Communication in Committees

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June 11 2009

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What impact does pre-vote communication have on committee decision-making in general?

II(1) Deliberative Committees

A committee, $N = \{1, \ldots, n\}$, $n \geq 3$ (n odd), first deliberates and then votes.

Committee decisions over given agenda $X = \{A, B\}$ are made by a q-rule, $q \leq n$,

B chosen iff B receives at least q votes.

Individuals $i \in N$ are described by *bias types* $t_i \in T$ and *signals* $s_i \in S$

$$\mathbf{t} = (t_1, \ldots, t_n) \in \mathbf{T} = T^n; \mathbf{s} = (s_1, \ldots, s_n) \in \mathbf{S} = S^n$$

Call $\mathbf{s} \in \mathbf{S}$ a *state* and $\mathbf{S} = S^n$ the set of states

Let $p(\mathbf{t}, \mathbf{s})$ describe the common prior beliefs (with full support) over $\mathbf{T} \times \mathbf{S}$

Given $t_i \in T$ and $s_i \in S$, i's payoff from $x \in X$ is $u(x, t_i, (s_i, \mathbf{s}_{-i}))$.

Assume: $\forall t \in T$, $\exists \mathbf{S}_t \subsetneq \mathbf{S}$, $\mathbf{S}_t \neq \emptyset$, such that

$$\begin{aligned} \mathbf{s} &\in \mathbf{S}_t \Rightarrow u(B, t, \mathbf{s}) > u(A, t, \mathbf{s}) \\ \mathbf{s} &\in \mathbf{S} \backslash \mathbf{S}_t \Rightarrow u(A, t, \mathbf{s}) > u(B, t, \mathbf{s}). \end{aligned}$$

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Suppose (largely for analytical convenience) that $\mathbf{T}$ and $\mathbf{S}$ are finite.

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Given $t_i \in T$, $u(B, t_i, \mathbf{s}) \equiv E[u_i(B, \omega)|\mathbf{s}]$.

Let $\mathbf{s}_k$ be any signal profile with k "b"-signals; then $\mathbf{S} = \{\mathbf{s}_k | k = 0, 1, \ldots, n\}$ and

$$p(\mathbf{t}, \mathbf{s}_k) \equiv p(\mathbf{s}_k) = \binom{n}{n-k} P^{n-k} (1-P)^k$$

Finally,

$$\Pr[\omega = B|\mathbf{s}_k] = \frac{(1-\pi)(1-p)^{n-k}p^k}{\Pr[\mathbf{s}_k|A \cup B]}$$

so, for all $t \in T$,

$$\begin{aligned} u(B, t, \mathbf{s}_k) &= -(1 - \Pr[\omega = B|\mathbf{s}_k])t; \\ u(A, t, \mathbf{s}_k) &= -\Pr[\omega = B|\mathbf{s}_k](1-t). \end{aligned}$$

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And therefore,

$$\begin{aligned} \mathbf{S}_t &= \{\mathbf{s}_k \in \mathbf{S} | \Pr[\omega = B|\mathbf{s}_k] > t\} \\ &= \{\mathbf{s}_k \in \mathbf{S} | k \geq k(t; \pi, p)\}. \ \square \end{aligned}$$

II(2) Communication and Decision

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$v : T \times S \times M^n \to \{0, 1\}$ is a symmetric (pure) *voting strategy*, where, for all $t \in T$, all $s \in S$ and all $\mathbf{m} \in M^n$, $v(t, s, \mathbf{m}) \equiv \Pr[i$ votes $B|\cdot]$.

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Suppose $(\boldsymbol{\mu}, \mathbf{v})$ is an equilibrium pair of strategy n-tuples; then

(1) $\mathbf{v}$ must satisfy the *vote-pivotal* constraints: for all i, $v(t_i, s_i, \mathbf{m})$ is a best response conditional on i's vote being pivotal;

(2) $\boldsymbol{\mu}$ must satisfy the *message-pivotal* constraints: for all i, $\mu(t_i, s_i)$ is a best response conditional on i's message being pivotal with respect to the final committee outcome, given $\mathbf{v}$.

