Discussion
Market Feedback: Who Learns What?
by Itay Goldstein, Jan Schneemeier, and Liyan Yang

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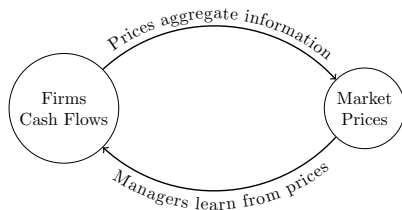
Yale and NBER

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This Paper

- This paper studies
  - endogenous information acquisition by firms and traders
  - in an environment with feedback effects
  - and multiple sources of uncertainty
- Feedback effects illustrated

- Complex strategic interactions
- Non-trivial implications for real efficiency and price efficiency
- Information overlap: agents learn about the same source of uncertainty
  - Interesting notion (the classic complement/substitutes notions are not that useful with multiple sources of uncertainty)

Main Results

1. Traders may want to acquire the same information as the firm
   - ▶ Information overlap when profitability is low (surprising)
   - ▶ The opposite occurs when profitability is high (intuitive)

   1.1 High profitability $\Rightarrow$ Little information overlap
   1.2 Low profitability $\Rightarrow$ Large information overlap
   1.3 Large comparative advantage of learning about one source exacerbates these effects

2. Real vs. price/market efficiency
   - ▶ Real efficiency moves opposite from information overlap (intuitive)
     - ▶ So large comparative advantage can lead to high or low real efficiency (surprising)
   - ▶ Price/market efficiency is highest when there is no comparative advantage (surprising)

- ▶ Extension: commitment and biased managers
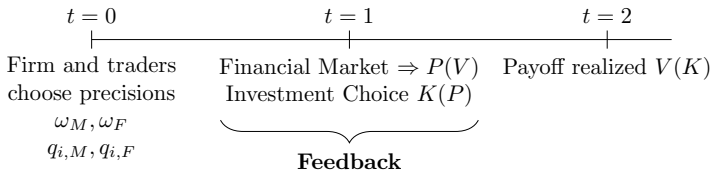
Roadmap of my discussion

1. Review of the environment
2. Review of the main results
3. Comments and thoughts

Environment

▶ A firm and traders, all risk neutral
▶ Three stages
  ▶ $t = 2$: Payoff stage
  ▶ $t = 1$: Trading and investment stage
    ▶ Binary decisions: invest/not invest $\{0,1\}$ and buy/sell $[-1,1]$
    ▶ Feedback effect (investment choice is a function of the price)
    ▶ Noise traders and a competitive market maker

$$P = \mathbb{E}\left[V|\text{order flow}\right]$$

  ▶ $t = 0$: Information acquisition stage

$t = 0$	$t = 1$	$t = 2$
Firm and traders choose precisions ω_M, ω_F $q_{i,M}, q_{i,F}$	Financial Market $\Rightarrow P(V)$ Investment Choice $K(P)$	Payoff realized $V(K)$

Feedback

Environment

- Final payoff: <u>two dimensions</u> of uncertainty
  - Used in Goldstein/Yang 2015, 2019

$$V = K \left(x^{\theta_M} + x^{\theta_F} \right)$$

- $x^{\theta_M} \in \left\{ x^H, x^L \right\}$, $p = 1/2$
  - $x^L < 0 < x^H$ (information is valuable)
  - $x^H + x^L < 0$ (NPV is negative without information)
- $\kappa_x = \frac{x^H}{-x^L} \in (0, 1)$ is a measure of <u>profitability</u> (**key variable**)
- The F and M index the dimension easier to learn for the firm (F) and traders (M) respectively
- The firm and each trader i receive private signals about each component
  - The firm also observes the price

Info Acquisition Problems

▶ The precision of each signal is endogenously chosen
  ▶ Precision: probability of learning true state
▶ Firm problem
$$\max_{\omega_M, \omega_F \in [0,1]} \mathbb{E}\left[V^\star\right] \quad \text{s.t.} \quad \delta\omega_M + \omega_F \leq 1 \quad \text{and} \quad \omega_M, \omega_F \geq 0$$

▶ Trader's problem

$$\max_{q_{i,M}, q_{i,F} \in [0,1]} \mathbb{E}\left[\Pi_i^\star\right] \quad \text{s.t.} \quad q_{i,M} + \delta q_{i,F} \leq 1 \quad \text{and} \quad q_{i,M}, q_{i,F} \geq 0$$

