Second Opinions and Disclosure

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Overview

Motivation

Consider a decision maker (DM) who faces uncertainty and is choosing between various alternatives, where only one of them will yield a positive outcome. Some examples:

- Going long or short on an investment: uncertainty over future payoffs
- Raising or lowering a binary policy lever: uncertainty about the magnitude of opposing economic forces
- Observing symptoms of a disease and taking treatment: uncertainty over which underlying pathway is actually the problem
- Police trying to identify a criminal out of a list of suspects: uncertainty over who committed the crime

Motivation

In these situations, a DM will often consult multiple “experts” to determine the correct course of action. This process is complicated by two concerns:

1. The DM may not know how well-informed any given expert is
2. The experts preferences may be only partially aligned with the DM
   - Experts care more about the DM when the DM actually follows their recommendation
   - Experts face a lower penalty than the DM when a wrong alternative is chosen

Canonical example: “2 and 20” payment scheme from investment advisors.

Question and Preview of Results

Question: When a decision maker has the ability to sequentially solicit information from multiple experts, whose preferences are partially aligned with the DM, does disclosure (transparency) help or harm the decision maker?

Tradeoff: The answer depends on two forces. In equilibrium,

- Disclosure allows the decision maker to sometimes learn the strength of expert's signals, making them more informative (overturning effect)
- Disclosure correlates the recommendations of the experts, making them less informative on average (herding effect)

Result: As the probability that experts possess information increases, the optimal strategy of the decision maker (disclosure vs. non-disclosure) is non-monotonic.

Model Overview

- A receiver (DM) will sequentially visit with two senders (experts), who may or may not have information about the state
- The senders will give recommendations (referrals) to the receiver about which action to take.
- After visiting both experts, the receiver will choose to take one of two risky actions, or a safe action
- Receiver payoffs will depend on the state and chosen action. Sender payoffs will also depend on whether the receiver followed the sender's recommendation.

Preliminaries

- Two states of the world: $\theta \in \{L, H\}$ with common, uniform prior
- Two types of players.
  - 2 Senders (experts, she) with preferences $U_S(m, a, \theta)$
  - Receiver (DM, he) with preferences $U_R(a, \theta)$
- 3 possible messages: $m \in \{l, h, \emptyset\}$; $\emptyset$ means "I don't know"
- 3 possible actions: $a \in \{L, H, 0\}$
- Information: Each expert receives a conditionally independent signal:
  - With probability p: the signal perfectly reveals θ
  - With probability $1 - p$: the signal is completely uninformative

Preferences

Receiver preferences: Taking an action that matches the state yields a payoff of 1, the wrong action bears a penalty of x, and the safe action gives 0

$$U_r(a,\theta) = \begin{cases} 1 & a = \theta \\ 0 & a = 0 \\ -x & a \neq \theta \end{cases}$$

Sender preferences: If the receiver does not follow the recommended (risky) action of the sender, the sender's payoff is 0. Otherwise, the Sender earns a payoff with the same sign as the receiver.

$$U_s(a,m,\theta) = \begin{cases} 1 & a = m = \theta \\ 0 & a \neq m \\ -y & a = m \neq \theta \end{cases}$$

Assumption: $x > y \geq 1$

Timing: Γ

1. Nature chooses $\theta \in \{L, H\}$
2. The two senders get their signals, conditionally independent of the state
3. Receiver is randomly matched with one of the two senders, has the opportunity to disclose a previous recommendation (which he cannot), and then the first Sender gives her recommendation
4. Receiver is matched with the other sender, has the opportunity to disclose the first sender's message, and then the second sender gives her recommendation
5. Receiver chooses an action and payoffs are realized

Equilibrium

- Solution concept: (symmetric) PBE
- Due to multiplicity, we will focus on the receiver-preferred equilibrium
- An equilibrium consists of
  1. A reporting strategy
  2. A disclosure strategy
  3. An action rule
- We will compute equilibrium payoffs under the assumption that the receiver can commit to (and publicly announce) a disclosure strategy at the beginning of the game.
  - We will see that any equilibrium of this game is also an equilibrium of the original (no-commitment) game
  - Receiver preferred(?)*

Timing: Γ'

2. Nature chooses $\theta \in \{L, H\}$
3. The two senders get their signals, conditionally independent of the state
4. Receiver is randomly matched with one of the two senders, has the opportunity to disclose a previous recommendation (which he cannot), and then the first Sender gives her recommendation
5. Receiver is matched with the other sender, has the opportunity to disclose the first sender's message, and then the second sender gives her recommendation
6. Receiver chooses an action and payoffs are realized

