# **Discussion** on

# “Open Data and Financial Market Quality”

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2026 ABFER Annual Meeting

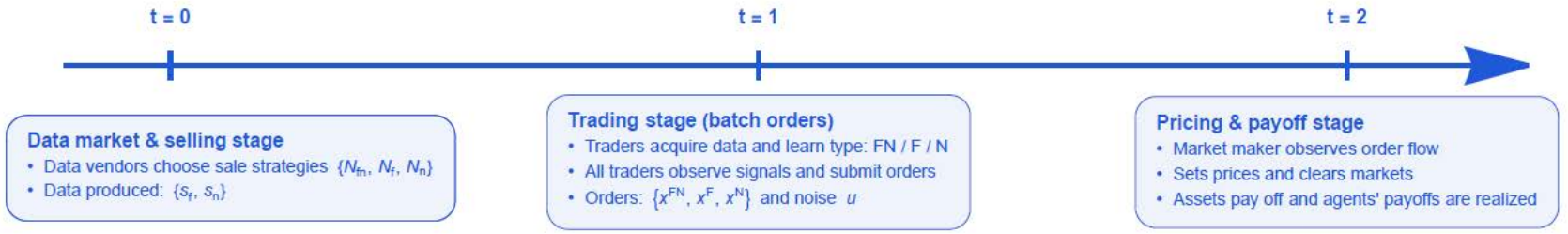
May 21, 2026

Singapore

# What the paper does

- Develop a theory to identify the value of fundamental and non-fundamental information in financial markets.
  - A new perspective of the value of non-fundamental information
- Examine the behavior and implications of six different data sales structure.
  - This is very comprehensive.
- Empirical test of the model prediction.
- My discussions:
  - Intuition and contribution
  - Value of information and strategic traders

# Model




- The core is Kyle (1985) with multiple strategic traders
- One risky asset with payoff $\theta \sim N(0, \tau_\theta^{-1})$
- Noise trading $u \sim N(0, \tau_u^{-1})$
- Fundamental information: $s_f = \theta + \epsilon_f$
- Non-fundamental information: $s_n = u + \epsilon_n$
- *J* strategic traders, who are risk neutral and informed of different private information and submit market orders.
- The price is set by a risk-neutral market maker, observing the total order flow $y$ from informed traders and noise traders.
- Data vendors sell signals $s_f$ and $s_n$ before trading, under different IO structures.

# Value of information and intuitions

# Value of Information in the Literature

- It is intuitive that the fundamental information $s_f$ has value since it helps to forecast fundamental $\theta$ (e.g., Grossman and Stiglitz 1980; Admati and Pfleiderer 1986).
- Why does the non-fundamental signal $s_n$ also have value?
- The literature (e.g., Ganguli and Yang 2009; Farboodi and Veldkamp 2020) consider the Grossman-Stiglitz (1980) setting in which traders are competitive and submit demand schedules (i.e., traders observe prices).
- The channel there works through helping traders to understand the market better so that they can better predict the fundamental ("purging noise" or "trading against dumb money").

# Specifically…

- These papers use REE models in which traders are competitive, submit demand schedules, and only need to forecast fundamental $\theta$.

- In REE models, the asset price is a function of fundamental $\theta$ (due to informed trading) and noise $u$ (due to noise trading):

$$p = \alpha + \beta \times \theta + \lambda \times u$$

  where $\alpha, \beta, \lambda$ are known constants in equilibrium.

- So, if a trader observes private information $s_n$ about $u$ and can submit demand schedule (that is, she can observe the price), then she can use the price and non-fundamental information to back out a private signal about fundamental ("purge noise"):

$$s_p = \frac{p - \alpha - \lambda(u - E[u|s_n])}{\beta} = \theta + \frac{\lambda}{\beta}(u - E[u|s_n]).$$

# Alternatively…

- The price $p = \alpha + \beta \times \theta + \lambda \times u$ and the private non-fundamental information $s_n = u + \epsilon_n$ offers two signals:

- Public signal: $s_{public} = \frac{p-\alpha-\lambda u}{\beta} = \theta + \frac{\lambda}{\beta} u$

- Private signal: $s_{private} = s_{public} - \frac{\lambda}{\beta} s_n = \theta - \frac{\lambda}{\beta} \epsilon_n$

- In the end, these two signals help to predict fundamental $\theta$

# What is new in this paper?

- In the present paper, traders submit market orders, and do not observe the later execution price $p$.
- They need to forecast the capital gain/loss: $\theta - p$.
  - Capital gain/loss can be understood as "fundamental" from traders' perspective.
- The later execution price $p$ is affected by noise trading $u$ from the market maker's pricing schedule: $p = \lambda y = \lambda(\Sigma_j x_j + u)$.
- Thus, non-fundamental information $s_n$ is useful for traders to forecast their capital gain/loss $\theta - \lambda(\Sigma_j x_j + u)$.

