Disclosure and Financial Markets Lecture 5: Disclosure, Welfare, and Trade Part 2

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Agenda

- **Disclosure and trading volume:** Kim and Verrecchia (1991); Harris and Raviv (1993); Kandel and Pearson (1995)

- **“Feedback effects:”** Gao and Liang (2013); Smith (2022)

Disclosure and Trade: Background

- Recall from Hakannson et al. that, following an initial round of trade, disclosure does not lead to trade when:
  1. markets are complete
  2. investors' beliefs satisfy

$$f_i\left(\tilde{s}|\tilde{x}\right) = f_j\left(\tilde{s}|\tilde{x}\right);$$
$$f_i(\tilde{s}) = f_j(\tilde{s})$$

  where x = cash flows and s = the disclosed signal.

- In practice, we do see a lot of trade around disclosures (e.g., Beaver (1968)).

  $\Rightarrow$ To study such trade, we need to examine models where one of the two assumptions above is violated.

- We start by looking at Kim and Verrecchia (1991), which violates the market completeness assumption.

- We will then discuss disagreement models, which violate the concordant beliefs assumption.

Kim and Verrecchia (1991): Background

- K&V study a two-period noisy rational expectations model in which a disclosure is released in between the two periods.
  - The first period of trade allows investors to arrive at an initially Pareto optimal allocation.
  - Moreover, it means investors can trade in anticipation of the disclosure.

- They study how differences across investors in information, risk aversion, and information quality affect post-disclosure trade. Key findings:
  - Heterogeneous **information** of homogeneous precision *does not* generate trade after a disclosure.
  - Heterogeneous **risk aversion** *does not* generate trade after a disclosure.
  - Heterogeneous **information quality** *does* generate trade after a disclosure.

Kim and Verrecchia (1991): Assumptions

- Continuum of traders indexed on $[0, 1]$; costless borrowing/lending; CARA utility with heterogeneous risk tolerances r_i.

- Two rounds of trade. All error terms are independent.

- Aggregate endowment of the stock $\int_0^1 \tilde{x}_i di \sim N\left(0, t^{-1}\right)$.

- Cash flow $\tilde{u} \sim N\left(\bar{u}, h^{-1}\right)$.

- **Round one:** investors receive private signals $\tilde{z}_i = \tilde{u} + \tilde{\varepsilon}_i$, where $\tilde{\varepsilon}_i \sim N\left(0, s_i^{-1}\right)$.
  - Importantly, investors' signals have heterogeneous precisions.
  - Traders also observe a public signal $\tilde{y}_1 = \tilde{u} + \tilde{\eta}$; $\tilde{\eta} \sim N\left(0, m^{-1}\right)$, though this adds little (just changes priors).

- **Round two:** traders observe a second public signal $\tilde{y}_2 = \tilde{u} + \tilde{v}$; $\tilde{v} \sim N\left(0, n^{-1}\right)$.

Kim and Verrecchia (1991): Equilibrium Notion

Conjecture that prices are linear in each period:

$$
\begin{aligned}
P_1 &= \alpha_1 + \theta_1 \tilde{y}_1 + \beta_1 \tilde{u} - \gamma_1 \tilde{x}; \\
P_2 &= \alpha_2 + \theta_{21} \tilde{y}_1 + \theta_2 \tilde{y}_2 + \beta_2 \tilde{u} - \gamma_2 \tilde{x}.
\end{aligned}
$$

- As identified in Grundy and McNichols (1989), it is possible that there exists a *fully-revealing equilibrium,* in which price in the second period fully reveals $\tilde{u}$.
- This is a common result in multi-period NREE models with noise trade that does not change over time.
- Occurs when $\frac{\beta_1}{\gamma_1} \neq \frac{\beta_2}{\gamma_2}$. In this case, we have an invertible system of equations in $\{\tilde{u}, \tilde{x}\}$.
  - Supported by a static Hellwig model in period 1, since, if $P_2 = \tilde{u}$, in period 1, traders act identically to a static model.
  - Clearly not realistic, so it is ignored.

