Political Economy
Theory and Experiments
Lecture 6

Francesco Squintani
University of Warwick

email: f.squintani@warwick.ac.uk

Jury and committee voting

. In juries and committees, information aggregation leads to collective decisions, usually made by voting.

. Committee members have access to private information.

. Jurors may interpret differently the evidence they are presented.

. In deciding how to vote, each agent considers alternatives on the basis of her information.

. When voting, she conditions her choice on being pivotal, i.e. on changing the outcome of the vote.

. The event of being pivotal is informative.

. It gives the agent information about the private information held by other agents, as this information determines their votes.

General jury voting model

. A jury/committee $N = \{1, 2, ..., n\}$, $n \geq 2$, must choose an alternative $d \in \{0, 1\}$; let 0 be the status quo.

. Each j has a bias $b_j \in [0, 1]$ that may be private information. The distribution F of b_j on $[0, 1]$ is common knowledge.

. Given unknown state $x \in \{0, 1\}$, payoff of agent j of bias b_j is

$$u_j(x, d, b_j) = \begin{cases} 0 & \text{if } d = x \\ -b_j & \text{if } \ d = 1,\ x = 0 \\ -(1 - b_j) & \text{if } \ d = 0,\ x = 1. \end{cases}$$

. Each j has a private signal $s_j \in \{0, 1\}$, $\Pr(s_j = x|x) > 1/2$, signals are independent across jurors.

. Each j's voting strategy is a function $v_j : [0, 1] \times \{0, 1\} \to \{0, 1\}$ that maps every type profile into a vote 0 or 1.

. There is a quorum rule q: $d(v) = 1$ if and only if $\sum_{j \in N} v_j \geq q$.

. Voters' preferences over alternatives depend on information:
For any bias $b \in [0,1]$ there is a set $S_b \subset \{0,1\}^n$ such that
$s \in S_b$ implies $Eu(0,b|s) > Eu(1,b|s)$ and
$s \notin S_b$ implies $Eu(0,b|s) < Eu(1,b|s)$.

. Beliefs over the optimal alternative are monotonic in signals:
For any $s, s' \in \{0,1\}^n$ such that $s > s'$, $Eu(1,b|s) > Eu(1,b|s')$ and $Eu(0,b|s) < Eu(0,b|s')$ for every $b \in [0,1]$.

. There exists signal profiles s such that all voters prefer 1:
For all bias profiles $b_1, ..., b_n \in [0,1]$, the set $\cap_{j \in N} S_{b_j} \neq \emptyset$.

. A committee is "minimally diverse" if there are members who disagree on the optimal alternative for the same signals:
There exist $b, b' \in [0,1]$ such that $S_b \neq S_{b'}$.

Unanimity in Homogeneous Juries (Feddersen & Pesendorfer 1998)

. $d{=}A$ stands for a defendant's acquittal and $d{=}C$ for conviction.

. With prob. π, defendant is guilty $x{=}G$, else she is innocent $x{=}I$.

. Each juror j has a signal $s_j \in \{g, i\}$, such that $\Pr(s_j = g|G) = p_g > 1/2$ and $\Pr(s_j = i|I) = p_i > 1/2$.

. Each j votes $v_j \in \{c, a\}$, c to convict, and to a acquit.

. The decision is $d = A$ unless all jurors vote $v_j = c$.

. Each juror j's bias is b, her payoff is:

$$u_j(x, d, b) = \begin{cases} -(1-b) & \text{if } \; d = A, \; x = G \\ -b & \text{if } \; d = C, \; x = I \\ 0 & \text{otherwise.} \end{cases}$$

- Truthful voting is $v_j = a$ if $s_j = i$, and $v_j = c$ if $s_j = g$.
- Let r be the probability of G, given a juror j's information.
- Her expected payoff is $-r(1-b)$ for A and $-(1-r)b$ for C.
- The juror j prefers A if $r < b$, and C if $r > b$.
- We prove that truthful voting is not a Bayesian equilibrium.
  - Consider juror j with signal i and suppose by contradiction that every other juror votes truthfully.
  - j's vote has no effect on d unless every other juror's signal is g.
  - Hence, j votes $v_j = a$ if and only if

$$Pr(G|i, g, ..., g) = \frac{(1-p_g)p_g^{n-1}\pi}{(1-p_g)p_g^{n-1}\pi + p_i(1-p_i)^{n-1}(1-\pi)} < b.$$

  - Unless b is large or n is small, voting truthfully is not a BNE.

