Communicating bias

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Big Picture

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  - Bias is known
  - Only coarse information transmission possible
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- Li and Madarász, JET 2008
  - Bias is unknown
  - Conflict hiding equilibrium exist
  - If DM's utility is sufficiently concave, then non-disclosure regime is preferred

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  - Senders send cheap talk messages about the bias before learning state (Bias revealing stage)
  - There are multiple senders and only one can get hired to give state relevant advice
- Main research questions
  - Can the senders' reveal their bias in equilibrium?
  - Can the bias revealing equilibrium give the decision maker a higher utility than any equilibrium which exists without the bias revelation stage?

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Results and contributions

1. If there is only one expert, bias revelation is not possible in equilibrium
2. When there are two experts, bias revealing equilibria exist
3. Under some conditions, the bias revealing equilibrium is preferred by the decision maker to any equilibrium possible without the bias revealing stage
4. We characterize closed form solutions for equilibrium payoffs under no bias revelation

Model

- State of the world - $\theta \sim U[0,1]$
- n experts $(S_1, S_2, ..., S_n)$. We look at only n=1 and n=2
- An expert S_i's bias b_i is her private information. Common knowledge that biases are drawn iid from the distribution:

$$b_i = \begin{cases} b_h & \textit{with probability } p_h \in (0,1) \\ b_l & \textit{with probability } 1 - p_h \end{cases} \quad \textit{where } b_l < b_h$$

- Decision maker can hire only one expert to get state relevant advice on. Has to choose an action in $[0,1]$
- If true state is θ, hired expert is expert i, and decision maker takes the action y, then the payoffs are as follows:

$$\begin{aligned} U_{DM}(\theta, y) &= -(y-\theta)^2 \\ U_i(\theta, y, b_i) &= -(y-\theta-b_i)^2 \\ U_{j\neq i} &= -A_j \end{aligned}$$

Bias revelation stage and timing

- Each expert privately learns her own bias
- Each expert simultaneously sends a message to the decision maker **(bias revealing stage)**
- Decision maker chooses one expert to get advice from
- Chosen expert learns the state perfectly
- Chosen expert sends a message to the decision maker (state message)
- Decision maker chooses an action
- Everyone gets paid

One Sender world

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- Note that in any separating equilibrium - CS equilibrium after revelation
- Deviations can have low bias sender 'hiding' in a CS b_h equilibrium or vice versa

Result

Proposition

When there is only one sender ($n = 1$), there is no bias revealing informative equilibrium in pure strategies

We show that the following cannot be an equilibrium:

Stage 1:

Sender reveals bias truthfully

Stage 2:

If sender reports type b_l in stage 1: Play an n partition CS b_l equilibrium

If sender reports type b_h in stage 1: Play an m partition CS b_h equilibrium

If the decision maker arrives at an off equilibrium node, she takes the lowest equilibrium action in n partition CS b_l equilibrium

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- What if exogenous bias revelation is difficult to implement a la Li and Madarasz?

Two Sender world

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Two Sender world

- Bias revealing equilibrium is possible
- Bias revealing equilibrium is welfare improving for decision maker over any equilibria possible when there is no bias revelation stage

Bias revealing equilibrium

Proposition

There exists a p' such that if $p_h \in [0, p']$, then the following strategies are part of a Perfect Bayesian equilibrium

Stage 1

Senders reveal bias truthfully

If senders send same message - randomly pick one

If senders send different messages - pick b_h

Stage 2

Senders reports (b_l, b_l) in stage 1: Play most informative CS b_l equilibrium with chosen exp

Senders reports (b_l, b_h) in stage 1: Play a babbling equilibrium with chosen expert

Senders reports (b_h, b_l) in stage 1: Play a babbling equilibrium with chosen expert

Senders reports (b_h, b_h) in stage 1: Play most informative CS b_h equilibrium with chosen exp

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Good revelation equilibrium

Stage 1

Senders reveal bias truthfully

If senders send same message - randomly pick one

If senders send different messages - pick $vb_h + (1 - v)b_l$

Stage 2

If senders reports (b_l, b_l) in stage 1: Play most informative equilibrium b_l equilibrium

If senders reports (b_l, b_h) in stage 1: Play most informative equilibrium with chosen expert

If senders reports (b_h, b_l) in stage 1: Play most informative equilibrium with chosen expert

If senders reports (b_h, b_h) in stage 1: Play most informative equilibrium b_h equilibrium

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  - Receiver's choice comes after a public signal

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  - Receiver's choice comes after a public signal
- Does not change one sender result

What limits no revelation welfare?

- As p_h increases the number of partitions in equilibrium reduces

Example and channel

Suppose $b_l = 0.072$, $b_h = \frac{1}{5}$. Assume that $A_l = \frac{1}{12} + b_l^2$, $A_h = A_l + 0.17$, $v = 0.65$, and $p_h \in (0.068, 0.092)$. Then, the good revelation equilibrium gives the decision maker higher utility than the best equilibrium possible without the bias revelation stage.

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- New channel via which sender competition helps decision maker

General

Proposition

Given b_h, there exists $\bar{b}$ such that if $b_l < \bar{b}$, there exists a range of p_h where the good bias-revealing equilibrium gives the decision maker higher utility compared to any equilibrium that can exist without the bias revealing stage.