

(In)efficiency in Information Acquisition and Aggregation through Prices

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Motivation

- **(In)efficiency in financial trading**
 - limit orders
 - private information

- **Endogeneity of traders' private information**
 - information collection/acquisition
 - attention

- **Sand in wheels of financial markets**
 - Tobin tax
 - various other policy proposals

- **Reduction in cost of information**
 - internet, big data, high-frequency trading
 - *beneficial to society?*

This Paper

- Model to investigate interaction
 - (in)efficiency in trading
 - (in)efficiency in information collection prior to trading
- Policy interventions

- **Exogenous** private information
 - Inefficiency in trading
 - pecuniary externality
 - information externality
 - both inefficiencies corrected with (non-linear) taxes/subsidies contingent on
 - price of financial asset
 - individual volume of trade

Findings

- **Endogenous** private information
 - *over-investment* in information acquisition
 - excessive sensitivity of eq. limit orders to private information
 - downward-sloping schedules
 - pecuniary externality prevails over info externality
 - *under-investment* in information acquisition
 - inefficiently low sensitivity of eq. limit orders to private information
 - upward-sloping schedules
 - info externality prevails over pecuniary externality
- No policy (measurable in price and individual volume of trade) inducing efficiency in both info acquisition and trading
- Efficiency in both info acquisition and trading possible when expenditure on info acquisition verifiable

- **Inefficiency in usage when info exogenous**

- Vives (1988), Angeletos and Pavan (2007), Amador and Weill (2012), Myatt and Wallace (2012), Vives (2019),...

- **Information acquisition in financial markets**

- Grossman and Stiglitz (1980), Diamond and Verrecchia (1981), Verrecchia (1982), Peress (2010), Manzano and Vives (2011), Vives (2014), Kacperczyk, Van Nieuwerburgh, and Veldkamp (2016), Davila and Parlato (2019),...

- **Efficiency in Information acquisition**

- Colombo, Femminis and Pavan (2014), Angeletos, Iovino, and La'O (2020),...

- **Impact of reduction in cost of information on performance of financial mkts**

- Peress (2005), Farboodi et al (2018), Azamsa (2019), Kacperczyk, Nosal and Stevens (2019), Malikov (2019), Mihet (2018),...

Plan

- 1 Introduction
- 2 **Model**
- 3 (In)efficiency in trading
- 4 (In)efficiency in info acquisition
- 5 Conclusions

Model

- Unit-mass continuum of traders with payoff

$$\pi_i = \left(\underbrace{\theta}_{\text{common value}} - \underbrace{p}_{\text{price}} \right) \underbrace{x_i}_{\text{demand of } i} - \underbrace{\lambda}_{\text{trading cost}} \frac{x_i^2}{2}$$

- Representative investor with payoff

$$\Pi = \left(p - \underbrace{\alpha - u}_{\text{opportunity cost}} \right) \underbrace{\tilde{x}}_{\text{aggregate supply}} - \underbrace{\beta}_{\text{trading cost}} \frac{\tilde{x}^2}{2}$$

Information and schedules

- Each trader observes private signal

$$s_i = \theta + f(\underbrace{y_i}_{\text{effort}}) \left(\underbrace{\eta}_{\text{common}} + \underbrace{e_i}_{\text{idiosyncratic}} \right)$$

- Attention/information collection: $y_i \in \mathbb{R}_+$

- cost $C(y_i)$, $C', C'' > 0$

- Trader i 's schedule

$$x_i = as_i + b - cp$$

- Representative investor's (inverse) supply

$$p = \alpha - u + \beta \tilde{x}$$

- $(\theta, u, \eta, (e_i)_{i \in [0,1]})$ independent and jointly Normal

Timing

- $t = 0$: traders choose y_i
- $t = 1$: traders observe s_i , representative investor observes u
- $t = 2$: limit orders
- $t = 3$: mkt clears
- $t = 4$: payoffs

