Costly Evidence and Discretionary Disclosure

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Motivation

In communication games, a (privately) informed sender communicates to an uninformed receiver by sending a message, following which the receiver takes an action

- Often, the sender's private information is obtained through costly acquisition
- More and finer information is generally more costly to acquire

We study a disclosure game in which information is endogenously and costly acquired

- E.g., the sender manages an asset and the receiver is a collection of market traders
- We follow Verrecchia (1983) and assume that disclosure is costly
  - the main insights persist if there is instead random failure à la Dye (1985)

Preview

Questions:

- what is the impact of transparency in the sender's information acquisition strategy?
- what is the role of the disclosure cost given that the information is endogenous?

Main Findings:

- transparency in the acquisition process does not help, and may hurt, the receiver
- under endogenous info, the receiver may prefer a strictly positive disclosure cost
  - this is never the case where information is exogenous

The Model

Model Basics

- Two players, sender (S; he) and receiver (R; she)
- Unknown state $\theta \in [0, 1]$, common prior with cdf F, density $f > 0$, and mean μ
- R's set of actions is $A = [0, 1]$ and her utility is the commonly-used quadratic loss:

$$u_R(a, \theta) = -(a - \theta)^2$$

- S's utility is state-independent and only depends on in R's action: $u_S(a, \theta) = v(a)$; assume v is strictly increasing
- S first acquires information then sends a message to R (more on messages shortly)
- Upon observing a message, R updates her beliefs and takes an action

Information Acquisition

- The quadratic loss utility of R means that R's uniquely optimal action at any posterior distribution is the posterior mean $x \in [0, 1]$; that is, $a^* = x$
- Since S only cares about R's action, only x is relevant for him: $v_S(x) := v(a^*) = v(x)$
- S's info acquisition strategy is summarized by a distribution of posterior means G
  - Blackwell (1951) indicates that G is feasible if and only if it is a mean-preserving contraction (MPC) of the prior F; denote the set of feasible distributions by $\mathrm{MPC}(F)$
- Assume that the cost of acquiring any $G \in \mathrm{MPC}(F)$ is "posterior mean measurable:"

$$C(G) = \kappa \int_0^1 c(x)\, \mathrm{d}G(x)$$

  - c is strictly convex, reflecting the idea that more precise information is costlier
  - $\kappa > 0$ is a scaling parameter: the "marginal cost" of acquiring information
- S's **net value function** is $w(x) := v(x) - \kappa c(x)$; w is either str. convex or str. concave

Overt and Covert Acquisition

We are interested in the effects of transparency and hence look at two different cases:

1. **Covert Acquisition**: R does not observe G and G cannot be certified.
2. **Overt Acquisition**: R observes G.

Overt acquisition is "more transparent" than covert acquisition: R observes S's information gathering activities, no matter whether S discloses the outcome.

Costly Disclosure

- if posterior mean x realizes, S can choose whether to disclose it.
- Disclosure of x incurs a cost $\gamma \in (0, 1 - \mu)$
  - one can think of S needs to pay a cost to certify that the posterior mean is x.
- S cannot lie but can choose not to disclose, which is costless.
  - in this case he sends message $m_{\varnothing}$, can be interpreted as declining to get certified.

Timeline

Timeline:

1. S acquires information by choosing a distribution of posterior means $G \in \mathrm{MPC}(F)$.
2. S observes the realization x from G then chooses to
   - either disclose x and incur cost γ (in which case he sends message x); or
   - not disclose (sends message $m_{\varnothing}$) and incur no cost.
3. R observes S's message, and also G if acquisition is overt.
4. R takes action a and payoffs accrue.

Analysis

Exogenous S Information Benchmark

Suppose S privately knows the state θ (and there is no information acquisition stage).

Proposition (Verrecchia, 1983). An equilibrium exists. In any equilibrium, there exists $\underline{\theta} \in (0,1]$ s.t. S doesn't disclose when $\theta \in [0, \underline{\theta}]$ and discloses otherwise.

- Suppose $\gamma = 0$, then since $v(x)$ is strictly increasing, in every equilibrium, S discloses in every state ("unraveling" à la Grossman, 1981; Milgrom, 1981).
- For $\gamma > 0$, lowest types prefer not to disclose: the gain doesn't justify the cost. Details

Covert Information Acquisition

Claim. A covert-information-acquisition equilibrium exists.

