Opinions as Incentives

Yeon-Koo Che
Columbia

Navin Kartik
Columbia and UCSD

UC Berkeley, April 13, 2009

Introduction: Motivation

- DMs often need advice from others
- A key issue is whom to seek advice from
- Often perceived as beneficial to gather a different opinion
  - Irving Janis (1972) and "groupthink"
  - Competing hypotheses: research, policy debates, ...
  - More broadly: different views generate new insights
- We develop a model to address (some) costs and benefits of difference of opinion
  - abstract from any direct productive benefits

Introduction: Basic Ideas

- What are differences of opinion?
  - Disagreements about how to achieve common goals
  - Common knowledge of heterogeneous beliefs
- DM must take an action: payoff depends upon unknown state
- Adviser is useful because he can learn something about state
- DM can choose adviser of any opinion (prior), incl. her own
- What kind of adviser will she choose?

Introduction: Basic Ideas

- Difference of opinion $\Longrightarrow$ interim conflicts of interest
- Strategic disclosure of information
- Information revelation maximized by a like-minded adviser
  - cost of difference of opinion

Introduction: Basic Ideas

- Information must be endogenously acquired
  - costly effort increases chances of observing signal about state
- Differences of opinion provide incentives to acquire information
- More effort from adviser with greater difference of opinion

Introduction: Basic Ideas

- DM's choice of adviser must balance the tradeoff:

  information acquisition vs. disclosure

- We show that it is not optimal to have a like-minded adviser

Related Literature

- Strategic disclosure
  - Grossman (1981), Milgrom (1981)
  - Shin (1994, 1998)
- Endogenous info. acq. and disclosure
  - Matthews and Postlewaite (1985), Shavell (1994)
- Benefits of "bias"
  - Calvert (1985)
  - Dewatripont and Tirole (1999)
  - Van Den Steen (2004), Gerardi and Yariv (2008)
- Gilligan and Krehbiel (1990)

Plan

Model

Disclosure Sub-game

Information Acquisition

Optimality of Difference of Opinion

Discussion

Model: Basics

- A DM must take a decision, $a \in \mathbb{R}$
- Payoff depends upon unknown state, $\omega \in \mathbb{R}$
- Individual i's prior is that $\omega \sim N(\mu_i, \sigma_0^2)$; wlog $\mu_{DM} = 0$
- μ_i is person i's opinion, common knowledge
- All players have identical vN-M payoffs:

$$u_i(a, \omega) := -(a - \omega)^2$$

$\Longrightarrow$ no fundamental preference conflict

- Interpretations...

Model: Information

- DM can choose a single adviser to advise about ω
- Pool of potential advisers, with every $\mu \in [\underline{\mu}, \overline{\mu}] \supsetneq \{0\}$
- Chosen adviser exerts costly effort to acquire signal about ω
  - chooses a probability $p \in [0, \bar{p}]$, $\bar{p} < 1$, at cost $c(p)$
  - $c(\cdot)$ increasing, convex, Inada conditions
  - with prob p, observes a signal $s \sim N(\omega, \sigma_1^2)$
  - with prob $1 - p$, gets no signal, denoted $\emptyset$
- Effort choice & outcome of 'experiment' unobserved by DM

Model: Advice

- Adviser strategically discloses information to DM
  - signal is verifiable ("hard information")
  - if s is observed, only choice is whether to disclose or not
  - if no signal obtained, has no choice to make
- Interpretations...

Model: Timing

- Game form:
  1. DM chooses adviser of type μ
  2. Adviser chooses p and observes s or $\emptyset$
  3. Choice of disclosure
  4. DM takes action a
- Everything except adviser's effort and information is CK
- Solution concept: (pure) perfect Bayesian Equilibrium

Interim Bias

- B/c quadratic utility, preferred action for player i is

$$\alpha(s|\mu_i) := \mathbb{E}[\omega|s, \mu_i] = \rho s + (1-\rho)\mu_i$$

where $\rho := \frac{\sigma_0^2}{\sigma_0^2+\sigma_1^2}$.