Kim and Verrecchia (1991): Equilibrium Derivation

- **So, instead conjecture an equilibrium in which $\frac{\beta_1}{\gamma_1} = \frac{\beta_2}{\gamma_2}$.**
  - Then, the date 2 price reveals nothing incremental to date 1 price.
  - The only new information at date 2 is the public signal.
  - Somewhat miraculously, this works out as an equilibrium; the next few slides demonstrate why.

Kim and Verrecchia (1991): Belief Updating and Price

- Under the partially revealing conjecture, P_1 reveals a truth-plus-noise signal $q_1 = \tilde{u} - \frac{\gamma_1}{\beta_1}\tilde{x}$; call its precision η_P.
- Investor i's date-1 posterior precision is therefore

$$\tau_{i1} = h + m + s_i + \eta_P.$$

- Their date-1 posterior mean satisfies

$$\tau_{i1}\mu_{i1} = h\bar{u} + m\tilde{y}_1 + s_i\tilde{z}_i + \eta_P q_1.$$

- At date 2, every investor observes the same new public signal

$$\tilde{y}_2 = \tilde{u} + \tilde{v}, \qquad \text{precision } n.$$

- Thus,

$$\tau_{i2} = \tau_{i1} + n, \qquad \tau_{i2}\mu_{i2} = \tau_{i1}\mu_{i1} + n\tilde{y}_2.$$

Kim and Verrecchia (1991): From Beliefs to the Price Ratio

- With CARA-normal demands,

$$D_{it} = r_i \tau_{it}(\mu_{it} - P_t).$$

- Market clearing implies

$$P_t = \frac{\int r_i \tau_{it} \mu_{it} di - \tilde{x}}{\int r_i \tau_{it} di}.$$

Assumption: $\int r_i \tau_{it} di = \int r_i di \int \tau_{it} di$.

- Define

$$K_1 = \int \tau_{i1} di = h + m + s + \eta_P, \qquad K_2 = \int \tau_{i2} di = K_1 + n,$$

as the average investor precisions in date 1 and 2, where

$$s = \frac{\int r_i s_i \, di}{\int r_i \, di}; \quad r = \int r_i di.$$

Then, the denominator of P_t reduces to $K_t r$.

Kim and Verrecchia (1991): From Beliefs to the Price Ratio

- Since

$$\tau_{i2}\mu_{i2} = \tau_{i1}\mu_{i1} + n\tilde{y}_2,$$

  we have

$$P_2 = \frac{\int r_i \tau_{i1}\mu_{i1} di + n\tilde{y}_2 r - \tilde{x}}{K_2 r}.$$

- But date-1 market clearing gives

$$K_1 r P_1 = \int r_i \tau_{i1}\mu_{i1} di - \tilde{x}.$$

- Therefore,

$$P_2 = \frac{K_1}{K_2}P_1 + \frac{n}{K_2}\tilde{y}_2.$$

- This shows that the date-2 price is simply a weighted average of the date-1 price and the new public signal.

Kim and Verrecchia (1991): Volume

Now, define trading volume as:

$$\text{Trading Volume} = \frac{1}{2}\int \Big| \overbrace{D_{i,2}}^{\text{investor } i\text{'s date 2 dmd.}} - \underbrace{D_{i,1}}_{\text{investor } i\text{'s date 1 dmd.}} \Big| di.$$

Question: why do we need to divide by 2?

Theorem

Let $s = \frac{\int r_i s_i di}{\int r_i di}$ denote the risk-tolerance weighted average investor precision. Then,

$$\textit{Trading Volume} = \left(\frac{1}{2}\int r_i \left|s_i - s\right| di\right) \left|\tilde{P}_2 - \tilde{P}_1\right|.$$

Kim and Verrecchia (1991): Volume

$$\text{Trading Volume} = \left(\frac{1}{2}\int r_i \left|s_i - s\right| di\right) \left|\tilde{P}_2 - \tilde{P}_1\right|.$$