# Data sales

# Data sales in the literature

- Competitive models:
  - Admati and Pfleiderer (1986): monopolisit
  - Cespa and Foucault (2014), Easley, O'Hara, Yang (2016): price information + fundamental information
  - Huang, Xiong, Yang (2022): information = *f*(data, labor)
  - ….
- Strategic models:
  - Admati and Pfleiderer (1986): monopolist
  - Garcia and Sangiorgi (2011): risk-averse traders + personalized information
  - …

# Admati and Pfleiderer (1988)

- A monopolist seller only sells fundamental information.
- The seller sets the data price $q$, then $N$ traders buy the data, and then a Kyle 85 model unfolds.
- The seller takes all the rent by setting $q$ equal to the expected profit $\pi(N)$ of an informed trader: $q = \pi(N)$.
- Each data price $q$ elicits an equilibrium number of informed traders, because $\pi(N)$ is decreasing due to competition.

# Check no-deviations:

- Existing informed trader:
  - Staying informed, payoff = $\pi(N) - q = 0$ when the seller sets $q = \pi(N)$
  - Switching to uninformed, no trade, and so payoff=0
- A potential buyer:
  - Staying uninformed, no trade and payoff=0
  - Buying data and becoming informed, payoff= $\pi(N+1) - q = \pi(N+1) - \pi(N) < 0$, because $\pi(N)$ is decreasing

- So, the seller's problem is $\max_N N\pi(N)$.
  - The optimal solution is $N^* = 1$ because competition erodes the total profit of Cournot traders.

# What does this paper add?

- Multiple types of information – fundamental and non-fundamental
  - Cespa-Foucault (2014) and Easley et al. (2016) study data-sales on two types of information (fundamental vs price information)
  - Ganguli-Yang (2019) and Farboodi-Veldkamp (2020) study fundamental and non-fundamental information acquisition, but not information sales

- More importantly, multiple data market structure
  - The literature has focused on monopolist setting, except Easley et al. (2016) on a monopolist and two separate data vendors
  - The current paper studies six settings: monopolist; separate specialized; generalists vs specialists.

# The monopolist setting

- The monopolist vendor charges $q_f$ and $q_n$ for fundamental data and non-fundamental data.
  - No price discrimination; for instance, if bundling, then $q_{fn} < q_f + q_n$
- Given these prices, $M$ traders buy fundamental data and $K$ traders buy non-fundamental data.
  - $N_f$ buy fundamental only; $N_n$ buy non-fundamental only; $N_{nf}$ buy both fundamental and non-fundamental data
  - $M = N_f + N_{nf}$ and $K = N_n + N_{nf}$
- The monopolist extracts all the consumer surplus by setting $q_f = \pi_f(M, K)$ and $q_n = \pi_n(M, K)$.
- Need to check this price vector does support an equilibrium trader composition $(N_f, N_n, N_{nf})$.

# Check no-deviations

- The profits of each type:

$$\pi_f = \frac{1}{\lambda(M+1)^2}\frac{\tau_f}{\tau_\theta(\tau_f+\tau_\theta)}, \pi_n = \frac{\lambda}{(K+1)^2}\frac{\tau_n}{\tau_u(\tau_n+\tau_u)}, \pi_{fn} = \pi_f + \pi_n$$

- Key observations:
  - Profits are decreasing in trader number
  - Two types of information are additive

- For instance, check a f-informed traders:
  - Status quo= $\pi_f(M,K) - q_f = 0$ by $q_f = \pi_f(M,K)$
  - Deviations:
    - Uninformed, payoff=0
    - f-informed: $\pi_f(M-1,K+1) - q_n$<0
    - fn-informed: $\pi_{fn}(M,K+1) - q_f - q_n$<0

- Optimal selling: $K^* = 0, M^* = 1$. What is the intuition? How important is the additive structure? What if personalized noise as in Garcia and Sangiorgi (2011)?
  - Easley et al. (2016), fundamental information $\theta$ and price information $\theta$ are complementary: $\theta - p$

# The oligopoly settings

- Let us consider the setting with two oligopolists who can sell both types of information.
- The paper assumes that the two vendors engage in Cournot competition, by choosing the number of buyers.
- Would Bertrand competition make more sense?
  - Given prices charged by the two vendors, there should be a corresponding financial market equilibrium, and the authors need to check no deviations.
- For Cournot competition, how to think about the trading game details?

# Strategic versus competitive traders

- Model details matter a lot with finite number of traders.
  - Which variables/quantities are observable? This affects the beliefs of other players.
- Why not competitive traders as in Vives (1995)? What is the advantage of strategic large traders?
  - Small traders will not affect the aggregate outcome, and so observability is irrelevant.
  - The information value is indeed the certainty equivalents as defined in the paper.
  - Either Vives (1995) with CARA traders or risk-neutral traders bearing some inventory costs. Market maker determines prices. The key intuitions should preserve.
- There are so many settings. What is the sharpest prediction/message?