- Difference of opinion creates conflicts

- Define interim bias, $B(\mu) := (1-\rho)\mu$

$$\implies \alpha(s|\mu) = \rho s + B(\mu) = \alpha(s|0) + B(\mu)$$

- Ex-ante bias is just μ

- If $\mu \neq 0$, $sign(B(\mu)) = sign(\mu)$ but $|B(\mu)| < |\mu|$

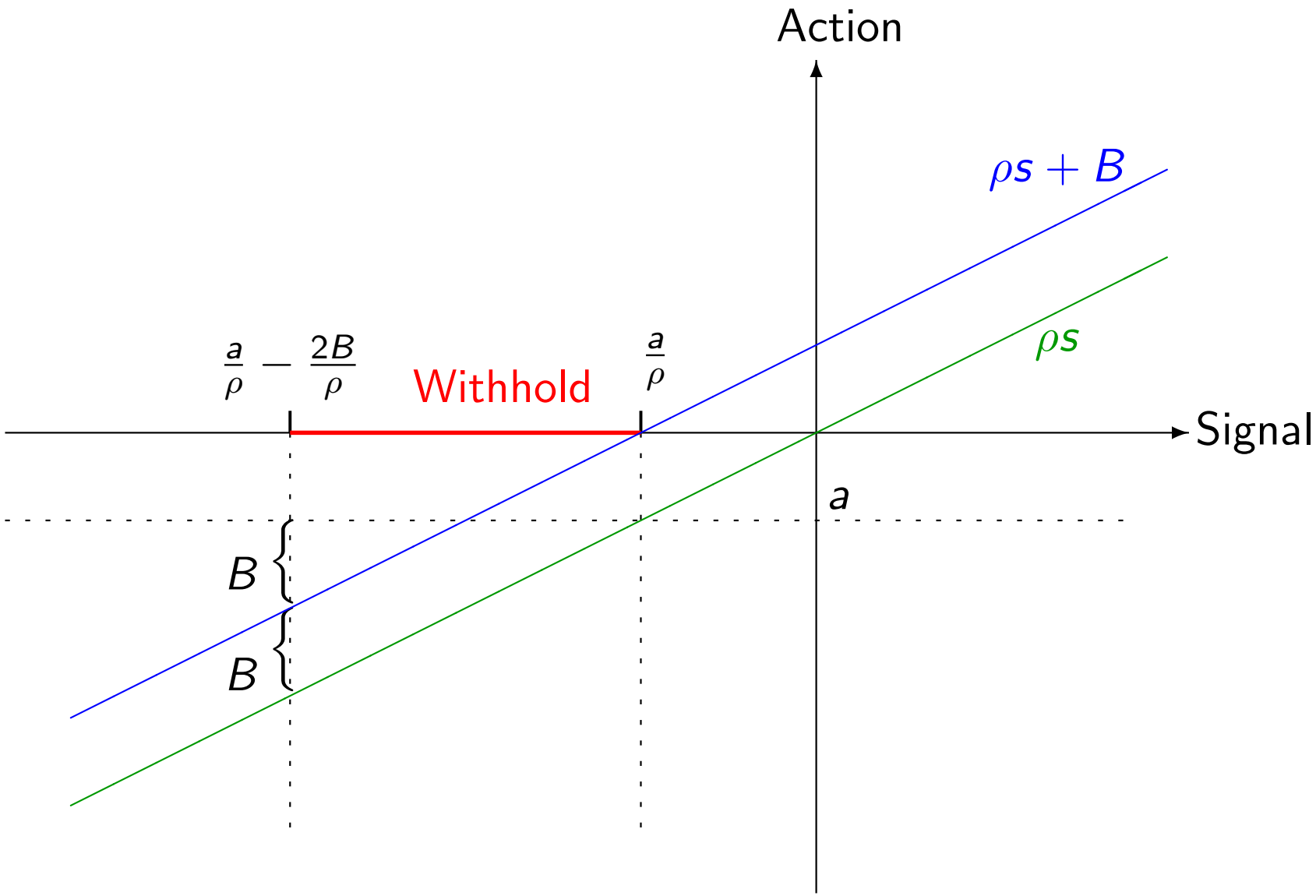
  $\implies$ disagreement persists, but is mitigated by information

Disclosure Sub-game

- Disclosure game behavior depends only on (B, p)
  - only DM's *belief about* effort matters, not true effort
- We need to characterize the non-disclosure action, $a_\emptyset$
  - if s is disclosed, DM plays $\alpha(s|0) = \rho s$
  - $a_\emptyset$ will determine the set of signals withheld by adviser

Disclosure Sub-game: Adviser's BR

Given any non-disc. action, a, BR is to withhold an interval $[\underline{s}, \overline{s}]$:



Disclosure Sub-game: DM's BR

- Given a (measurable) non-disclosure region, S, DM's BR is her posterior expectation of ω:

$$\begin{aligned} a_N(p, S) &= \rho\mathbb{E}[s|\text{non-disc}] \\ &= \frac{p\rho \int_S s\gamma(s;0)\,ds}{p\int_S \gamma(s;0)\,ds + 1 - p}, \end{aligned}$$

  where $\gamma(s;\mu)$ is density of $N(\mu, \sigma_0^2 + \sigma_1^2)$

- Note:
  - DM uses her opinion about signal, $\mu = 0$
  - only DM's belief about p matters

- a_N is increasing in strong set order (when $p > 0$)

Disclosure Sub-game: Equilibrium

- Must have a fixed point of the two BR's

Proposition.
Consider any (B, p) *with* $p \in (0, \bar{p})$.

1. *There is a unique equilibrium in the disclosure "sub-game."*
2. *The nondisclosure action* $a_\emptyset(B, p)$ *is zero if and only if* $B = 0$, *and is strictly decreasing in* B.