- **Economic intuition:** investors update to a different extent from the disclosure.
  - E.g., investors with precise private signals place less weight on an optimistic disclosure.
  - Thus, they sell the stock to those with imprecise private signals.
  - This effect strengthens with the magnitude of the signal, which also drives $\left|\tilde{P}_2 - \tilde{P}_1\right|$.
- Absolute price changes and volume move together, consistent with empirical evidence (Karpoff (1987)).
  - $\Rightarrow$ $Var\left[P_2 - P_1\right]$ and E [Trading Volume] move together
    Related to early discussion in Beaver (1968).
- Investors with greater risk tolerance drive a greater amount of volume.
- Suggests more trade in a Grossman-Stiglitz than in a Hellwig framework.
- What might drive dispersion in information quality?

Learning from Volume

In practice, traders can observe volume, but this isn't allowed in the model.
What happens if we let them observe volume?

- **Blume, Easley, and O'Hara (1994):** show that if you take NREE models and allow for conditioning on volume, you get a fully-revealing equilibrium.
  - Common info quality setting. Volume depends on supply noise and not the fundamental $\Rightarrow$ reveals supply noise leading to full revelation in conjunction with price.
  - They also examine a model in which traders' information precisions are unknown. Equilibrium is again fully revealing when volume is observed.

- **Schneider (2009):** Develops a model with imperfect revelation and learning from volume.
  - Noise in price comes from endowment noise, not noise trade. Common component of endowment does not generate volume, so volume does not reveal it.
  - Correlation between different investors' signals is not known.
  - Investors need to know correlation to properly update from price. They learn correlation through volume, as a higher correlation leads to lower volume.

- **For reflection:** what might traders learn from observing volume around earnings?

Options and Trade in K&V

Brennan and Cao (1998): information does not lead to trade in K&V's model when markets are completed via trade in options.

- **Remember:** *market completeness* in a model of financial markets refers to the ability for investors to trade in a security that pays off as *any* function of the underlying firm's cash flow.
  - It can be achieved by introducing enough derivatives, or, in some cases, allowing for dynamic trade.

- "*Effective market completeness*" refers to the ability to trade in enough securities to achieve Pareto efficiency.
  - Effective completeness is the essential assumption for Milgrom and Stokey's no-trade theorem to apply in financial models.
  - Options make the market effectively complete in K&V's model.
    Technically, a quadratic security is sufficient to effectively complete the market.
  - Thus, options lead Milgrom and Stokey's theorem to apply.

Investor Disagreement and Trade

What about dropping the concordant beliefs assumption?
Intuitively, this means allowing them to have different perceptions of the disclosure's properties.

- **Classic papers:** Kandel and Pearson (1995), Harris and Raviv (1993).

- **Main idea:** take a public signal $\tilde{s} = \tilde{x} + \tilde{\varepsilon}$ and suppose that investor i believes:

$$\tilde{\varepsilon} \sim N\left(\mu_i, \sigma^2\right).$$

  Investors who believe μ_i is greater sell to (buy from) those who believe μ_i is lower after (before) the disclosure. "Belief flipping."

- **Models are highly tractable** $\Rightarrow$ many extensions of this work.
  - Dynamics Scheinkman and Xiong (2003), Banerjee and Kremer (2010)
  - Disagreement over the inclusion or exclusion of information Fischer and Bloomfield (2011)

Gao and Liang (2013): Background

- **Informational feedback models:** firm invests based upon what it learns from its price.
  - Investors might have knowledge or expertise not possessed by the manager.
  - Common example: macroeconomic information.

- From a technical point of view, these models can be difficult (but also interesting).
  - Fixed point: price depends upon investment which depends upon price.
  - Papers usually based upon a one- or two-period Glosten-Milgrom (1985) model.
  - Often obtain multiple equilibria. Equilibria without trade or without short-selling can be "self-fulfilling" (e.g., Edmans, Goldstein, and Jiang (2015))

- Gao and Liang (2013) consider substitutive disclosure in such a model.

