information Acquisition and Aggregation through Prices

by Alessandro Pavan, Savitar Sundaresan, and Xavier Vives

Eduardo Dávila

Yale and NBER

Econometric Society Meetings  
January 8, 2022

## This paper

- ▶ Central (underexplored) questions in normative finance
  1. Is trading in financial markets efficient?  
(when investors learn from prices)
  2. Is information acquisition efficient?
  3. Which policies can correct inefficiencies?
- ▶ Very hard questions
  - ▶ Welfare analysis with dispersed information is hard
  - ▶ A lot of the literature falls short

## This paper

- ▶ Central (underexplored) questions in normative finance
  1. Is trading in financial markets efficient?  
(when investors learn from prices)
  2. Is information acquisition efficient?
  3. Which policies can correct inefficiencies?
- ▶ Very hard questions
  - ▶ Welfare analysis with dispersed information is hard
  - ▶ A lot of the literature falls short
- ▶ This paper: **provides answers to all three questions**
  - ▶ In a particular linear quadratic environment
  - ▶ Building on Xavier's earlier work (Vives 2017, Restud)
    - ▶ Correlated noise and information acquisition

## This paper

- ▶ Central (underexplored) questions in normative finance
  1. Is trading in financial markets efficient?  
(when investors learn from prices)
  2. Is information acquisition efficient?
  3. Which policies can correct inefficiencies?
- ▶ Very hard questions
  - ▶ Welfare analysis with dispersed information is hard
  - ▶ A lot of the literature falls short
- ▶ This paper: **provides answers to all three questions**
  - ▶ In a particular linear quadratic environment
  - ▶ Building on Xavier's earlier work (Vives 2017, Restud)
    - ▶ Correlated noise and information acquisition
- ▶ **Key insights**
  1. Trading is inefficient (pecuniary and information externality)
    - ▶ Optimal policy  $T(x_i, p)$
  2. Info. acquisition is inefficient even when financial trading is optimal
    - ▶ Optimal policy  $T(x_i, p, \tilde{x})$  or  $T(x_i, p, y_i)$

# Outline of the discussion

- ▶ Revisit
  1. Environment
  2. Main results
- ▶ Comments

# Environment

## ▶ Traders

- ▶ Linear-quadratic objective; learn from prices

$$\max_{x_i} (\theta - p)x_i - \lambda \frac{x_i^2}{2}$$

- ▶ Private signals over  $\theta \sim N(0, \sigma_\theta^2)$ ; cost of  $y_i$  is  $\mathcal{C}(y_i)$

$$s_i \equiv \theta + \epsilon_i \quad \text{where} \quad \epsilon_i \equiv \frac{1}{\sqrt{y_i}} (\eta + e_i)$$

- ▶ Correlated signals
- ▶ Linear demand

$$x_i(s_i, p) = \frac{1}{\lambda} (\mathbb{E}[\theta \mid I_i, p] - p) = a^* s_i + \hat{b}^* - \hat{c}^* p$$

# Environment

## ▶ Traders

- ▶ Linear-quadratic objective; learn from prices

$$\max_{x_i} (\theta - p)x_i - \lambda \frac{x_i^2}{2}$$

- ▶ Private signals over  $\theta \sim N(0, \sigma_\theta^2)$ ; cost of  $y_i$  is  $\mathcal{C}(y_i)$

$$s_i \equiv \theta + \epsilon_i \quad \text{where} \quad \epsilon_i \equiv \frac{1}{\sqrt{y_i}} (\eta + e_i)$$

- ▶ Correlated signals

- ▶ Linear demand

$$x_i(s_i, p) = \frac{1}{\lambda} (\mathbb{E}[\theta \mid I_i, p] - p) = a^* s_i + \hat{b}^* - \hat{c}^* p$$

## ▶ Liquidity supplier

- ▶ Linear-quadratic objective, no learning, non-strategic

$$\max_{\tilde{x}} (p + u - \alpha)\tilde{x} - \beta \frac{\tilde{x}^2}{2} \Rightarrow \tilde{x} = \frac{1}{\beta} (p + u - \alpha)$$

- ▶ Hedging/noise shock  $u \sim N(0, \sigma_u^2)$

# Equilibrium/Welfare

1. Competitive REE with price signal  $z$

$$z = \theta + f(y)\eta - \frac{u}{\beta a^*}$$

- ▶ Payoff ( $\theta$ ) + 2 sources of noise ( $\eta$  and  $u$ )
- ▶ **Question:** can we kill  $u$ ? And the liquidity providers?



# Equilibrium/Welfare

## 1. Competitive REE with price signal $z$

$$z = \theta + f(y)\eta - \frac{u}{\beta a^*}$$

- ▶ Payoff ( $\theta$ ) + 2 sources of noise ( $\eta$  and  $u$ )
- ▶ **Question:** can we kill  $u$ ? And the liquidity providers?

