Financial Reporting and Market Efficiency with Extrapolative Investors

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Overview

- Model of financial market
  - Investors have limited attention (sampling)
  - Companies report financial data strategically
- **How do stock prices differ from the fundamental values?**
  - A monopolist can induce a stock price bounded away from the fundamental
  - The valuation of the marginal investor exceeds the average valuation competition:
- **What is the effect of competition (number of companies)?**
  - Mispricing increases with the number of companies
  - Additional effect from self-selection of investors

Introduction

- Firms can deliberately obfuscate their financial statements
  - Transparent: simple statement, single number summarizing the overall profitability
  - Opaque: large set of numbers describing the profitability of each single activity
- Investors may not be able to recognize the opaqueness
- What should be the regulatory response?
  - Impose disclosure requirements
  - Educate the investors
- The simple model in the paper mildly suggests the former

Model (Introduction)

- Firm problem: choose financial report, maximize trading price
- The report is a set of signals with correct mean but companies are free to choose the *noise* level

- Investors are boundedly rational: they cannot observe the whole report
- Report's complexity (opacity) creates disagreement in beliefs
- Sampling heuristic (collect K signals from the report)
- "Overextrapolate" the value of firms from a small sample
  - Representativeness as law of small numbers in Kahneman-Tversky
  - Winner's curve in a common value auctions

Model (Notation)

- j firm index $j = 1, \ldots, F$
- i investor index (unitary mass of investors)
- $\varphi \in \mathbb{R}_+$ profitability (true value)
- $\sigma^j \in \Sigma$ financial report (distribution of activities)
    - $\bar{x} = \varphi$ constraint
    - $X_j \subset \mathbb{R}_+$ support of σ^j
- $\hat{x}_i^j$ sample heuristic
- r stock to trade (buy/sell)
- p^j price of the stock in equilibrium
- ω tie-breaking rule
- $D^j(\sigma, p, \omega) = S^j(\sigma, p, \omega)$ market clearing condition

Monopoly

- $F = 1$ one firm, $K = 1$ one signal
- Median beliefs = market clearing price (half buy, half sell)
- **Proposition 1**: If F=1 and K=1, the monopolist chooses

$$\sigma_M = \left\{0, \frac{1}{2}; 2\varphi, \frac{1}{2}\right\}$$

  and the equilibrium price is $p_M = 2\varphi$
- The result is driven by different samples collected by investors
- Investors are ex ante identical and ex post different in beliefs

Monopoly and Sophistication

- $F = 1$ one firm, $K > 1$ more signals
- Failure in the l.l.n. since the report is endogenous in K
- The optimal two-signal distribution is

$$\sigma_K = \left\{0, \left(\frac{1}{2}\right)^{1/K}; h(K), 1 - \left(\frac{1}{2}\right)^{1/K}\right\}$$

- Generate a skewed distribution: more 0s, few higher values[1]
- **Proposition 2**: If F=1, K=1, the equilibrium price is no smaller than $\frac{\varphi}{ln(2)} > \varphi$

[1] Note that the result requires unboundedly high returns.

Oligopoly

- **Proposition 3**: No equilibrium with full transparency
- **Proposition 4**: No stock price is below the fundamental value
- Equilibrium predictions are generally difficult (we cannot find any equilibrium price), but we can find the highest equilibrium price in the case of $K = 1$
- **Lemma 1**: maximum price $p^* = \frac{\varphi}{2\mu^*}$, report $\sigma^* = \left\{0, 1 - \mu^*; \frac{\varphi}{\mu^*}, \mu^*\right\}$ with $\mu^* = 1 - (1/2)^{1/F}$
- **Lemma 2**: p^* and σ^* are an equilibrium (just add the tie-breaking rule)

Oligopoly

Main results (combining Lemmas 1 and 2):

- **Proposition 5**: The maximal price achieved in a symmetric equilibrium is $p^*(F) = \frac{\varphi}{2[1-(1/2)^{1/F}]}$. This price increases in F.

- **Proposition 6**: For $F > 1$ there is a symmetric equilibrium with market clearing prices $p = \varphi$. It is very fragile[2] and transparency increases in F.

- For $F = 2$, σ is a uniform distribution on $[0, 2\varphi]$.

[2] Why is it fragile? An obvious and simpler alternative best-response would be to report just the fundamental value, but this would not be an equilibrium (Proposition 3).

Discussion

- Bounded rationality
  - Alternative heuristics would lead to smaller bias but the same sign as in the current model
- Trading constraints
  - Relax the assumption of "one unit of one stock"
  - If $K = 1$, $F = 1$ and $f(\cdot)$ is strictly concave, the firm can achieve a price $p > \varphi$ [Proposition 7]

Further extensions

- Upper bound on firms' reports
- Reporting overall profitability
- Asymmetric and/or stochastic fundamentals
- Correlation between investors' draws
- Introduce a fraction of rational investors