Informational Feedback: Some Empirical Evidence

- **Luo (JF, 2005):** Mergers are more likely to be canceled when prices react negatively and the market possesses a greater information advantage.
- **Chen, Goldstein, and Jiang (RFS, 2007):** Price informativeness impacts investment sensitivity to price (IPS). IPS is now a standard measure of feedback effects in the literature.
- **Foucault and Fresard (RFS, 2012):** Cross-listing impacts investment sensitivity to price.
- **Foucault and Fresard (JFE, 2013):** Investments are sensitive to peers' stock prices.
- **Jayaraman and Wu (RFS, 2018):** Segment reporting regulation reduces investment-price sensitivity.
- Also, several recent empirical papers in accounting journals.

Informational Feedback: Alternative Interpretation

From Bond, Edmans, and Goldstein's review:

Second, even if decision makers do not learn from market prices, they care about market prices because they are party to contracts that are contingent on market prices. This is most relevant for firm managers, whose compensation is tied to the firm's share price. Then, the manager's incentives to take real actions will depend on the extent to which they will be reflected in the stock price. If the stock price is not closely tied to firm value, but instead driven by noise, the manager has weak incentives to exert costly effort to improve the firm's fundamental value.

Importantly, even though this second channel does not involve active learning from the price, it is ultimately similar to the first channel, in that market prices end up having a real effect due to their informational role. The reason that contracts are conditioned on prices to begin with is most likely due to their informational role. Shareholders choose to solve agency problems with the firm's manager by tying his compensation to the stock price, because they believe that the stock price contains information about firm value. If prices were uninformative, shareholders would not tie managerial compensation to stock prices, and so managers would not care about them.

Third, another possibility, favored by proponents of behavioral finance, is that secondary market prices have a real effect on economic activity because real decision makers irrationally follow the price and use it as an anchor. Although we do not deny that irrationality exists, the ultimate source of the effect is likely to be the informational role of prices. Presumably, the reason that real decision makers look at the price, rather than other public signals, is that the price often contains information. There may be overreaction due to bounded rationality, but the informational content is key for some reliance on the price to arise. Even fully rational learning from the price can lead to inefficient decisions, given that price changes sometimes arise from nonfundamental shocks (such as price pressure caused by fire sales), which real decision makers may misinterpret as arising from fundamental shocks.[3]

Gao and Liang (2013): Timeline

- **Date 1:**
  - Firm chooses a disclosure level β: w/p β, the firm will later reveal a signal regarding its value.
  - Primary market for shares opens. There is a mass 1 of "initial investors" in the primary market.

- **Date 2:**
  - A speculator chooses how much information to acquire about the firm.
  - Then, the firm may reveal the disclosure.

- **Date 3:** Glosten and Milgrom type model.
  - The speculator trades.
  - Original investors experience a liquidity shock, which may also require them to trade.

- **Date 4:** The firm makes an investment decision.

- **Date 5:** Cash flows are realized.

Gao and Liang (2013): Information Structure

- Firm's value is the combination of an asset in place and a growth opportunity:

$$\begin{aligned}\tilde{V}(K) &= \tilde{A} + \tilde{G} \\ &= \tilde{\mu} + \tilde{\mu}\sqrt{2gK} - K,\end{aligned}$$

  where $\tilde{\mu} \in \{\mu_0 - \sigma_\mu, \mu_0 + \sigma_\mu\} = \{L, H\}$ with equal probability, $g > 0$, and K is the firm's investment choice.

  - Concave benefit, linear cost will lead to an interior solution.

- Speculator's signal is $\tilde{y} \in \{l, h\}$;

$$\Pr(\tilde{y} = h | \tilde{\mu} = H) = \Pr(\tilde{y} = l | \tilde{\mu} = L) = \frac{1+\gamma}{2},$$

  where γ is a choice variable with $c(\gamma) = \frac{c\gamma^2}{2}$. γ is observable.

- Asset in place rules out perverse equilibria.
  - Cash flows remain sensitive to investor's info even when $K = 0$.

Gao and Liang (2013): Information Structure

- With probability f the firm observes its value; it then discloses it with probability β and reveals nothing otherwise.
  - Denote its signal by $\tilde{z} \in \{\emptyset, \tilde{\mu}\}$.