. I contruct a symmetric mixed strategy equilibrium in which each type g juror votes C, and each type i juror randomizes.

. The mixed strategy $\sigma_i(C)$ of type i juror is such that:

$$b = \frac{(1-p_g)(p_g+(1-p_g)\sigma_i(C))^{n-1}\pi}{(1-p_g)(p_g+(1-p_g)\sigma_i(C))^{n-1}\pi+p_i(1-p_i+p_i\sigma_i(C))^{n-1}(1-\pi)}.$$

. Hence: $\sigma_i(C) = \frac{p_g\chi-(1-p_i)}{p_i-(1-p_g)\chi}$ where $\chi = \sqrt[n-1]{\frac{\pi(1-p_g)(1-b)}{(1-\pi)p_i b}}$.

. As $n \to \infty$, $\chi \to 1$ and hence $\sigma_i(C) \to 1$.

Jurors whose signals point to innocence likely vote for conviction.

. The probability that an innocent defendant is convicted $Pr(C|I;n) = [1-(1-\sigma_i(C))(1-p_i)]^n$ increases in n.

A larger jury makes more likely an innocent defendant convicted.

Quorum rules and heterogenous preferences

. For every juror j, the bias $b_j \in (0,1)$ is private information.

. Let $\Delta u_j(s_j, b_j) = \sum_{\{v_{-j}:|\{k:v_k=c\}|=q-1\}} [Eu_j(d(v_j{=}c, v_{-j}), x, b_j)$
$-Eu_j(d(v_j{=}a, v_{-j}), x, b_j)] \Pr(v_{-j}|s_j)$.

. The payoff difference Δu_j is linear in b_j for both $s_j = i, g$.

. Ruling out dominated strategies, Δ is strictly decreasing in b_j.

. A cutoff strategy is s.t. j votes $v_j = c$ if only if $\Delta u_j(s_j, b_j) \geq 0$, i.e., iff $b_j < \Pr(x{=}C|s_j, |\{k \neq j : v_k{=}c\}| = q-1)$.

. Every undominated equilibrium is in cutoff strategies.

. If a truthful voting equilibrium exists under unanimous rule, then it exists under with any quorum q.

Deliberation

. The above analysis presumes that not all information has been aggregated in deliberation prior to the vote.

. If voters deliberate and all voters' biases b_j coincide, then of course they share all information in deliberation.

. Models of straw poll show that there may exist informative equilibria even if biases differ among voters.

. But full information aggregation via straw poll requires that the voters are unsure about each other's biases.

. Constrained first best may be achieved via a stochastic direct mechanism unless the quorum is unanimity.

. The optimal mechanism may be implemented with deliberation and voting with randomized quorum.

Straw Polls (Austen-Smith and Feddersen 2006)

. Each j's message strategy is $m_j : [0,1] \times \{0,1\} \to \{0,1\}$.

. j's voting strategy is $v_j : [0,1] \times \{0,1\} \times \{0,1\}^{n-1} \to \{0,1\}$ that maps every straw poll into a voting decision.

Proposition Preference uncertainty can support full information sharing in straw poll under majority rule.

. Full information aggregation via straw poll requires that the voters are unsure about each other's biases.

. Else, the agent with the least moderate bias in the committee would not reveal information.

Example Suppose that $N = \{1, 2, 3\}$, $d \in \{A, C\}$, $\Pr(G) = \Pr(I) = 1/2$, and voting is by majority.

. Each juror j has signal $s_j = g, i$, $\Pr(g|G) = Pr(i|I) = p > 1/2$.

. For each j, bias $b_j = \ell, h$, is private information, $\Pr(b_j = h) = q$.

