Theoretical Political Economy
Communication Games

Lecture 12

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Asymmetric information and conflict

. Players $i = A, B$ dispute a stake of value 1.

. In case of war, i pays cost c_i and wins with prob. p_i.

. Win probabilities p_A and $p_B = 1 - p_A$ are common knowledge.

. If A knows c_B, it offers $x_B \geq p_B - c_B$ and B accepts.
A's share $x_A = p_A + c_B$ is greater than war payoff $p_A - c_A$.

. Say $c_B \in \{c_L, c_H\}$ is unknown to A, with $\Pr(c_B = c_L) = q$.

. The high offer $x_B = p_B - c_L$ yields a low share $x_A = p_A + c_L$.

. The low offer $x_A = p_B - c_H$ yields high share $x_A = p_A + c_H$ with prob. $1 - q$ and war payoff $p_A - c_A$ with prob. q.

. If $(1 - q)c_H - qc_A > c_L$, then A prefers to take the risk of the low offer, and war obtains with positive prob.

- The private information in the above game is of private value.
- Let's see a game where information is of interdependent value.
- Player B's army strength a_B is either high or low, with $\Pr(a_B = H) = q$.
- If $a_B = H$, player B wins with probability $p_H > 1/2$, and if $a_B = L$, B wins with probability $p_L = 1 - p_H$.
- War shrinks the stake to $\theta < 1$. There are no private costs.
- A's high offer $x_B = p_H$ avoids war and yields $x_A = p_L$, low offer $x_B = p_L$ yields $x_A = p_H$ with prob. $1 - q$ and war with prob. q.
- If $(1 - q)p_H + qp_L\theta > p_L$, then A prefers to take the risk of the low offer and war.

Mediation and private values (Fey and Ramsay 2009)

. Conflict is caused by asymmetric information of private value: cost of war, willingness to fight, ...

. Mechanisms aimed at sharing information and building trust reduce the risk of war.

. Bargaining through diplomatic channels may be effective.

. Peace talks act as a coordination device on possible agreements, and improve the chance of peace.

. Mediation does not improve chances of peace over unmediated peace talks.

The model

- Each player i's war cost $c_i \in \{c_L, c_H\}$ is private information.
- Each player i wins war with probability $p_i = 1/2$.
- By revelation principle, a mediation protocol without loss is:
  - each player i privately reports $\hat{m}_i \in \{c_L, c_H\}$ to the mediator;
  - with prob. $\rho(\hat{m}_A, \hat{m}_B)$, mediator proposes $x \in [0, 1]$ drawn from $F|\hat{m}_A, \hat{m}_B$, with prob. $1 - \rho(\hat{m}_A, \hat{m}_B)$ mediator quits;
  - A and B fight if mediator quits. Else, A and B settle iff they simultaneously accept $x_A = x$ and $x_B = 1 - x$.
- There is also no loss in considering only equilibria in which:
  - players reveal their types to the mediator, $c_i = \hat{m}_i$,
  - and accept all split proposals $(x, 1 - x)$ made by the mediator.

. These equilibria are characterized by the following constraints:

IR. Ex-post individual rationality: for all c_A, c_B,

$$x \geq p_A - c_A,\ 1 - x \geq p_B - c_B, \text{ for all } x \in Supp(F|c_A, c_B).$$

IC*. Interim incentive compatibility: for all c_A, c'_A, c_B, c'_B,

$$\begin{aligned}
&\textstyle\sum_{c_B}[\rho(c_A, c_B)\int_0^1 \max\{x, p_A - c_A\}dF(x|c_A, c_B) \\
&\qquad\qquad + [1 - \rho(c_A, c_B)](p_A - c_A)]\Pr(c_B) \\
&\quad \geq \textstyle\sum_{c_B}[\rho(c'_A, c_B)\int_0^1 \max\{x, p_A - c_A\}dF(x|c'_A, c_B) \\
&\qquad\qquad + [1 - \rho(c'_A, c_B)](p_A - c_A)]\Pr(c_B);
\end{aligned}$$