- Assumes a convex cost to choosing a higher β, and that $4c - g(1-f)\sigma_{\mu}^{2} > 0$, which ensures an interior choice of $\beta \in (0, 1)$.

- Original investors experience a liquidity shock, having to trade $\tilde{n} \in \{-\sigma_n, \sigma_n\}$ shares in total with equal probabilities.

- Order flow $Q = \tilde{n} + \tilde{d}$, where $d \in \{-\sigma_n, \sigma_n\}$ is the speculator's demand. So, $Q \in \{-2\sigma_n, 0, 2\sigma_n\}$.
  - Unlike Glosten and Milgrom, both informed and noise trader are in the market at the same time.
  - Note some order flows are off equilibrium path: we must set beliefs appropriately to sustain the equilibrium.

Gao and Liang (2013): Investment & Trading Stages

Firm solves:

$$\arg\max_K E\left[\tilde{\mu} + \tilde{\mu}\sqrt{2gK} - K|\tilde{z}, P\right]$$
$$= \frac{g}{2} E\left[\tilde{\mu}|\tilde{z}, P\right]^2.$$

- Note this introduces a novel fixed-point problem: the investment depends upon the price, but the price depends upon the conjectured investment.

Sps. first that the firm learns $\tilde{\mu}$, which occurs with probability f i.e., $\tilde{z} = \tilde{\mu}$.

- Then, $E\left[\tilde{\mu}|\tilde{z}, P\right] = \tilde{\mu}$; no dependence on price. We have that:

$$K = \frac{g}{2}\tilde{\mu}^2.$$

Gao and Liang (2013): Investment & Trading Stages

Next, suppose that the firm doesn't learn $\tilde{\mu}$, i.e., $\tilde{z} = \emptyset$.

- We have that $E[\tilde{\mu}|\tilde{z}, P] = E[\tilde{\mu}|P]$ depends on price.

- It can be shown in any equilibrium that the informed investor buys (sells) when $y = h$ $(y = l)$. As such, $Q = 2\sigma_n$ $(Q = -2\sigma_n)$ reveals to the firm and market maker that $y = h$ $(y = l)$, and nothing if $Q = 0$.

- Therefore,

$$K = \frac{g}{2}E[\tilde{\mu}|P]^2 = \begin{cases} \frac{g}{2}E[\tilde{\mu}|\tilde{y} = h]^2 & \text{if } Q = 2\sigma_n \\ \frac{g}{2}E[\tilde{\mu}]^2 & \text{if } Q = 0 \\ \frac{g}{2}E[\tilde{\mu}|\tilde{y} = l]^2 & \text{if } Q = -2\sigma_n. \end{cases}$$

  Note $E[\tilde{\mu}|\tilde{y}]$ is a function of the informed trader's information acquisition γ.

- When γ is higher, $E[\tilde{\mu}|\tilde{y}]$ is closer to the true value of $\tilde{\mu}$. So, the firm's investment choice is more efficient.

Gao and Liang (2013): Information Acquisition

- Informed trader's expected profit given γ can be shown to equal:

$$\pi(\beta;\gamma) = \frac{\sigma_n \sigma_\mu}{2}(1 - f\beta)(1 + g\mu_0)\gamma$$

- The term $1 - f\beta$ represents the fact the trader only profits if the disclosure does not occur. So, profit decreases in β.

- The term γ reflects a linear increase in profit as signal precision rises.

- The term $1 + g\mu_0$ arises from the investment decision.
  - When g is higher, the firm's value is more sensitive to $\tilde{\mu}$, the investor's private info.
  - When μ_0 is higher, the firm invests more, which also makes the firm's value more sensitive to $\tilde{\mu}$.

- The optimal γ decreases in disclosure quality β.

Gao and Liang (2013): Optimal Disclosure

- The firm chooses β to maximize the firm's value.