Unfortunately, there is in general no nice relationship between vote-pivotal and message-pivotal constraints

For example, in a 3-person/3-signal version of the CJ model with majority rule, Austen-Smith & Feddersen (2005) find 8 distinct pure strategy equilibria that differ *only* with respect to voting strategies; that is -

for a given situation $(\mathbf{t}, \mathbf{s})$, the realized debate $\mathbf{m} = \mu(\mathbf{t}, \mathbf{s})$ is invariant across equilibria;

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But first ...

III A Mechanism Design Approach

From a pragmatic perspective, jointly analysing the vote- and message-pivotal constraints is typically intractable in anything but the simplest environments.

From a conceptual perspective, the descriptive and normative limitations imposed by any particular communication protocol (such as a single round of simultaneous cheap talk) are undesirable.

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From a conceptual perspective, the descriptive and normative limitations imposed by any particular communication protocol (such as a single round of simultaneous cheap talk) are undesirable.

A more abstract mechanism design approach seems sensible, therefore.

Let $\theta_i \in \Theta_i$ be i's generalized type and $\Theta = \Pi_{i \in N} \Theta_i$

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For all $\boldsymbol{\theta} = (\theta_1, \ldots, \theta_n) \in \Theta$, let $p(\boldsymbol{\theta}) > 0$ be the probability that $\boldsymbol{\theta}$ is the realized type-profile.

Types are private information

$u_i(x, \theta_i, \boldsymbol{\theta}_{-i}) \in \mathbb{R}$ is i's payoff from committee choice $x \in \{A, B\}$

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Suppose first that there exists a mediator and, wlog (Revelation Principle), consider the following direct mechanism.

- Each individual $i \in N$ privately (and costlessly) reports a type $\theta_i \in \Theta_i$ to the mediator

- Given the reported profile $\boldsymbol{\theta} \in \Theta$, the mediator selects a vote profile $\mathbf{v}(\boldsymbol{\theta}) = (v_1(\boldsymbol{\theta}), \ldots, v_n(\boldsymbol{\theta}))$ according to a distribution $\gamma(\boldsymbol{\theta})$ and, for all $i \in N$, recommends i vote $v_i(\boldsymbol{\theta})$.

- Given the recommendation, each individual votes as she chooses

- Alternative B is chosen if and only if it receives at least q votes, $q \leq n$.

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Given a particular q-rule, let Γ_q denote the set of *sequential equilibrium* outcomes under the mechanism.

Theorem (Gerardi & Yariv 2007)

$\Gamma_1, \Gamma_n \subseteq \Gamma_2 = \Gamma_3 = \ldots = \Gamma_{n-1}$.

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Intuition Sequential equilibria do not preclude weakly dominated voting strategies;

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this effectively makes all *nonunanimous* q-rules equivalent at the communication stage.

Committee debate rarely (never?) involves an impartial mediator.

Let $\mathcal{C}$ denote the following communication protocol:

All $i \in N$ simultaneously make cheap talk public statements, $\mu_i(\theta_i) \in M_i$

For $i = 3, \ldots, n$, $M_i \equiv \Theta_i$ and, for $j = 1, 2$, $M_j \equiv \Theta_j \times [0, 1]$.

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Intuition Essentially the same - but here, individuals $j = 1, 2$ each report a number chosen according to a uniform distribution on $[0, 1]$ that jointly coordinates all individuals voting unanimously for an alternative defined by the reported type profile.