$$\begin{aligned}
&\textstyle\sum_{c_A}[\rho(c_A, c_B)\int_0^1 \max\{1 - x, p_B - c_B\}dF(x|c_A, c_B) \\
&\qquad\qquad + [1 - \rho(c_A, c_B)](p_B - c_B)]\Pr(c_A) \\
&\quad \geq \textstyle\sum_{c_A}[\rho(c_A, c'_B)\int_0^1 \max\{1 - x, p_B - c_B\}dF(x|c_A, c'_B) \\
&\qquad\qquad + [1 - \rho(c_A, c'_B)](p_B - c_B)]\Pr(c_A).
\end{aligned}$$

- Let us consider the following unmediated peace talks game:
  - players $i = A, B$ meet in peace talks and simultaneously exchange messages $\hat{m}_i \in \{c_L, c_H\}$ and $r_i \in [0, 1]$;
  - depending on r_A, r_B, $\hat{m}_A$, $\hat{m}_B$, either the meeting is a success: a split proposal (x_A, x_B) is selected for possible ratification, or the meeting fails: $(x_A, x_B) = (0, 0)$;
  - A and B simultaneously choose whether to accept or reject (x_A, x_B). A and B settle if and only if they both accept.

Proposition The set of mediation mechanism (F, q) outcomes that satisfy IR and IC* coincide with the set of equilibrium outcomes of the unmediated peace talks game.

Proof. By the revelation principle, unmediated talks cannot improve upon mediation.

. There is no gain in mediation as information is of private value.

. Knowing opponent's type c_j does not change i's expected payoff.

. The mediator role is only to randomly select split proposals.

. In equilibrium, un-mediated peace talks replicate optimal random selection of split proposals with a "jointly controlled lottery":

. $i = A, B$ reveals $\hat{m}_i = c_i$ and randomizes r_i uniformly on $[0, 1]$;

. for every $r_A, r_B \in [0, 1]$, let $\varphi(r_A, r_B) \equiv r_A + r_B - \lfloor r_A + r_B \rfloor$;

. if $\varphi(r_A, r_B) \leq \rho(\hat{m}_A, \hat{m}_B)$, then the meeting is a success: split $(x, 1 - x) = F^{-1}(\frac{\varphi(r_A, r_B)}{\rho(\hat{m}_A, \hat{m}_B)} | \hat{m}_A, \hat{m}_B)$ is selected, A and B accept split $(x, 1 - x)$ and settle;

. if $\varphi(r_A, r_B) > \rho(\hat{m}_A, \hat{m}_B)$, then meeting fails, A and B fight.

. Mixing $r_A, r_B \sim U[0, 1]$ is an equilibrium because, if j chooses $r_j \sim U[0, 1]$, then $\varphi(r_A, r_B) \sim U[0, 1]$, regardless of i's strategy.

Proposition Mediation (and unmediated peace talks) cannot achieve peace with probability one.

. War is the punishment for a high cost type to pretend that its war cost is low.

. Suppose by contradiction that a mediation mechanism (F, q) achieves peace with probability one.

. Then the IC^* constraints are violated, because there is no "punishment" for a lying high cost type.

Bargaining without peace talks

. Suppose that players bargain with a Nash demand game.

. Players $i = A, B$ simultaneously make demand x_i.

. If $x_A + x_B > 1$, then war initiates.

. If $x_A + x_B \leq 1$, each i gets $x_i[1 + \frac{1-x_A-x_B}{x_A+x_B}]$.

. The best equilibrium is such that player i of type c_H demands $p_i - c_H$ and player i of type c_L demands $1 - (p_j - c_H)$.

. Pairs of c_L types fight with probability one.

. Peace talks reduce prob. of war among c_L types to $\rho(c_L, c_L)$.