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Inefficiency in Trading

Equilibrium Use of Information

Proposition 1

Unique symmetric equilibrium. Sensitivity of eq demand schedules to private information:

$$a^* = \frac{1}{\lambda} \frac{\tau_\epsilon y \tau_\eta (y \tau_\eta - \tau_\omega(a^*))}{y^2 \tau_\eta^2 (\tau_\omega(a^*) + \tau_\epsilon + \tau_\theta) - \tau_\omega(a^*) \tau_\epsilon (\tau_\theta + 2y \tau_\eta)}$$

where

$$\tau_\omega(a^*) \equiv \frac{\beta^2 a^{*2} y \tau_u \tau_\eta}{(\beta^2 a^{*2} \tau_u + y \tau_\eta)}$$

is precision of endogenous signal

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

contained in eq. price.

- Team Problem
 - planner controls traders' limit orders but cannot transfer info from one trader to another
 - chooses orders $x_i = as_i + b - cp$ to max total welfare

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

Proposition 2

Team problem has unique solution. Efficient sensitivity of traders' demand schedules to private information:

$$a^T = \frac{1}{\lambda y^2 \tau_\eta^2} \frac{\tau_\epsilon y \tau_\eta (y \tau_\eta - \tau_\omega(a^T))}{(\tau_\omega(a^T) + \tau_\epsilon + \tau_\theta) - \tau_\omega(a^T) \tau_\epsilon (\tau_\theta + 2y \tau_\eta) + \Xi(a^T) + \Delta(a^T)}$$

Given a^T , \hat{c}^T and \hat{b}^T given by same functions as in eq.

- $\Xi(a) > 0$: **pecuniary externality**
 - traders do not internalize co-movement of trades with aggregate shocks
- $\Delta(a) < 0$: **information externality**
 - traders do not internalize informational content of prices

Efficient Use of Information

- Efficient schedules $x_i = a^T s_i + \hat{b}^T - \hat{c}^T p$

- downward-sloping when pecuniary externality prevails:

$$\hat{c}^T > 0 \Leftrightarrow \Xi(a^T) + \Delta(a^T) > 0$$

- upward-sloping when info externality prevails

$$\hat{c}^T < 0 \Leftrightarrow \Xi(a^T) + \Delta(a^T) < 0$$

Proposition 3

Efficient trading can be induced through combination of linear-quadratic tax on volume of trade along with proportional subsidy/tax on price:

$$T(x_i, p) = \frac{\delta}{2} x_i^2 + (pt_p - t_0) x_i$$

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Info acquisition

Proposition 4

Let y^T denote socially optimal quality of private information. Suppose traders constrained to submit efficient demand schedules (for y^T). When efficient demands are downward-sloping, quality of private information acquired in eq. higher than y^T . Opposite true when efficient demand schedules upward-sloping.

Proposition 5

Suppose planner uses policy that induces efficiency in trading when info is exogenous. Traders acquire information of quality other than y^T and then submit inefficient demand schedules.

Impossibility of efficient trade and acquisition

Proposition 6

There exists no (differentiable) policy $T(x_i, p)$ inducing efficiency in both info acquisition and trading

- Any smooth policy inducing efficiency in trading induces traders to misperceive marginal value of private information

- Efficiency in both info acquisition and trading
 - unorthodox policies where tax bill
 - non-smooth in (x_i, p)
 - contingent on information other than x_i and p (e.g., distribution of trades and/or ex-post profitability θ).

Proposition 7

Suppose expenditure on info acquisition y_i verifiable. There exist (differentiable) policies

$$T(x_i, p, y_i)$$

inducing efficiency in both trading and information acquisition.

Conclusions

- Inefficiency in trading
 - pecuniary externality
 - info externality
- Exogenous (private) information
 - inefficiency can be corrected with tax on volume of trade + subsidy on price
- Endogenous (private) information
 - non-existence of (canonical policies) inducing efficiency in both trading and info acquisition
- Efficiency in both info acquisition and trading possible with verifiable acquisition
- Future work:
 - financial decisions interacting with real decisions
 - multiple assets
 - dynamics

THANKS!