- Initial capital providers "price protect" and the firm takes this into account when choosing β.
  - If these providers experience a liquidity shock, they become the "noise traders" and will lose money in expectation.
  - Knowing this, they require a higher cost of capital when providing capital to the firm.
  - Better disclosure makes the secondary market more liquid, attenuating this effect.
  - This part of the model is based on Diamond and Verrecchia (1991).

- There is a trade-off to a higher β:
  - Greater $\beta \Rightarrow$ less information acquisition γ. Makes investment less efficient.
  - But, capital providers expect lower losses should they experience a shock. Thus, they price protect to a lesser extent.

Gao and Liang (2013): Optimal Disclosure

- What determines optimal disclosure choice?

PROPOSITION 3. *Ceteris paribus,*

1) firms with a higher uncertainty (higher σ_μ^2) disclose less if and only if g is sufficiently large,
2) firms with higher growth prospects (higher g) disclose less if g is sufficiently large, and
3) firms that are more likely to learn information from the stock price (lower f) disclose less.

- Gao and Liang (2013) also consider an extension in which competitors learn from the firm's stock price.

Gao and Liang (2013): Discussion

- Speculators collect info knowing both past and future disclosure quality.
  - McNichols and Trueman (1994) suggest that these types of disclosure quality could have very different effects.
  - While in Fishman and Hagerty, higher disclosure precision encourages investors to process the firm's disclosure, it would not enhance feedback. Why?

- Potential types of information possessed by managers and investors in the model are the same.

- **Goldstein and Yang (2018, JFE):** a related model, asks what type of information is useful to disclose.
  - Information acquisition is a "package deal." Investors know both A & B.
  - The firm by default knows A. External disclosure of A causes investors to trade more heavily on B, which is good. Conversely, disclosure of B is bad.

Smith (2022): Background

- Risk disclosure has a very different impact on traders' desire to acquire information than does "conventional" disclosure.

- Uncertainty is a key determinant of the profitability of information acquisition.
  - Thus, knowing more about uncertainty $\Rightarrow$ greater knowledge about how much info to acquire.
  - Assumption: investors' information advantage is not about risk itself.

- Unlike Gao and Liang (2013), the disclosure is released prior to information acquisition.

- Critically, managers have a greater demand for information when risk is higher, so risk disclosure can enhance investment efficiency.

Smith (2022): Timeline

- **Date 1:** Firm either discloses its risk or does not.
- **Date 2:** A speculator decides how much information to acquire.
- **Date 3:** Glosten and Milgrom type model. A speculator arrives. Noise/liquidity trader also arrives.
- **Date 4:** The firm makes an investment decision.
- **Date 5:** Cash flows are realized.

Smith (2022): Assumptions

- Firm has an investment $\tilde{x}$ with the following payoff distribution:

Project payoff given $\tilde{V}$	
$\tilde{\omega} = 0$	$\mu - \tilde{V}$
$\tilde{\omega} = 1$	$\mu + \tilde{V}$

  where $\Pr(\tilde{\omega} = 1) = 1/2$. Can be interpreted as an existing project or a new project.

- The variance $\tilde{V}$ follows a general distribution.

- The firm's manager is risk averse and chooses whether to continue/liquidate the project; if they liquidate, the firm's payoffs are normalized to zero.

- Assume that $\tilde{V}$ is bounded below by $\mu > 0$, such that:
  - When $\tilde{\omega} = 0$, the investment is unprofitable independent of $\tilde{V}$.
  - When $\tilde{\omega} = 1$, the investment is profitable independent of $\tilde{V}$.

Smith (2022): Assumptions

- Informed trader can learn ω with probability q at a cost $\frac{1}{2}kq^2$.
  - Assume this is unobservable to outside parties.
  - The trader will only trade if they successfully acquire a signal.

- Market again consists of market maker, informed trader, and liquidity trader.

- Noise trader submits an order of 1 or -1 at random.
  - Order flow $\tilde{O} \in \{-2, -1, 0, 1, 2\}$.
  - $\tilde{O} = -2$ or $\tilde{O} = 2$ fully revealing; $\tilde{O} \in \{-1, 0, 1\}$ uninformative.