. Coordination by means of peace talks improves chance of peace relative to bargaining through standard diplomatic channels.

Interdependent values (Hörner, Morelli and Squintani 2013)

. Conflict is caused by asymmetric information of interdependent value: military strength, strength of alliances, foreign support, ...

. Communications through diplomatic channels reduces risk of war.

. The organization of peace talks improves the chance of peace.

. And mediation further improves chances of peace over unmediated peace talks.

. Arbitration need not improve peace chances over mediation.

The model

. Players A and B dispute a stake of value 1.

. In case of war then the value shrinks to $\theta < 1$.

. Each player i's strength $a_i \in \{L, H\}$ is private information, with $\Pr(a_i = H) = q$ independently across players.

. If $a_A = a_B$ then each i wins with prob. $= 1/2$, otherwise the stronger wins with prob. $p > 1/2$, where $p\theta > 1/2$.

. We reparametrize the model:

$\tau \equiv q/(1-q)$ is the odds ratio of H vs. L type;

$w \equiv \frac{p\theta - 1/2}{1/2 - \theta/2}$, is the benefit/cost ratio of war for H type.

. τ increases in q, whereas w increases in p and θ.

Unmediated peace talks

- A, B meet in peace talks and exchange $\hat{m}_i \in \{h, \ell\}$, $r_i \in [0,1]$.
- Based on $(\hat{m}_A, \hat{m}_B)$ and $\varphi(r_A, r_B)$, proposal (x_A, x_B) is selected.
- A, B simultaneously choose whether to accept (x_A, x_B) or not.
- In the optimal separating equilibrium:
  - Given messages (h, h), players coordinate on peace with split $(1/2, 1/2)$ with prob. ρ_H, and on war with prob. $1 - \rho_H$.
  - Given messages (h, ℓ) players coordinate on $(b, 1-b)$, $b > 1/2$, with prob. ρ_M, and on war with prob. $1 - \rho_M$.
  - Given messages (ℓ, ℓ) players coordinate $(1/2, 1/2)$ with prob. ρ_L and war with prob. $1 - \rho_L$.

- The best separating equilibrium $(b, \rho_L, \rho_M, \rho_H)$ maximizes

$$V = (1-q)^2 \rho_L + 2q(1-q)\rho_M + q^2 \rho_H$$

subject to sequential rationality (ex-post IR) constraints and to truthtelling (interim IC*) constraints.

Proposition In the unique best separating equilibrium, for $\tau < w$, LL dyads do not fight, $\rho_L = 1$, HH dyads fight with probability $1 - \rho_H > 0$, and the L-type IC* constraint binds.

- If $w \geq 1$ and/or $\tau \geq \frac{1}{1+w}$, then H-type IC* does not bind and $b = p\theta$; if $\tau < w/2$, then $\rho_H = 0$ and $\rho_M \in (0,1)$; if $\tau \geq w/2$ (which covers $\tau \geq \frac{1}{1+w}$), then $\rho_H \in (0,1)$ and $\rho_M = 0$.
- If $w < 1$ and $\tau < \frac{1}{1+w}$, then H-type IC* binds and $b > p\theta$; if $\tau < w/2$, then $\rho_H = 0$, $\rho_M \in (0,1)$; else, $\rho_H \in (0,1)$, $\rho_M = 1$.
- For $\tau \geq w$, neither L nor H types fight, $\rho_L = \rho_M = \rho_H = 1$.

Mediation

- By the revelation principle, mediation is represented as follows:
  - players report their types privately to the mediator;
  - mediator proposes split $(x, 1-x)$ or quits.
- We show the following symmetric mechanisms to be w.l.o.g.
  - After reports (h, h), mediator recommends $(1/2, 1/2)$ with prob. ρ_H, and quits with prob $1-\rho_H$.
  - After (h, ℓ), mediator recommends $(b, 1-b)$ with prob ρ_M, $(1/2, 1/2)$ with prob $\bar{\rho}_M$, and quits with prob $1-\rho_M-\bar{\rho}_M$.
  - After (ℓ, ℓ), mediator recommends $(1/2, 1/2)$ with prob ρ_L, $(b, 1-b)$ and $(1-b, b)$ with prob $\bar{\rho}_L$ each, and else quits.