Timing: Γ'

1. Receiver publicly announces and commits to whether she will disclose or not.
2. Nature chooses $\theta \in \{L, H\}$
3. The two senders get their signals, conditionally independent of the state
4. Receiver is randomly matched with one of the two senders, has the opportunity to disclose a previous recommendation (which he cannot), and then the first Sender gives her recommendation
5. Receiver is matched with the other sender, has the opportunity to disclose the first sender's message, and then the second sender gives her recommendation
6. Receiver chooses an action and payoffs are realized

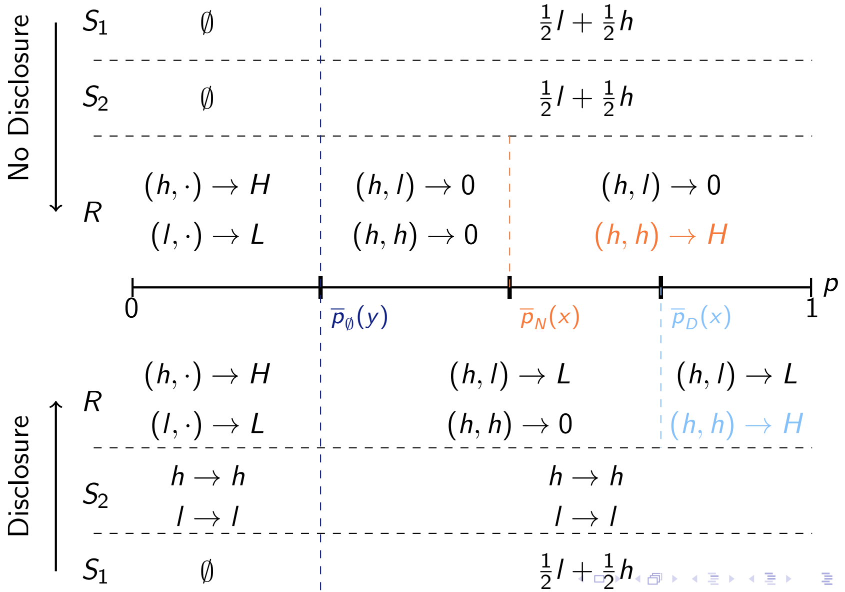
Equilibrium Characterization: Preliminary Observations

- In general, the possible equilibria depends on the 3 model parameters: (p, x, y).
- The receiver will take a risky action iff his posterior beliefs $(\mu = \Pr[\theta = 1|\mathcal{I}])$ are sufficiently strong: $\mu \geq \overline{\mu}(x)$ or $1 - \mu \geq \overline{\mu}(x)$
- In a receiver-preferred equilibrium, it is without loss to have informed senders always recommend the correct action: $m = \theta$.

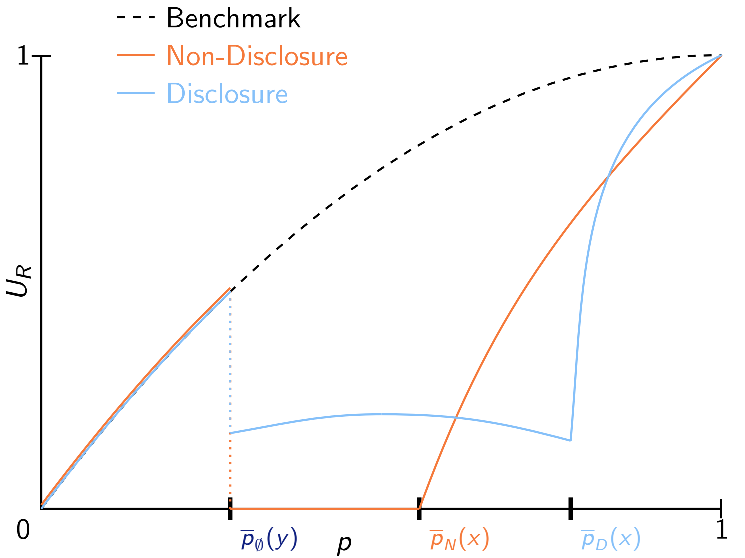
Coming up: the equilibrium strategies for the *uninformed* sender and the receiver under disclosure and non-disclosure.

(lots of information...)