. Bias type h prefers A unless $s = (g, g, g)$:

$u_h(C, (g, g, g)) = 0$, $u_h(A, (g, g, g)) = -1$,

$u_h(A, s) = 0$, $u_h(C, s) = -1$, if $s \neq (g, g, g)$.

. Bias type ℓ prefers C unless $s = (i, i, i)$:

$u_\ell(A, (i, i, i)) = 0$, $u_\ell(C, (i, i, i)) = -1$,

$u_\ell(C, s) = 0$, $u_\ell(A, s) = -1$, if $s \neq (i, i, i)$.

. I show existence of equilibrium with truthful communication.

. Consider a juror j with bias $b_j = \ell$ and signal $s_j = i$.

. If the bias types of jurors $k \neq j$ differ, then juror j and the other ℓ type juror are a voting majority.

. Then, there is no reason for j to lie at the message stage.

. If the jurors $k \neq j$ have the same bias type, juror j changes the final outcome d by lying only in one of these events:

E_1. $b_k = h$ and $s_k = g$ for both jurors $k \neq j$,

E_2. $b_k = \ell$ and $s_k = i$ for both jurors $k \neq j$.

. j loses 1 by telling the truth over lying in E_1, and gains 1 in E_2.

. Truth-telling is a best response for j with $b_j = \ell$ and $s_j = i$ iff

$$\Pr(E_2|s_j = i) = (1-q)^2[(1-p)^3 + p^3] \geq$$
$$\Pr(E_2|s_j = i) = q^2[p(1-p)^2 + p^2(1-p)].$$

. The same is true for j with $b_j = h$ and $s_j = g$, by symmetry.

Proposition There exists a fully revealing equilibrium under unanimity rule if and only if the committee is not minimally diverse.

. Else, least moderate bias agents would not reveal information.

Proposition If there exists a fully revealing equilibrium with the unanimity rule then so is the case under all *q*-rules.

. Extreme bias agents have less influence on the vote, and each voter's vote is pivotal when the others' votes are more balanced.

Proposition (Van Weelden 2008) If the straw poll takes place sequentially, a fully revealing equilibrium exists if if and only if the committee is not minimally diverse, regardless of the quorum rule.

. Suppose an extreme bias voter speaks last. If the other voters spoke truthfully, she would not be truthful for all signal profiles.

Two agent case (Doraszelski, Gerardi, and Squintani, 2000)

. Each juror j signal s_j s.t. $\Pr\{s_j = x|x\} = p > 1/2$.

. Each j's bias b_j is private information, uniformly distr. on $U[0, 1]$.

. Status quo is $d = 1$, approving $d = 0$ requires both votes.

. Every equilibrium is identified by message thresholds b_s^* and voting thresholds $b^*_{s,\hat{m},m}$, with $\hat{m} \in \{0, 1\}$ and $m \in \{0, 1\}$.

. Juror j with signal s sends $m_j = 1$ if and only if $b_j > b_s^*$.

. Juror j with signal s, who received message $\hat{m}$, and sent message m, votes $v_j = 1$ if and only if $b_j > b^*_{s,\hat{m},m}$.

. The equilibrium concept is Perfect Bayesian Equilibrium.

. The welfare concept is the sum of ex-ante equilibrium payoffs.

. There are 3 equilibria, ranked in terms of welfare.

. the babbling equilibrium,

. an informative eqm. with $b^*_{s11} \leq b^*_{s01} = b^*_s < b^*_{s00} = b^*_{s10}$,

. an informative eqm. with $b^*_{s01} < b^*_{s11} < b^*_s < b^*_{s00} < b^*_{s10}$.

. Extremist types express and vote according to their propensity.

