The Social Value of Credible Public Information

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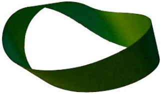

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Introduction

Model

Analysis

MOTIVATION

- This paper is motivated by the paper *'Social Value of Public Information'*, Morris and Shin, 2002
- Recall that in Morris and Shin 2002:
  - A central bank (CB) interacts with a continuum of private agents
  - Players try to take actions appropriate to the state, but their utility functions also exhibit strategic complementarity
  - Private agents receive both *private* and *public* (released by CB) signal on the underlying fundamentals
  - Conclusion: the welfare effect of better public information is ambiguous
    $\rightarrow$ The coordination motive entails placing too much weight on the public signal

Motivation Cont'd

- Very influential paper and many variations of the same problem has been studied
- In all these papers, released public information is (implicitly) assumed to be perfectly credible

  $\rightarrow$ a Bayesian updating is enough to incorporate public and private information
- However,
  - $U_{CB} \neq U_{\text{agents}}$
  - The main lesson that we know from the cheap talk literature: *perfect communication is not to be expected in general unless agents' interests are completely alligned*
  - Released public information might be perceived to be strategic by private agents

This Paper

- Study a similar model under the strategic information transmission constraints
- Basic questions:
  - Can CB truthfully reveal her signal to private agents?
  - How does the precision of CB's own signal affect her capacity to communicate truthfully?

PREFERENCES

- There is a central bank (CB) and two private agents
- Utility functions:
  - $U_{CB} = -(a_1 - \theta)^2 - (a_2 - \theta)^2$
  - $U_i = -(1 - r)(a_i - \theta - b_i)^2 - r(a_1 - a_2)^2$

    θ: is unknown state variable with distribution $F(\theta)$ on $[0, 1]$

    r: the degree of complementarity $(0 < r < 1)$

    b_i: individual bias.

TIMING

1. Nature draws θ
2. CB and players receive informative signals y and x_i respectively
3. CB makes a public announcement $\tilde{y}$
4. Upon receiving signals player i takes an action conditional on the information set $\{\tilde{y}, x_i\}$

- This description of the game is a cheap talk game with two audiences and complementarities.

  $\rightarrow$ The sender(CB) imperfectly observes the state and receivers has some private information in addition to the sender's message
- Use PBE as an equilibrium concept

LITERATURE ...

- Two early references are Seidmann (1990) and Watson (1996).
- Chen (2009) studies two-sided cheap talk and finds that the decision maker cannot elicit more information from the expert by communicating to him first.
- Lai (2010) studies communication between an expert and an amateur who knows whether the state of the world is below or above a cutoff point that is her private information.
- Ishida and Shimizu (2011) analyses communication when both, the expert and the decision maker, have discrete imperfect signals about a binary state of the world.
- Barreda (2011) investigates the strategic interaction between an informed expert and a decision maker when the latter has imperfect private information relevant to the decision.

PERFECT INFORMATION CASE

- CB observes the state without noise
- CB sends a public signal
- Players don't have any private information besides the public signal

PERFECT INFORMATION CASE

- First order conditions:

$$\frac{\partial U_i}{\partial a_i} = -2(1-r)(a_i - \theta - b_i) - 2r(a_1 - a_2)$$
$$\implies a_i = (1-r)(\theta + b_i) + ra_j\,.$$

- Solving for the equilibrium:

$$a_i^* = E_i(\theta) + \frac{1}{1+r}(b_i + rb_j), \qquad i, j = 1, 2.$$

where E_i is the player i's information set.

Perfect Information Case Con't

- Since there is only public information in the environment, players' information sets are the same
- This observation leads to the following lemma

Lemma

For any message $\tilde{y}$, equilibrium actions satisfy

$$a_1^* - a_2^* = \tilde{r}(b_1 - b_2),$$

where, $\tilde{r} = \frac{1-r}{1+r}$.

- Now we can characterize the public equilibrium

PERFECT INFORMATION CASE CON'T

Theorem

In any public equilibrium state space is partitioned by a finite number of points $\{\theta_0, \theta_1, \ldots, \theta_N\}$*, given by*

$$\theta_k = \frac{k}{N} + k(N-k)(b_1+b_2), \quad k = 0, 1, \ldots, N$$

where $N \in \{1, \ldots, N(b_1+b_2)\}$ *with*

$$N(b_1+b_2) = \parallel \frac{-1}{2} + \frac{1}{2}(1 + \frac{4}{b_1+b_2})^{\frac{1}{2}} \parallel$$

And for each $\theta \in (\theta_{k-1}, \theta_k)$*, equilibrium actions are given by*

$$a_{i,k}(\theta) = \frac{1}{2}(\theta_{k-1}+\theta_k) + \frac{1}{1+r}(b_i + rb_j), \qquad i, j = 1, 2.$$

($\parallel x \parallel$ denotes the smallest integer greater than or equal to x.)

PERFECT INFORMATION CASE CON'T

- CB behaves as if facing with a single receiver with bias $(b_1 + b_2)/2$
- Truth-telling is not possible unless $b_1 + b_2 = 0$
- Public equilibrium partition is independent of the complementarity parameter r.

Imperfect Information Case

- Both CB and private agents receive noisy signals:
  - $\theta \in \{0, 1\}$
  - Prior on θ: $p\{\theta = 0\} = p\{\theta = 1\} = 1/2$
  - CB's signal y: $p\{y = t|\theta = t\} = p, \qquad t = 0, 1$
  - Agent's signal x: $p\{x = t|\theta = t\} = q, \qquad t = 0, 1$
  - $p, q \in (1/2, 1]$
- CB makes announcement based just on y
- Agents' information set: $\{x_i, y\}$
- How *range of truth-telling equilibria* changes with the precision of CB's signal y?

Imperfect Information Case Cont'd

Theorem

For the average bias there is a threshold value b^*

$$b^* = q(1-q)(2p-1)\left[\frac{1}{P_{0|1}P_{1|1}} - 2\right]$$

such that CB can truthfully report her signal only when

$$b_1 + b_2 \leq b^*$$

Imperfect Information Case Cont'd

Corollary

The range of the average bias that CB can truthfully communicate with the private agents increases in the precision of her signal, i.e.

$$\frac{\partial b^*}{\partial p} > 0\,.$$

Coclusions

- CB only cares about the average bias of the private agents
- CB can not communicate credibly unless average biases of players is zero even if CB observes the state perfectly
- However, CB's ability to communicate increases in her precision
- CB can truthfully reveal her signal only if the average bias is below a certain threshold
- The possibility of truthful communication increases in her signal precision