Equilibrium Strategies for R and Uninformed S



Equilibrium Payoffs



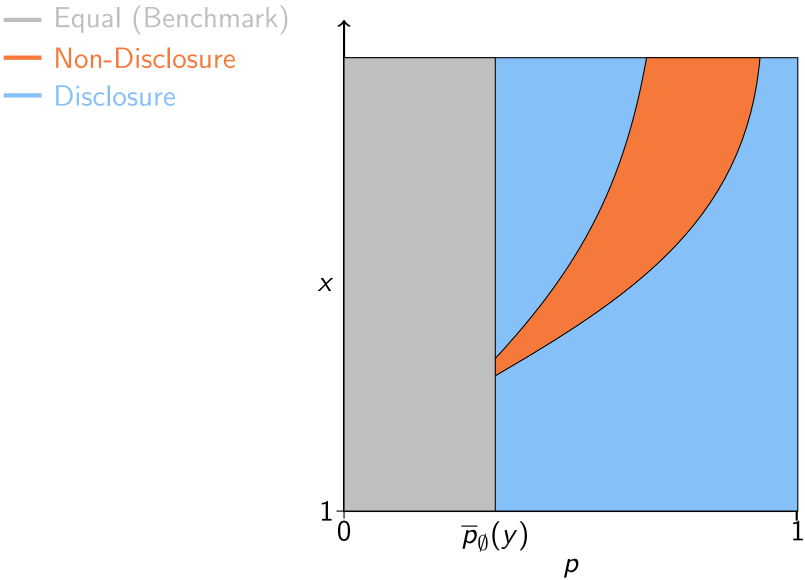
Main Intuition and Comparative Statics

Suppose that the first sender recommended $m_1 = h$.
Under disclosure:

- Observing an overturning recommendation $m_2 = l$ gives the DM a lot of information
- Observing another of the same recommendation $m_2 = h$ gives the DM little additional information due to herding.

A small comparative statics result: Fix $y < x$. As x increases, the set (interval) of p for which non-disclosure is optimal increases in the strong set order.

Disclosure-Optimal Regions



Extension: $n > 2$ States

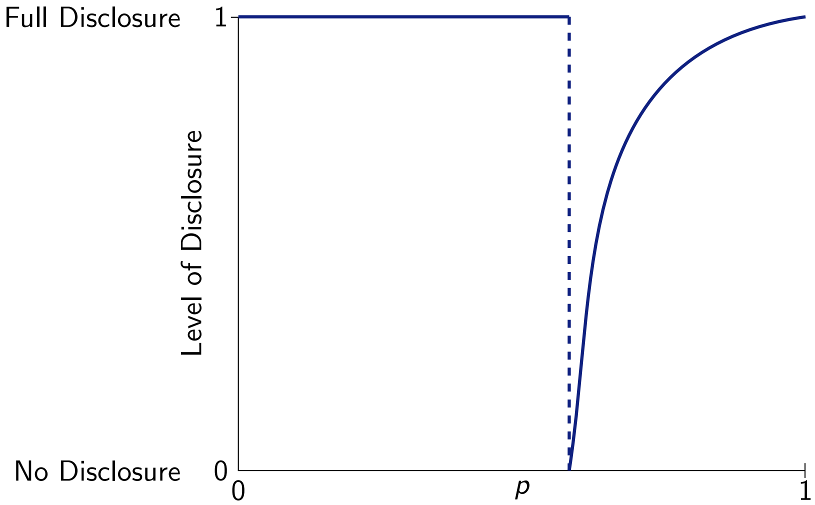
Suppose $n > 2$, and there are n states, and n actions. Each action is correct in exactly one state, and payoff structures are otherwise unchanged.

Can the DM use *partial disclosure* to manage the tradeoff between the overturning effect and the herding effect?

Partial disclosure: "Expert 1 recommended one action out of $\{a_1, a_3, a_{11}, \ldots\}$"

Yes! The optimal disclosure rule uses partial disclosure for intermediate values of p.

Optimal Disclosure Policy for Large n



Related Literature

- Banerjee (1992); Bikhchandani, Hirshleifer & Welch (1998) - Herding, Information Cascades
- Wolinsky (2002, 2003) - Credence Goods, Eliciting Information from Multiple Experts
- Hung (2019)- Endogenous Search for Expert Information
- McGee & Yang (2013); Li, Rantakari & Yang (2016) - Cheap Talk with Multiple Senders

Further Extensions

- Generalizations of Sender and Receiver preferences and actions
  - Conjecture: some general sufficient conditions regarding convexity of payoffs as a function of beliefs with a strict interior minimum
  - Continuum of actions: $a \in [0, 1]$ corresponds to the level of investment in a risky asset, with the remainder invested in a safe asset
- More general information structures: we expect the tradeoff to be different depending on the difference in signal strengths, etc.
- Actions with payoffs that are not negatively correlated (i.e. independent)

Thank you!