- As before, the manager can observe price when making their investment decision.

Smith (2022): Assumptions

The firm observes a signal $\tilde{s} \in S$ that is statistically related to $\tilde{V}$. General signal structure subject to:

$$s_1 > s_2 \implies \tilde{V}|\tilde{s} = s_1 \succ_{FSD} \tilde{V}|\tilde{s} = s_2. \quad (1)$$

where FSD refers to first-order stochastic dominance.

The firm may release a disclosure, which I capture with the random variable $\tilde{\Delta}$.

- I compare two possibilities: one in which $\tilde{\Delta} = \tilde{s}$ (“risk disclosure”) and one in which $\tilde{\Delta} = ND$ (“no disclosure”).

From the paper: This setup allows for significant generality in terms of the signal that the firm observes. For example, it includes the cases in which: (1) $\tilde{s}$ is precisely equal to $\tilde{V}$; (2) $\tilde{s}$ and $\tilde{V}$ are binary; (3) $\tilde{V}$ is gamma distributed and $\tilde{s}$ has a Poisson distribution with parameter proportional to $\tilde{V}$; (4) $\tilde{V}$ is inverse gamma and $\tilde{s}$ is the sum-of-squared draws from a normal distribution with variance $\tilde{V}$; (5) $\tilde{s}$ reveals one of multiple independent components of $\tilde{V}$.

Smith (2022): Firm's Investment Decision

Key features: The manager continues the project whenever they perceive that $\Pr(\tilde{\omega} = 1) \geq T(\mu, s)$, where:

1. The threshold $T(\mu, s)$ decreases in the investment's ex-ante expected payoff μ.
2. There exists a value $\hat{s} \in S \cup \infty$ such that the manager liquidates the investment should they receive no information from price if and only if $\tilde{s} > \hat{s}$.
3. When the manager is risk-neutral, $T(\mu, s) < \frac{1}{2}$ and does not depend on s.

Smith (2022): Equilibrium

- Suppose first the manager is **risk neutral**.
- The manager liquidates the investment when price contains bad news.
- Since, in the risk-neutral case, $T(\mu, s) < \frac{1}{2}$, they continue the project given an uninformative order flow.

Stock Price

	$\tilde{\Delta} = \tilde{s}$	$\tilde{\Delta} = ND$
$\tilde{O} = 2$	$\mu + \mathbb{E}\left[\tilde{V} \mid \tilde{s}\right]$	$\mu + \mathbb{E}\left[\tilde{V}\right]$
$\tilde{O} \in \{-1, 0, 1\}$	μ	μ
$\tilde{O} = -2$	0	0

- As in other informational-feedback models, there also exist other perverse equilibria. But, these aren't robust to perturbations to the information structure.

Smith (2022): Informed Trader Profits

- Conditional on learning, informed profits given non-disclosure are:

$$\mathbb{E}\left[\Pr(\text{Noise trade moves against them}) * \left(\mu + \tilde{V} - \mu\right)\right] = \frac{1}{2}\mathbb{E}\left[\tilde{V}\right].$$

- Conditional on learning, informed profits given disclosure are:

$$\mathbb{E}\left[\Pr(\text{Noise trade moves against them}) * \left(\mu + \tilde{V} - \mu\right)|\tilde{s}\right] = \frac{1}{2}\mathbb{E}\left[\tilde{V}|\tilde{s}\right].$$

- In expectation, these are the same (why?). The trader acquires info of $q(ND) = \frac{1}{2k}\mathbb{E}\left[\tilde{V}\right]$ in the first case and $q(s) = \frac{1}{2k}\mathbb{E}\left[\tilde{V}|\tilde{s} = s\right]$ in the second. So, the expected amount of learning is also the same.

- **Nevertheless:** Risk disclosure increases the expected profits available to sophisticated traders.
  - Traders can raise $q\left(\tilde{s}\right)$ when profits given learning are higher.
  - $\Rightarrow$ Thus, it is again detrimental to liquidity traders.