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Definition

An individual i's strategy $\sigma_i = (\mu_i, v_i)$ is *ex ante weakly undominated* if there is no distinct σ_i' such that

$$E_{\theta_i} E_{[\boldsymbol{\theta}_{-i}|\theta_i]} \left[u_i(\cdot, \theta_i, \boldsymbol{\theta}_{-i}) | \sigma_i, \boldsymbol{\sigma}_{-i} \right] \geq E_{\theta_i} E_{[\boldsymbol{\theta}_{-i}|\theta_i]} \left[u_i(\cdot, \theta_i, \boldsymbol{\theta}_{-i}) | \sigma_i', \boldsymbol{\sigma}_{-i} \right]$$

for all $\boldsymbol{\sigma}_{-i}$ with at least one inequality strict.

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To address (3), voting has to matter and voting matters with weakly undominated or trembling hand perfect voting strategies, *given* any debate.

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Assume the deliberative committee model described in Sections II(1) and II(2):

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the equilibrium concept is perfect Bayesian with weakly undominated voting strategies.

Consider the existence of equilibria in which all signals are credibly revealed in debate.

If there are such separating equilibria, then (given a two-alternative agenda), all individuals have a unique weakly undominated voting strategy: vote sincerely conditional on the shared information.

two properties ...

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Consensus For all $\mathbf{t} = (t_1, ..., t_n) \in \mathbf{T}$, $\mathbf{S}(\mathbf{t}) \equiv \cap_{i \in N} \mathbf{S}_{t_i} \neq \emptyset$.

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Let $\succ$ be an ordering on S for which the following condition obtains

Monotonicity For any $s, s' \in S$ such that $s \succ s'$ and $\mathbf{s}_- \in \mathbf{S}^{n-1}$, let $\mathbf{s} = (\mathbf{s}_-, s) \in \mathbf{S}$ and $\mathbf{s}' = (\mathbf{s}_-, s') \in \mathbf{S}$. Then for all $t \in T$, $u(B, t, \mathbf{s}) > u(B, t, \mathbf{s}')$ and $u(A, t, \mathbf{s}) < u(A, t, \mathbf{s}')$.

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A *message* strategy profile $\boldsymbol{\mu}$ is *fully revealing* if, for all pairs of distinct signals $s, s' \in S$, $[\cup_{t \in T} \mu(t, s)] \cap [\cup_{t \in T} \mu(t, s')] = \emptyset$.

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Definition

A perfect Bayesian equilibrium $(\boldsymbol{\mu}, \mathbf{v})$ is a *fully revealing debate equilibrium* (FRDE) if $\boldsymbol{\mu}$ is fully revealing and $\mathbf{v}$ is a profile of weakly undominated voting strategies.

and two theorems

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Theorem (Coughlan 2000)

Suppose the bias profile $\mathbf{t}$ *is common knowledge and assume consensus and monotonicity. Then for all q-rules,* $n/2 < q \leq n$*, there exists a FRDE if and only if the committee is not minimally diverse.*

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Note: Coughlan (2000) assumes $T = (0, 1)$ and $S = M = \{a, b\}$. Hence, minimal diversity can be consistent with heterogeneous bias-types.

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Note: Coughlan (2000) assumes $T = (0, 1)$ and $S = M = \{a, b\}$. Hence, minimal diversity can be consistent with heterogeneous bias-types.

Theorem (Austen-Smith & Feddersen 2006)

Assume consensus and monotonicity. Then there exists a FRDE under unanimity rule if and only if the committee is not minimally diverse. Moreover, the necessity claim for unanimity rule does not generalize to q-rules with $n/2 < q < n$*.*

Comparing Coughlan's result with that of A-S&F yields two recommendations (other things being equal) for designers who wish to encourage full information revelation in debate:

(1) *Don't* use unanimity rule;

(2) *Don't* require committee members to declare their private biases before deliberating.

Intuition Under non-unanimous q-rules and conditional on being message pivotal, individuals are uncertain about whether or not they are in a de facto winning coalition -

if a member of the winning coalition, then full revelation in debate is a best response

if a member of the losing coalition, then concealing private information is a best response

The best response depends on the relative likelihoods of these events

Conditioning on being message-pivotal reveals decision-relevant information about others' signals *and* others' bias-types, despite biases and signals being uncorrelated.