## 2. Welfare

$$W \equiv \int_0^1 \left( \theta x_i - \frac{\lambda}{2} x_i^2 \right) di + \left( u - \alpha - \beta \frac{\tilde{x}}{2} \right) \tilde{x}$$

- ▶ Team-efficient solution: reasonable benchmark
  - ▶ Maximizes welfare subject to linear demands
  - ▶ Liquidity provider choices are taken as given
  - ▶ Aggregation exploits quasilinearity

## Main Results: Trading Stage

- ▶ Planning solution

$$a^T = \frac{\dots}{\dots + \Xi(a^T) + \Delta(a^T)}$$

- ▶ Pecuniary externality  $\Xi(a^T) > 0$ : investors respond too much to private info
  - ▶ Independent of informativeness of price
- ▶ Information externality  $\Delta(a^T) < 0$ : investors response too little to private info

## Main Results: Trading Stage

- ▶ Planning solution

$$a^T = \frac{\dots}{\dots + \Xi(a^T) + \Delta(a^T)}$$

- ▶ Pecuniary externality  $\Xi(a^T) > 0$ : investors respond too much to private info
  - ▶ Independent of informativeness of price
- ▶ Information externality  $\Delta(a^T) < 0$ : investors response too little to private info
- ▶ Optimal policy:

$$\begin{aligned} T(x_i, p) &= \frac{\delta}{2}x_i^2 - t_0x_i + t_ppx_i \\ &= \left( \frac{\delta}{2}x_i - t_0 + t_pp \right) x_i \end{aligned}$$

- ▶ **Remark:** the planner wants to correct each of the three demand coefficients

## Main Results: Info. Acquisition Stage

- ▶ Info acquisition is inefficient even under optimal financial trading
  - ▶ Sign depends on slope of efficient demands
  - ▶ Strategic complements/substitutes?

## Main Results: Info. Acquisition Stage

- ▶ Info acquisition is inefficient even under optimal financial trading
  - ▶ Sign depends on slope of efficient demands
  - ▶ Strategic complements/substitutes?
- ▶ Optimal policy #1: (aggregate volume of trade)

$$T(x_i, \tilde{x}, p) = \frac{\delta^*}{2} x_i^2 - t_0^* x_i + t_p^* p x_i + \underbrace{(t_{\tilde{x}}^* \tilde{x}) x_i}$$

- ▶ Optimal policy #2: (info. acquisition choice)

$$T(x_i, p, y_i) = \frac{\delta}{2} x_i^2 - t_0 x_i + t_p p x_i - \underbrace{A y_i}$$

- ▶ **Remark:** #2 is very intuitive
  - ▶ Pigouvian principle
  - ▶ An extra instrument is needed

# Comments/Thoughts

## 1. Mechanism behind pecuniary externality

- ▶ Large literature on constrained inefficiency in incomplete markets (e.g.: GP86, GV02, DK18)
- ▶ With complete markets, this externality should disappear
- ▶ Which exact form of incompleteness is critical here?
  - ▶ With respect to individual signals or aggregates?

# Comments/Thoughts

## 1. Mechanism behind pecuniary externality

- ▶ Large literature on constrained inefficiency in incomplete markets (e.g.: GP86, GV02, DK18)
- ▶ With complete markets, this externality should disappear
- ▶ Which exact form of incompleteness is critical here?
  - ▶ With respect to individual signals or aggregates?

## 2. Mechanism behind information externality

- ▶ Why are exactly investors better off with more informative prices?
  - ▶ No production here; there is only risk sharing
- ▶ Linear-quadratic preferences are not expected utility
  - ▶ They embed early resolution of uncertainty
  - ▶ Is this the explanation?
- ▶ Is it possible to derive results with expected utility?
- ▶ I very much like the cursed equilibrium result

# Comments/Thoughts

## 3. Asymmetry

- ▶ Would it possible to derive some results without liquidity providers?
- ▶ A setup with ex-ante symmetric investors may be easier to understand
- ▶ In this model liquidity providers are unregulated by assumption. Why?



# Comments/Thoughts

## 3. Asymmetry

- ▶ Would it possible to derive some results without liquidity providers?
- ▶ A setup with ex-ante symmetric investors may be easier to understand
- ▶ In this model liquidity providers are unregulated by assumption. Why?

## 4. Generality

- ▶ It'd be nice to consider more general environments
- ▶ Within linear-quadratic class would be enough
- ▶ Can the signs of the externalities switch?

# Comments/Thoughts

## 3. **Asymmetry**

- ▶ Would it possible to derive some results without liquidity providers?
- ▶ A setup with ex-ante symmetric investors may be easier to understand
- ▶ In this model liquidity providers are unregulated by assumption. Why?

## 4. **Generality**

- ▶ It'd be nice to consider more general environments
- ▶ Within linear-quadratic class would be enough
- ▶ Can the signs of the externalities switch?

## 5. **Hard to implement policies**

- ▶ Linear trading subsidies
- ▶ Quadratic taxes
- ▶ Constrained but more easily implementable policies?

## Conclusion

- ▶ Very nice paper in a very important topic
- ▶ Natural next step in this literature
- ▶ Opens the door to further research in the area