Smith (2022): Feedback and Investment Efficiency

- Disclosure does not affect the expected amount of information the investor acquires. Thus, it does not affect the on-average information content of price.
- However, the value of information to the manager depends upon $\tilde{V}$: information is more valuable when there is more uncertainty.
- Thus, the manager would accept a trade-off where the investor acquires more information when the firm is riskier and less information when it is less risky.
- This is precisely the effect that risk disclosure has!

Smith (2022): Risk-Averse Manager

Suppose now that the manager is risk averse.

- Now, the manager doesn't take the project when price is uninformative and firm risk is high. Price takes this into account.

Stock Price

	$\tilde{\Delta} = \tilde{s}$	$\tilde{\Delta} = ND$
$\tilde{O} = 2$	$\mu + \mathbb{E}\left[\tilde{V} \mid \tilde{s}\right]$	$\mu + \mathbb{E}\left[\tilde{V}\right]$
$\tilde{O} \in \{-1, 0, 1\}$	$\mu \mathbf{1}\left(\tilde{s} < \hat{s}\right)$	$\mu \Pr\left(\tilde{s} < \hat{s}\right)$
$\tilde{O} = -2$	0	0

Smith (2022): Informed Trader Profits

The informed investor can only profit if $\tilde{s}$ is low enough that the manager invests given an uninformative order flow.

- Conditional on learning, informed profits given non-disclosure:

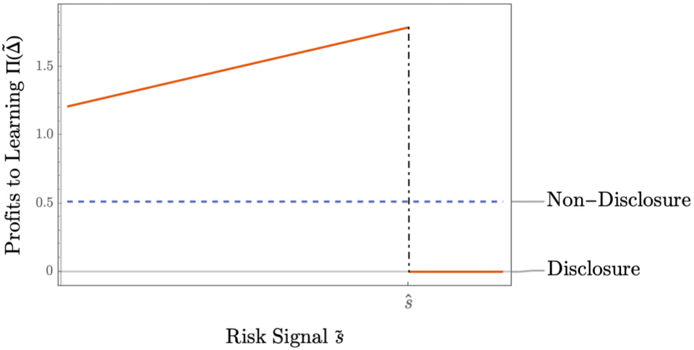
$$\frac{1}{2}\Pr\left(\tilde{s} < \hat{s}\right)\mathbb{E}\left[\tilde{V}|\tilde{s} < \hat{s}\right].$$

- Conditional on learning, informed profits given disclosure:

$$\frac{1}{2}\mathbf{1}\left(\tilde{s} < \hat{s}\right)\mathbb{E}\left[\tilde{V}|\tilde{s}\right].$$

In expectation, these are still the same!

Smith (2022): Information Acquisition



Smith (2022): Informed Profits, Liquidity, and Investment Efficiency

Proposition

Suppose the manager is strictly risk averse. Then,

1. *The firm's expected value in the case of risk disclosure less that in the case of non-disclosure may be either positive or negative.*
2. *Risk disclosure increases the probability that the manager liquidates the investment.*

- **Intuition:** Risk disclosure has an *ambiguous* effect on the correlation between information acquisition and the manager's demand for information.

Smith (2022): Form 8-K

What is the effect of requiring firms to file 8-Ks, that is, to disclose the presence of material events in a timely fashion, on liquidity and investment efficiency?

8-Ks appear to contain both mean and risk information.

1. Mean component: investors might privately know about the event's mean impact in the absence of an 8-K.
   - This component can be analyzed using traditional models; substitutive impact on information acquisition.
2. Risk component: 8-K reveals heightened uncertainty and an opportunity to profit by learning.
   - Upon the release of an 8-K, the full impact of the underlying event on firm value is often not fully resolved.

Smith (2022): Form 8-K

- Mandating 8-Ks could harm liquidity traders.
  - In the absence of 8-Ks, investors would not know about the opportunity to investigate the firm!
- This force trades off against the substitutive effect that the “mean” information in an 8-K has.
- Causes prices to be more informative when managers have a precipitous need for information: around material events.
- Similar arguments hold for other disclosures that contain both mean and risk info.