   $\Longrightarrow$ *Interim bias leads to strategic witholding*

   $\Longrightarrow$ *"Prejudicial effect"* (*recall:* $B(\mu) > 0 \iff \mu > 0$)

Information Acquisition: Benchmark

PROPOSITION.

If the probability of acquiring a signal is given exogenously by some fixed $p > 0$, the DM's utility is strictly decreasing in $|\mu_A|$. In particular, the uniquely optimal type of adviser for the DM is like-minded, i.e. an adviser with $\mu_A = 0$.

Information Acquisition: Equilibrium

- Suppose DM expects effort p^e. The MB of exerting effort is

$$\Delta(B(\mu), \mu, p^e) := \int_{s \notin S(\cdot)} \left[\underbrace{\left(a_\emptyset(\cdot) - (\rho s + B)\right)^2}_{\text{not observing } s} - \underbrace{B^2}_{\text{disclosing } s} \right] \gamma(s; \mu)\, ds$$

- Equilibrium requires that MB=MC and belief be correct, so

$$\Delta(B(\mu), \mu, p) = c'(p) \tag{1}$$

LEMMA.
For any μ, p is an equilibrium effort choice if and only if $p \in (0,1)$ and satisfies (1). For any μ, a solution to (1) exists.

REMARK.
Don't rule out multiple equilibrium efforts for given μ; focus on highest one, denoted $p(\mu)$. Unique solution to (1) for $|\mu|$ small.

Information Acquisition: Incentivizing Effect

Proposition.

An adviser with a greater difference of opinion acquires a signal with higher probability: $p(\mu') > p(\mu)$ *if* $|\mu'| > |\mu|$.

Intuition.

- *Suppose information is public:* $S(\cdot) = \emptyset$ *and* $a_\emptyset(\cdot) = 0$
- *Adviser's expected utility without signal:* $-Var[\omega|\emptyset] - \mu^2$; *with signal:* $-Var[\omega|s] - (B(\mu))^2$

  Hence, MB of effort is

$$\Delta^{pub}(\mu) = \underbrace{\sigma_0^2 - \tilde{\sigma}^2}_{\text{uncertainty reduction}} + \underbrace{\mu^2 - (B(\mu))^2}_{\text{persuasion}}$$

- *Incentive to persuade increasing in* $|\mu|$ $(\because B(\mu) = (1-\rho)\mu)$

Information Acquisition: Incentivizing Effect

Intuition. (cont'd)

- *Now consider covert info acq*
- *Without signal, expected utility* $-Var[\omega|\emptyset] - \mu^2 - (a_\emptyset)^2 + 2a_\emptyset\mu$
- *Adviser always has the choice to disclose any signal, so*

$$\begin{aligned}\Delta(B(\mu),\mu,p^e) &\geq \Delta^{pri}(\mu, a_\emptyset(B(\mu),p^e)) \\ &= \underbrace{\sigma_0^2 - \tilde{\sigma}^2}_{\text{uncertainty reduction}} + \underbrace{\mu^2 - B^2}_{\text{persuasion}} + \underbrace{(a_\emptyset)^2 - 2a_\emptyset\mu}_{\text{avoiding prejudice}}\end{aligned}$$

- *Because of prejudicial effect,* $(a_\emptyset)^2 > 0$, $2a_\emptyset\mu < 0$ *if* $|\mu| > 0$
- *Even bigger incentive to acquire information than when public*
- *Note: when* $\mu = 0$ *only incentive is uncertainty reduction*

Resolving the Tradeoff

Proposition.
There exists some $\mu_A \neq 0$ such that it is strictly better for the DM to appoint an adviser of type μ_A over a like-minded adviser.

Intuition.
Persuasion effect dominates strategic disclosure locally

- *If $\rho = 1$, then for all μ, $B(\mu) = 0$, so full disclosure in communication stage; hence*

$$U_{DM}^{\rho=1}(\mu) = -\sigma_0^2(1 - p(\mu))$$

- *Since $p(\cdot)$ strictly incr., $U_{DM}^{\rho=1}(\mu) > U_{DM}^{\rho=1}(0)$*
- *By continuity, type μ is better for DM than type 0 $\forall \rho \approx 1$*