- For any conjectured posterior mean following no disclosure, $\alpha \in [0, \mu]$, S's payoff as a function of the realized posterior mean x is

$$V_\alpha(x) = \begin{cases} v(\alpha) - \kappa c(x), & \text{if} \quad v(x) - \gamma < v(\alpha), \\ v(x) - \gamma - \kappa c(x), & \text{if} \quad v(x) - \gamma \geq v(\alpha). \end{cases}$$

- In his information acquisition problem, S chooses a distribution G_α that solves

$$\max_{G \in \text{MPC}(F)} \int V_\alpha(x)\, \mathrm{d}G(x).$$

- We show that there exists an α such that R's conjecture of the posterior mean is indeed α upon observing non-disclosure.

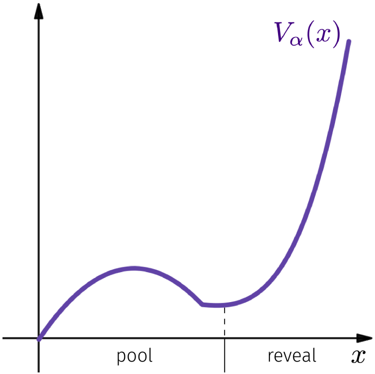
Covert Acquisition: Result

Proposition. Suppose information acquisition is covert.

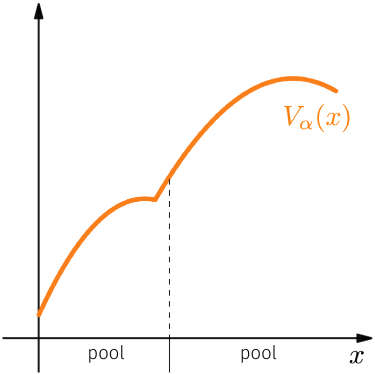
1. If w is strictly convex, the equilibrium is unique. There is a threshold $z_C \leq 1$ such that all values $x \in [0, z_C]$ are pooled and subsequently not disclosed, and the sender acquires full information and discloses on $(z_C, 1]$.

2. If w is strictly concave, in any equilibrium the distribution of posterior means acquired by the sender, G, has support on at most two points.

Covert Acquisition: Illustration



Convex *w*



Concave *w*

Overt Acquisition: Result

Proposition. Suppose information acquisition is overt. Illustration

1. If w is strictly convex, in every equilibrium there is a threshold $z_O \leq 1$ such that all values $x \in [0, z_O]$ are pooled and subsequently not disclosed, and the sender acquires full information and discloses on $(z_O, 1]$.
2. If w is strictly concave, in the unique equilibrium S does not acquire any information and does not disclose either.

Covert vs. Overt: Transparency Hurts R

Observation. If w is str. concave, R obtains more info under covert info acquisition.

Proposition. If w is str. convex, unless no information acquisition in the covert equilibrium, $z_O > z_C$. Thus, R obtains more info under covert info acquisition.

Transparency reduces R skepticism following nondisclosure

- The effect works at both the **intensive** margin and the **extensive** margin

The Role of Disclosure Cost γ

Proposition. In the exogenous info benchmark, R obtains less info as γ increases.

Proposition. When information acquisition is either overt, or it is covert but w is strictly convex, R obtains less information as γ increases.

The Role of Disclosure Cost γ

Observation. Suppose information acquisition is covert and w is strictly concave. If disclosure is costless ($\gamma = 0$), but information acquisition is costly ($\kappa > 0$), the unique equilibrium is that in which S acquires no information but gets it certified.

Proposition. When info acquisition is covert and w is strictly concave, R prefers a strictly positive disclosure cost to no disclosure cost.

Summary

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We study a disclosure game with endogenous information where

- more and finer information is more costly to acquire
- disclosure requires costly certification (or certification subject to random failure)

Main takeaways:

- transparency in the acquisition process does not help, and may hurt, the receiver
- the receiver may prefer a strictly positive certification cost to zero certification cost

Other results:

- comparative statics on net value function w getting more (or less) convex

Thank you!

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Backup Slides

Exogenous S Information Benchmark: Details

Suppose S knows the state θ and hence doesn't need to acquire any information. Back

Proposition (Verrecchia, 1983). An equilibrium exists. In any equilibrium, there exists $\underline{\theta} \in (0, 1]$ s.t. S doesn't disclose when $\theta \in \left[0, \underline{\theta}\right]$ and discloses otherwise.

- An eqm is characterized by $\underline{\theta}$ satisfying $\mathbb{E}\left[v(\theta) \mid \theta \in \left[0, \underline{\theta}\right]\right] = v\left(\underline{\theta}\right) - \gamma$ (or $\geq$ if $\underline{\theta} = 1$).
- By Tarski's fixed point theorem, either $\geq$ holds for $\underline{\theta} = 1$ or there is $\underline{\theta}$ s.t. $=$ holds.

Overt Acquisition: Illustration

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