  ▶ $\Pi_i = y_i \left(V - P\right)$
▶ δ measures <u>comparative advantage</u> (**key variable**)
▶ Information capacity equal for both (normalized to 1)

Equilibrium

- ▶ Perfect Bayesian Equilibrium
  - ▶ Trading and investment equilibrium at date 1 (y_i, P and K)
  - ▶ Information acquisition equilibrium at date 0 (ω^F and q_i^F)
- ▶ The paper focuses on equilibrium in which
  - ▶ A fraction χ of traders specialize in θ_M
  - ▶ A fraction $1 - \chi$ specializes in θ_F
  - ▶ The firm receives perfect signals with probabilities ω_M and ω_F
- ▶ Natural choice: other equilibria?

Main Results

1. Trading stage: $P(Y)$ is increasing (price increases with order flow)

2. Investment stage: $K(P)$ is increasing in P (investment increases with price)

3. Info. acquisition stage
   - $\frac{\partial \omega_F^\star}{\partial \chi} \geq 0$: firm incentive to learn about F is higher when traders learn about M
   - $\frac{\partial \chi^\star}{\partial \omega_F} \geq 0$ when κ_x is high
   - $\frac{\partial \chi^\star}{\partial \omega_F} \leq 0$ when κ_x is low: "very valuable for the traders to learn about firm's investment policy" (information overlap)

4. Comparative statics on δ
   - $\uparrow \delta$, $\uparrow \omega_F$
   - $\uparrow \delta$, χ increases when profitability is high, decreases when low
     - when δ is high and profitability is low, firm is very unlikely to invest, so it is very valuable for traders to learn about F

Main Results

▶ Market efficiency: $ME \equiv -\mathbb{E}\left[\frac{\text{Var}(V|P)}{\text{Var}(V)}\right]$

    ▶ Maximized at $\delta = 1$ (when δ is high, learning capacity is low)

▶ Real efficiency: $RE \equiv \mathbb{E}[V]$ (expected profit)

    ▶ Maximized at $\delta = 1$ (low profitability) or $\delta = \infty$ (high profitability)
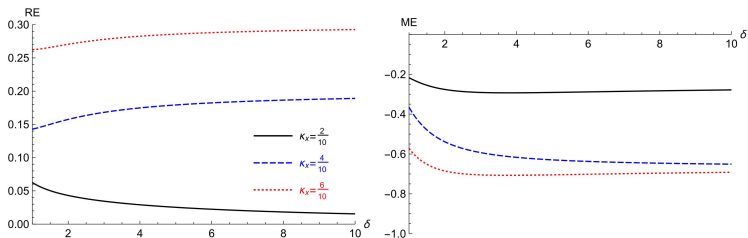
Figure 6: Efficiency measures. The left panel depicts real efficiency RE; the right panel depicts market efficiency ME. We set $x^L = -1$ for the right panel.

Comments/Thoughts

1. It may be useful to consider separately the "substitution" and income "effects" of δ
   - In the paper, increasing δ changes comparative advantage and expands information capacity
   - Alternative: $\delta\omega_M + \omega_F \leq \Gamma(\delta)$ adjusting $\Gamma(\delta)$ (same for traders)
   - Either through a variational argument or duality
   - This seems critical for the market efficiency result
   - It may matter for the other results

2. It may be helpful to think about alternative efficiency notions, in addition to real and price efficiency
   - The right version of constrained Pareto efficiency
   - This is particularly important from the perspective of traders
   - What if traders could coordinate their information choice?
   - Or what if there is a single trader?
   - This would highlight the role of the market structure in the trading stage

Comments/Thoughts

3. It may helpful to unpack the efficiency implications more
   - ▶ Decomposition of the effects when δ varies
   - ▶ Direct effects, equilibrium effects
4. Also, relaxing payoff structure may be useful
   - ▶ Varying κ_x varies total risk
     - ▶ Because investment is an option, this matters, even though agents are risk neutral
   - ▶ Important for real efficiency

Comments/Thoughts

5. Market maker knows the precision of both signals
   - ▶ This is a standard assumption in the literature
   - ▶ This assumption becomes more restrictive with multiple sources of uncertainty

6. Maybe instead of learning θ_j perfectly, we can think of more general signals
   - ▶ More generally: strong functional form assumptions
   - ▶ Broader issue with work on feedback effects
     - ▶ Intrinsic non-linearities (hard problems)