Numerical Illustration

$$c(p) = \frac{p^4}{(1-p)^2}, \sigma_0^2 = 15, \sigma_1^2 = 2$$

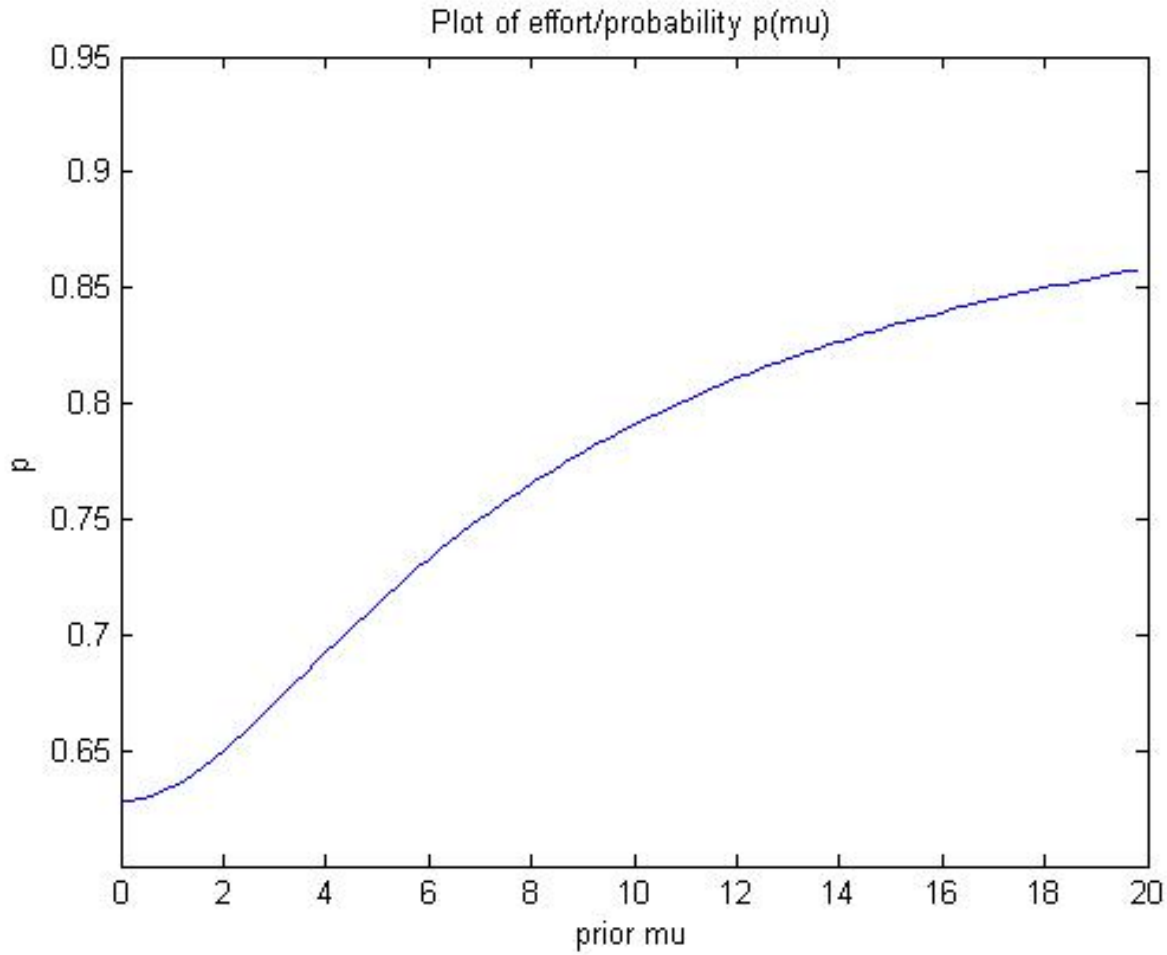


Figure: effort as a function of adviser type

Numerical Illustration

$$c(p) = \frac{p^4}{(1-p)^2}, \sigma_0^2 = 15, \sigma_1^2 = 2$$

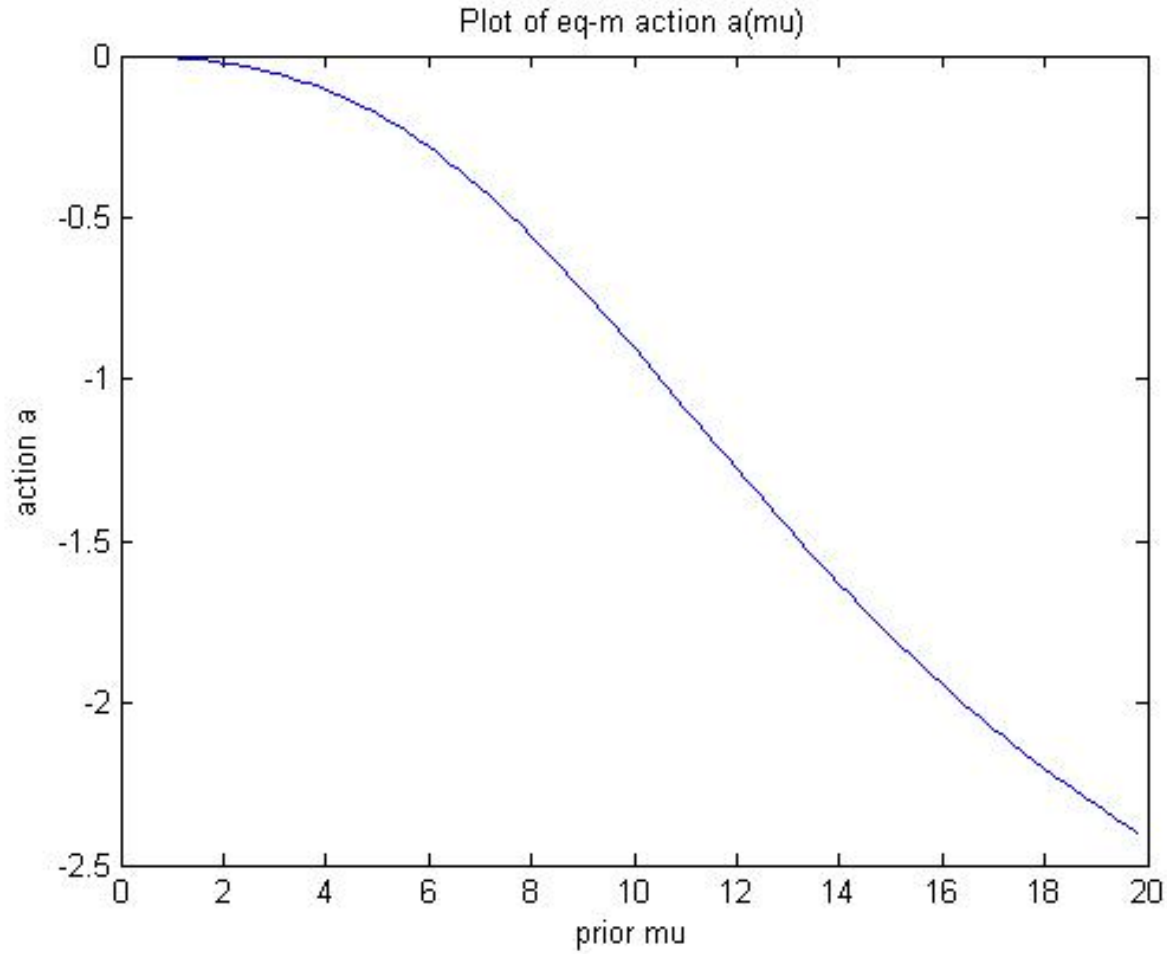


Figure: $a_\emptyset$ as a function of adviser type

Numerical Illustration

$$c(p) = \frac{p^4}{(1-p)^2}, \sigma_0^2 = 15, \sigma_1^2 = 2$$

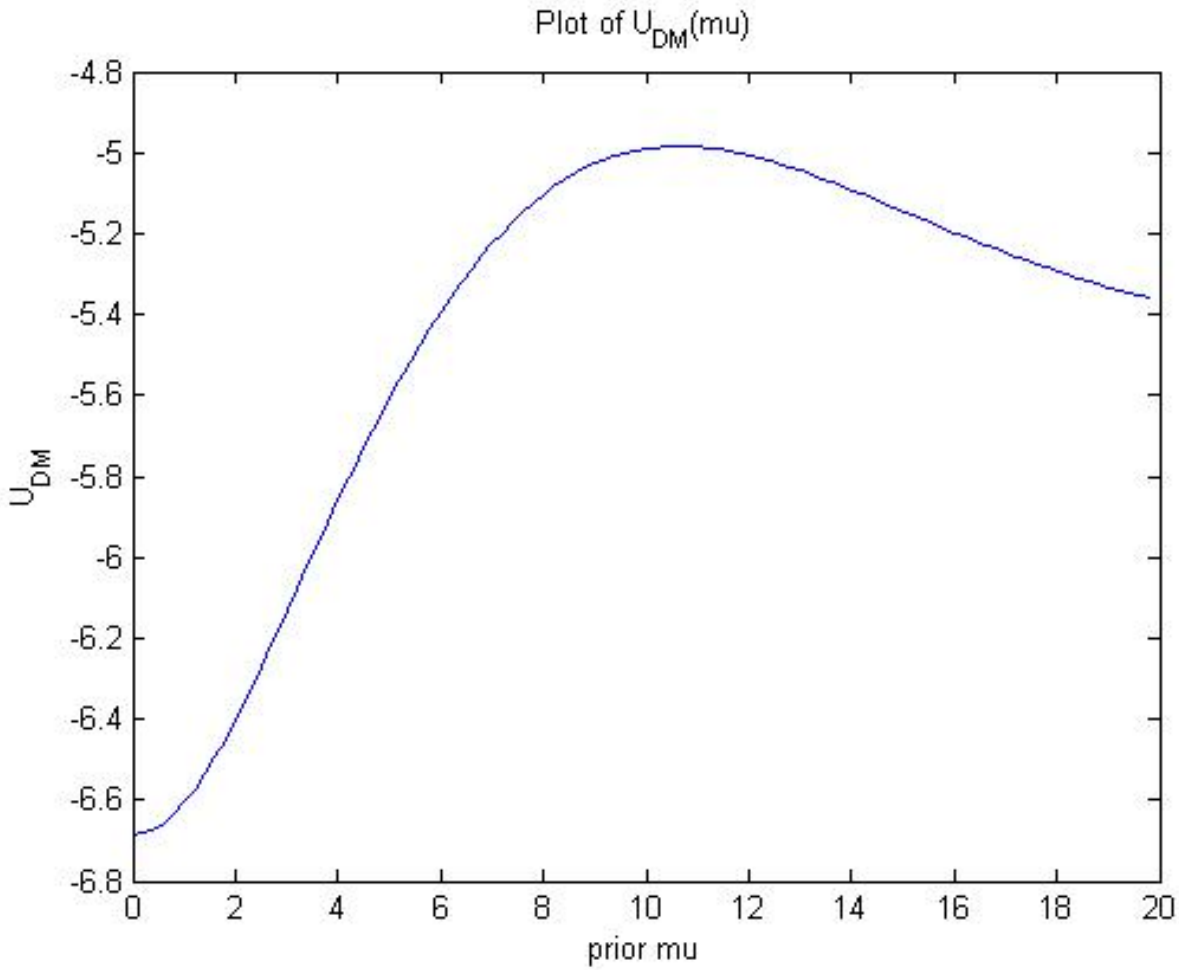


Figure: DM's ex-ante utility as a function of adviser type

Numerical Illustration: Comparative Statics

$c(p) = \frac{p^4}{(1-p)^2}$; $\rho = \frac{7}{8}, \frac{8}{9}, \frac{9}{10}$

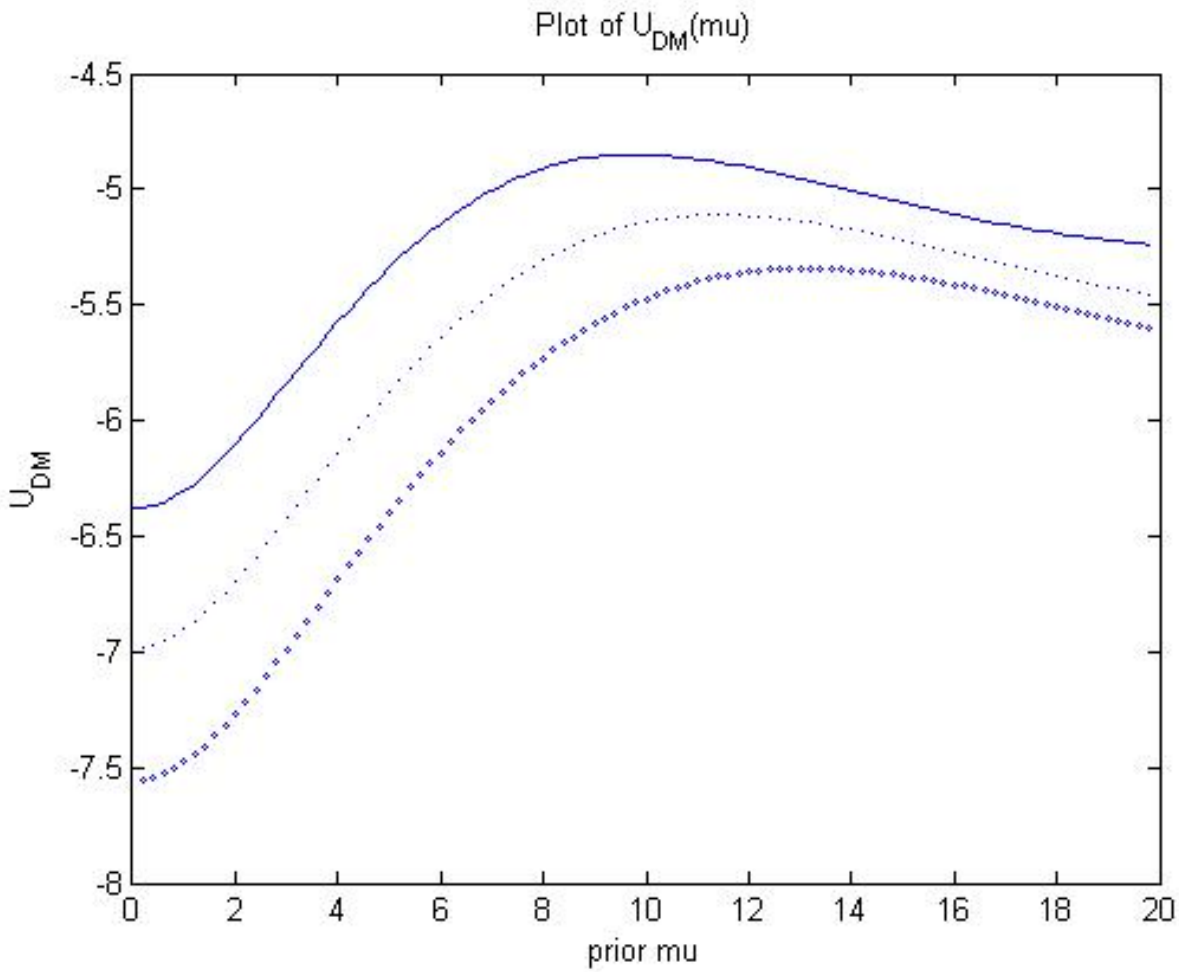


Figure: Comp stats of DM's ex-ante utility as a function of adviser type

Delegation

- Aghion and Tirole (1997): "initiative" vs. "loss of control"