Some remarks

Meirowitz (2007) exploits correlation among bias-types, rather than among signals, to induce truth-telling under majority rule in a two-type model without consensus (see also Meirowitz 2006).

The difficulty of supporting full revelation in debate under unanimity rule has also been observed by Doraszelski, Gerardi & Squintani (2004) for $n = 2$ and Austen-Smith & Feddersen (2005) in an $n = 3$ model in which one of three available signals is wholly uninformative.

The intuition underlying Austen-Smith & Feddersen (2006) result also yields that (loosely speaking) the subsets of parameters for which FRDE's exist for any given q-rule shrinks monotonically as q increases from simple majority rule to unanimity rule.

Example $N = \{1, 2, 3\}$, $X = \Omega = \{A, B\}$

The prior belief that A is the correct decision ($\omega = A$) is $1/2$.

Assume: $T = \{h, l\}$, $M = S = \{a, b\}$ and, $\forall i \in N$,

$$\Pr[t_i = h] = r \in (0, 1), \Pr[s_i = z | \omega = Z] = p \in (\tfrac{1}{2}, 1).$$

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Individual bias types and signals are private information.

Preferences:

$$u(A, h, \mathbf{s}) = -1 - u(B, h, \mathbf{s}) = \begin{cases} 0 & \textit{if} \quad \mathbf{s} \neq (b, b, b) \\ -1 & \textit{if} \quad \mathbf{s} = (b, b, b) \end{cases}$$

and

$$u(A, l, \mathbf{s}) = -1 - u(B, l, \mathbf{s}) = \begin{cases} 0 & \textit{if} \quad \mathbf{s} = (a, a, a) \\ -1 & \textit{if} \quad \mathbf{s} \neq (a, a, a) \end{cases} .$$

So

$$\begin{aligned} \mathbf{S}_h &= \{(b, b, b)\}, \\ \mathbf{S}_l &= \mathbf{S} \backslash \{(a, a, a)\} \end{aligned}$$

and both Consensus and Monotonicity obtain.

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Suppose $t_j = l$ and $s_j = a$: given both $i \neq j$ reveal their signals truthfully in debate, what should j say?

(1) *Unanimity rule*, $q = 3$.

There is a *unique* message-pivotal event for j

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Under unanimity rule, therefore, there can be no FRDE if $\Pr[\mathbf{t} \neq (t, t, t)] > 0$.

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Piv-2 $\Rightarrow$ j strictly prefers to tell the truth,reporting $m_3 = a$.

Truth-telling in debate is incentive compatible for j, therefore, iff

$$\Pr(\textit{Piv-2}|s_j = a) \geq \Pr(\textit{Piv-1}|s_j = a)$$

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Rehearsing similar calculations for $t_j = h$ and $s_j = b$, we find there exists a FRDE under majority rule iff

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Conditioning on being message-pivotal, however, the minority type has no incentive to reveal her signal truthfully in debate whenever it is common knowledge that $\mathbf{t} \neq (t, t, t)$. $\square$

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both of the others have the b signal and are both h types.

Therefore, if j is message-pivotal and it is relatively more likely that others share j's signal, then it must also be relatively more likely that the others share j's bias type.

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Theorem (Van Weelden 2008)

Assume consensus and monotonicity. Suppose deliberation is sequential with common knowledge about the order in which committee members speak. Then for all q–rules, $n/2 < q < n$, there exists a FRDE if and only if the committee is not minimally diverse.

Intuition FRDE's are supported by individuals being uncertain which particular message-pivot event obtains:

in some events, the speaker is a member of a full information decisive coalition, so best-responds by truth-telling;

in others, the speaker is not in a full information decisive coalition, so best-responds by dissembling.

Moreover, the sets of signal profiles consistent with the two types of pivot event have an empty intersection.

If all others reveal their signals truthfully in sequential debate and j is message-pivotal, therefore, j knows for sure which type of message-pivot event obtains.

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(6) What are the optimal voting rules with and without deliberation? Are they the same?