

(In)efficiency in Information Acquisition and Aggregation through prices

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Overview

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- ▶ Is information acquisition efficient?
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- ▶ Pecuniary and information externalities make trading inefficient
- ▶ Information acquisition is inefficient even if trading is not
- ▶ Optimal policy: linear + quadratic taxes + condition on aggregate vol or info choice

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Main model ingredients

- ▶ Correlated noise in trader signals
- ▶ Exogenous liquidity suppliers
- ▶ Costly information acquisition

Model

- ▶ One homogeneous, perfectly divisible asset unobservable payoff $\theta \sim N(0, \tau_\theta^{-1})$
- ▶ **Liquidity supplier** with utility

$$p\tilde{x} - (\alpha - u)\tilde{x} - \beta\frac{\tilde{x}^2}{2} \quad \text{where} \quad u \sim N(0, \tau_u^{-1})$$

- ▶ **Traders** $i \in [0, 1]$ with linear-quadratic expected utility

$$\mathbb{E}[\pi_i | s_i, p] = (\mathbb{E}[\theta | s_i, p] - p)x_i - \lambda\frac{x_i^2}{2}$$

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- ▶ *Dispersed information*: Private signal $s_i \equiv \theta + \varepsilon_i$ where $\varepsilon_i \equiv \frac{1}{\sqrt{y_i}}(\eta + e_i)$
 - ▶ Signals are **correlated**: $\eta \sim N(0, \tau_\eta^{-1})$

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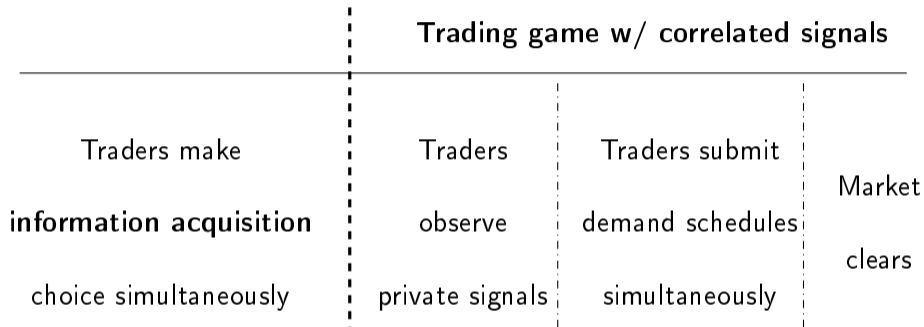
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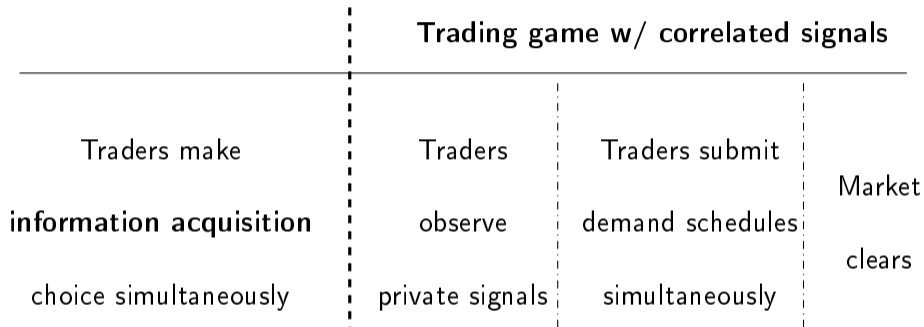
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 - ▶ Signals are **correlated**: $\eta \sim N(0, \tau_\eta^{-1})$
- ▶ *Information acquisition*: Pay cost $C(y_i), C'(y_i), C''(y_i) > 0$ to get a signal precision

$$\tau_\varepsilon \equiv \frac{y\tau_e\tau_\eta}{\tau_e + \tau_\eta}$$

Timing



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Symmetric equilibrium in linear strategies in trading game

- ▶ Liquidity inverse supply

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

- ▶ Traders' linear demand schedule

$$x_i = X(p; I_i) = a^* s_i + \hat{b}^* - \hat{c}^* p$$

- ▶ Market clearing $\tilde{x} = \int x_i di \Rightarrow$

$$p = \frac{\alpha + \beta \hat{b}^*}{1 + \beta \hat{c}^*} + \frac{\beta a^*}{1 + \beta \hat{c}^*} z \quad \text{where} \quad z \equiv \theta + f(y) \eta - \frac{u}{\beta a^*}$$

- ▶ With correlated signals, there are two sources of noise
 - ▶ liquidity trades u
 - ▶ correlated noise in private signals η (modulated by y_i)

Welfare in trading stage

- ▶ Planner's utility

$$\mathcal{W} = \int \left(\theta x_i - \frac{\lambda}{2} x_i^2 \right) di + \left(u - \alpha - \beta \frac{\tilde{x}}{2} \right) \tilde{x}$$

- ▶ Team-efficient solution: Minimize welfare loss subject to
 - ▶ 1) linear demands and 2) liquidity providers as exogenous

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- ▶ Planning solution boils down to choosing demand sensitivity to private info a^T

$$a^T = \frac{A(y, \tau_\omega(a^T))}{B(y, \tau_\omega(a^T)) + \Xi(a^T) + \Delta(a^T)}$$

- ▶ Pecuniary externality $\Xi(a^T) > 0$: do not internalize the aggregate price movements
- ▶ Information externality: $\Delta(a^T) < 0$: do not internalize higher price informativeness

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Information acquisition

- ▶ Information acquisition is inefficient even if trading is efficient
 - ▶ Over/under investment depends on whether demand slope
 - ▶ Correlated noise is important!
- ▶ Optimal policies
 1. Conditional on aggregate volume

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

2. Conditional on information acquisition choice

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- ▶ Are these easy to implement?

Comments/Suggestions

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 - ▶ How important are liquidity providers?
 - ▶ Ex-ante symmetric traders who add noise: hedging needs (?)
 - ▶ No need for unregulated market participants

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 - ▶ Preferences for early resolution of uncertainty
 - ▶ Is this important for the externalities to be present
 - ▶ Trading stage with CARA expected utility should be ok (?)

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4. Two sources of aggregate variation
 - ▶ Correlated noise + liquidity providers
 - ▶ Are both necessary in both stages?