- Similar logic in Gilligan and Krehbiel's (1987) rationale for closed rules (for extreme but not too extreme committees)
- Our model suggests that delegation can lead to a decrease in initiative

Delegation

- Suppose DM can choose to delegate or communicate with adviser
- Key observation: under delegation, not only is there a loss of control,

  but adviser with $\mu \neq 0$ has no incentive to persuade or to avoid prejudice.

Proposition.
Under delegation, it is uniquely optimal for the DM to choose a like-minded adviser. However such an arrangement is strictly worse for the DM than retaining authority and choosing an appropriate adviser with a difference of opinion.

Opinions vs. Preferences

- Opinions and Preferences are not isomorphic
- Consider differences in fundamental preferences: type b has vN-M utility
$$u(a, \omega, b) = -(a - \omega - b)^2$$
- Conditional on a signal, opinion type μ is identical to a preference type $b = B(\mu)$
  - so prejudicial effect goes through
- But they differ at ex-ante stage

Opinions vs. Preferences: Public Information

- Let adviser type be $(b, \mu) \in \mathbb{R}^2$; normalize DM to $(0, 0)$
- Ex-ante bias is $b + \mu$; interim bias is $B(b, \mu) = (1 - \rho)\mu + b$
- For adviser, w/o signal utility is $-\sigma_0^2 - (b + \mu)^2$; with signal, $-\tilde{\sigma}^2 - (B(b, \mu))^2$

$$MB = \underbrace{\sigma_0^2 - \tilde{\sigma}^2}_{\text{uncertainty reduction}} + \underbrace{\left(2\rho - \rho^2\right)\mu^2}_{\text{persuasion}} + \underbrace{(1 + \rho)\, b\mu.}_{\text{reinforcement}}$$

REMARK.

If information were public, and advisers only differ in preferences, any adviser exerts the same amount of effort, thus there is no gain to appointing an adviser with a different preference from the DM.

- Under preference bias alone, ex-ante and interim bias are identical $\implies$ no persuasion motive

Opinions vs. Preferences: Public Information

- But *interacting* opinion and preference is useful when there is some difference of opinion or preference

$$MB = \underbrace{\sigma_0^2 - \tilde{\sigma}^2}_{\text{uncertainty reduction}} + \underbrace{\left(2\rho - \rho^2\right)\mu^2}_{\text{persuasion}} + \underbrace{(1+\rho)\, b\mu.}_{\text{reinforcement}}$$

- Reinforcement $\implies$ if $b > 0$, appoint someone with $\mu > 0$ (zealot) rather than $\mu < 0$ (skeptic)
- Intuition
  - concavity
  - should expect to move DM towards $b + \mu$

Opinions vs. Preferences: Private Information

- Because of the prejudicial effect under strategic disclosure, preference bias nevertheless has an incentivizing effect when info acq is covert (Proposition 5 in paper)
- Incentivizing effect and strategic disclosure loss are of same order of magnitude around 0: locally, bias may or may not be beneficial
- But globally, bias can be beneficial