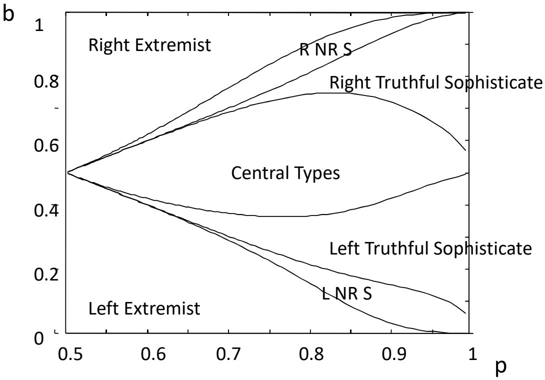
. Central types express and vote according to their signal.

. Sophisticated types vote according to the opponent's message if and only if their signal is in conflict with their biases.

. Message behaviors distinguish sophisticated types into non-revealing, and truthful ones, depending on their biases.

. The intermediate equilibrium is welfare equivalent to the optimal equilibrium of the straw poll game where only one voter speaks.

Top Equilibrium Cutoff Plot against Signal's Quality

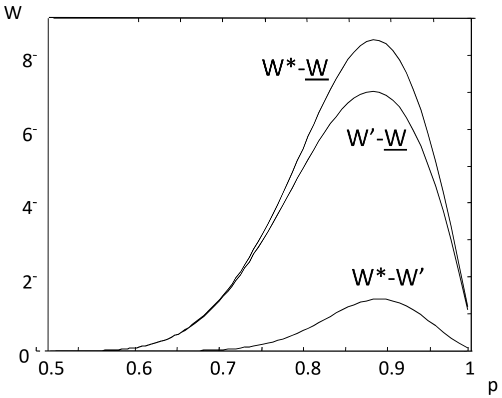


. When information is imprecise, most voters act based on their propensities.

. When information is precise, most voters are truthful, and vote according to opponent's message whenever their signal is in conflict with their propensity.

. Behavior is more diverse for intermediate information quality.

Equilibrium Welfare



. W* is the welfare of the most informative equilibrium.

. W' is the welfare of the intermediate equilibrium.

. <u>W</u> is the welfare of the babbling equilibrium.

Optimal deliberation (Gerardi and Yariv 2007)

. Let us consider a direct mechanism:

  . Each voter j (privately) reports her information (s_j, b_j) to a mediator, who then makes a recommendation $d(s, b)$.

  . A final vote on X and Y takes place according to a q rule.

. By the revelation principle, any equilibrium of a game of deliberation and voting can be achieved as eqm. of this mechanism with truthful reporting of (s_j, b_j) and approval of $d(s, b)$.

. Every non-unanimous quorum q has unanimous equilibria: voters truthfully report, the mediator proposal is unanimously approved.

. Constrained first best is achieved unless quorum is unanimity.

. Voting can only harm welfare in the optimal direct mechanism.

. This begs a question: why do committees decide through voting?

. Direct mechanism can be implemented as "randomized voting":

. Voters share private information (s_j, b_j) with each other.

. The decision $d(s, b)$ is chosen randomly, with prob. $P|s, b$ function of individual reports.

. Because final decisions are public, there is no use for confidential reports, and no need for a mediator.

. These results were tested in the lab (Goeree and Yariv 2011).

. Deliberation in the form of unconstrained communication before the vote significantly improved efficiency.

. Subjects revealed private information with public messages.

. Such messages were a good predictor for final group choices.

Summary

. I have presented models of information aggregation in juries and committees.

. Voting without deliberation leads to information aggregation distortions when the quorum is too demanding (e.g., unanimity).

. Straw polls improve information aggregation, but full aggregation is impossible with unanimity (Austen-Smith and Feddersen 2006).

. Optimal deliberation through a mediator and voting achieve constrained first best unless the quorum is unanimity.

. Optimal deliberation can be implemented without a mediator with “randomized quorum” voting rules (Gerardi and Yariv 2007).

Next Lecture

. I turn to consider international relations and conflict.

. Because conflict is costly, there should always be a negotiation outcome that dominates war (Coase theorem).

. Political scientists identified possible sources of conflict:

- . commitment problem leading to preventive/preemptive wars,
- . multilateral interests,
- . agency problem caused by biased leaders.

. I present a model that describes conflict as a "Hobbesian trap" caused by private information.

. I show that communication reduces risk of international conflict.