Opinions vs. Preferences: Private Information

$c(p) = \frac{p^2}{1-p}, \sigma_1^2 = 1, \sigma_0^2 = 0.5$

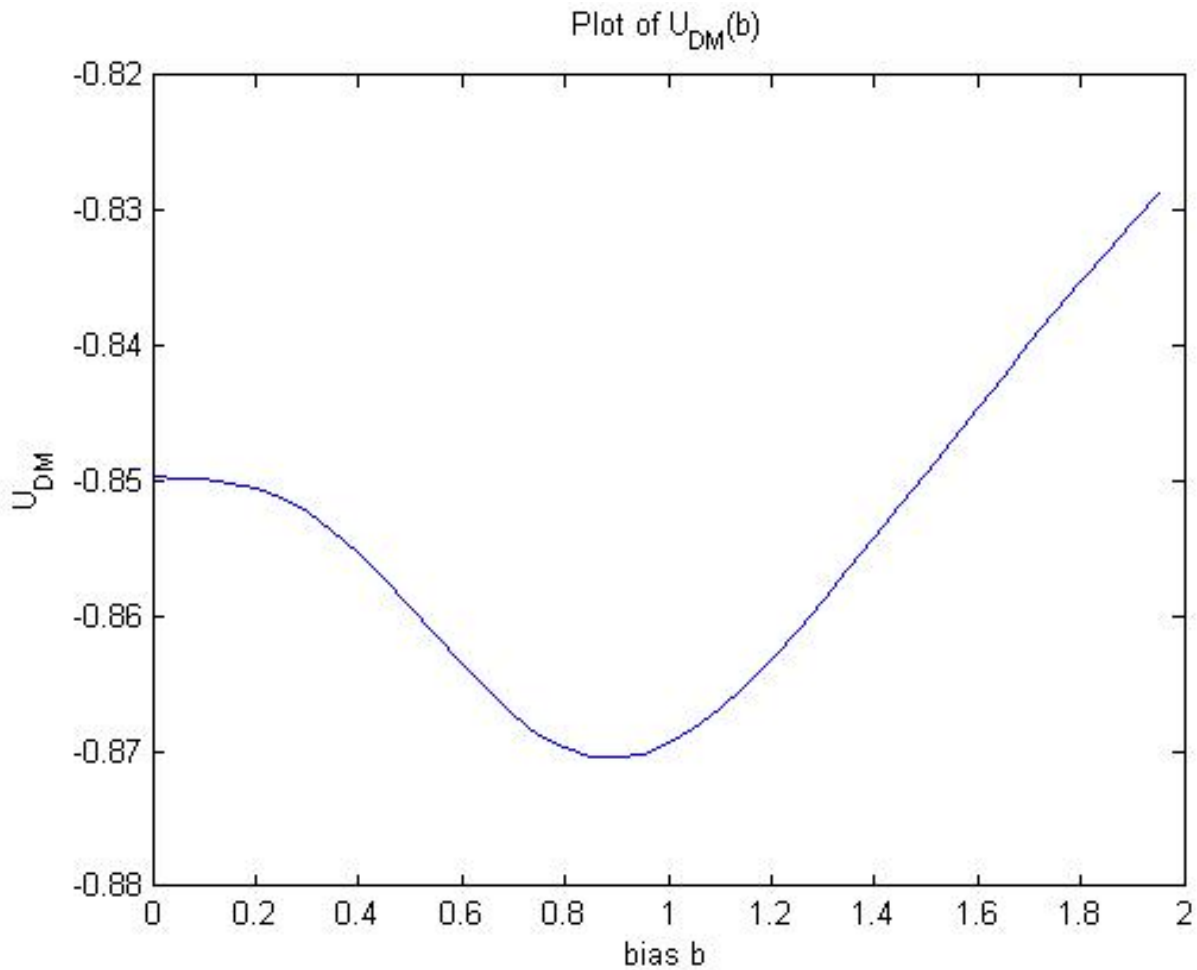


Figure: DM's ex-ante utility as a function of adviser's preference bias

Other Issues

- Richer models of information acquisition and communication
  - Precision enhancing effort + manipulation
  - Confirmatory bias
  - Uncertain quality of signal
- Selecting a "biased" DM
- Monetary payment
- Soft information
- Multiple advisers

Thank you!

Confidence

- Suppose all advisers have $\mu_A = 0$ but now vary in beliefs about signal precision
- The DM has $\rho_{DM} \in (0, 1)$, can choose an adviser with any $\rho_A \in [0, 1]$
- $\rho_A > \rho_{DM}$ is overconfidence; $\rho_A < \rho_{DM}$ is underconfidence
- Here no ex-ante bias; but still interim bias when $\rho_A \neq \rho_{DM}$
  - given signal s, adviser wants action $\rho_A s$, whereas the DM would take action $\rho_{DM} s$
- What type of adviser would DM choose? Note: no persuasion motive

Confidence

Proposition.

If advisers are distinguished only by confidence, ρ_A, the DM uniquely prefers to appoint a maximally overconfident adviser, i.e. one with $\rho_A = 1$ who believes that his signal is perfectly informative.

Intuition.

- *Consider $\rho_A \geq \rho_{DM}$: there is a full disclosure eqm independent of effort*
  - *if DM plays $a_\emptyset = 0$, optimal for adviser to fully disclose, because he weights signal higher than DM*
  - *if adviser fully discloses, optimal for DM to play $a_\emptyset = 0$*

Confidence

Proposition.

If advisers are distinguished only by confidence, ρ_A, the DM uniquely prefers to appoint a maximally overconfident adviser, i.e. one with $\rho_A = 1$ who believes that his signal is perfectly informative.

Intuition.

- *Consider $\rho_A \geq \rho_{DM}$: there is a full disclosure eqm independent of effort*
  - *if DM plays $a_\emptyset = 0$, optimal for adviser to fully disclose, because he weights signal higher than DM*
  - *if adviser fully discloses, optimal for DM to play $a_\emptyset = 0$*
- *So only motivation is uncertainty reduction: but this is increasing in overconfidence*