. Optimal mediation mechanism $(b, \rho_L, \bar{\rho}_L, \rho_M, \bar{\rho}_M, \rho_H)$ maximizes

$$V = (1-q)^2(\rho_L + 2\bar{\rho}_L) + 2q(1-q)(\rho_M + \bar{\rho}_M) + q^2\rho_H$$

subject to ex-post IR and interim IC* constraints.

Proposition A solution to the mediator's problem is such that, for all $\tau < w$, L types do not fight, $\rho_L + 2\bar{\rho}_L = 1$. The L-type IC* constraint binds, the H type constraint IC* does not, and $b = p\theta$.

. For $w \geq 1$ and $\tau > w/2$, HH dyads fight with probability $1 - \rho_H \in (0, 1)$, HL dyads do not fight, $\rho_M + \bar{\rho}_M = 1$, and mediation strictly improves upon unmediated peace talks.

. For $w \geq 1$ and $\tau \leq w/2$, the solution coincides with the separating equilibrium of unmediated peace talks game, $\rho_L = 1$, $\bar{\rho}_M = 0$, $\rho_M \in (0, 1)$ and $\rho_H = 0$.

. For $w < 1$, there are unequal splits obtain in LL dyads, $\bar{\rho}_L > 0$, and mediation strictly improves upon unmediated peace talks.

. Hence, mediation improves on unmediated talks when war is costly ($w < 1$), and/or when strengths uncertain ($w/2 < \tau < w$).

. For $w \geq 1$, $\tau > w/2$, mediator lowers incentives to exaggerate strength by not always proposing $(b, 1-b)$ if messages are (h, ℓ).

. Mediator proposes $(1/2, 1/2)$ with prob. $\bar{\rho}_M > 0$ after (h, ℓ).

. This allows to satisfy the L-type IC* constraint with a lower probability of war in HH dyads.

. This is equivalent to not always revealing a self-reported H type that she is facing a L type.

. Of course, this cannot be achieved in face-to-face meetings without a mediator.

. When conflict is costly, $w < 1$, mediator lowers incentive to hide strength, by not always offering $(1/2, 1/2)$ after (ℓ, ℓ) messages.

. This is equivalent to not always revealing a self-reported L type that she is facing a L type.

. It reduces the payoff for hiding strength and then waging war against L types: a H type reporting to be a L type will not always know when she is facing a L type.

. This allows to satisfy the H-type IC* constraint without increasing b, i.e. without tightening the L-type IC* constraint.

. Hence, this allows to keep war probability low in dyads with at least one H type.

Arbitration and enforcement

. Because nations are sovereign, mediators cannot enforce peace. Hence, we have imposed ex-post IR and interim IC* constraints.

. Let us consider arbitration: if parties choose to participate, the arbitrator's decisions are enforced by an external agency.

. By revelation principle, arbitration may be formulated as follows:

- . Players report types to an arbitrator who makes decisions;
- . after reports (ℓ, ℓ), split $(1/2, 1/2)$ is enforced with prob. ρ_L, and else the arbitrator quits and war occurs;
- . after reports (h, ℓ), $(b, 1-b)$ is enforced with prob. ρ_M;
- . after reports (h, h), $(1/2, 1/2)$ is enforced with prob. ρ_H.

. The arbitrator chooses $b, \rho_L, \rho_M, \rho_H$ to maximize prob. of peace V subject to interim IR and interim IC constraints.

Proposition Optimal arbitration mechanism (with enforcement power) yields same ex-ante probability of peace V as the optimal self-enforcing mediation mechanism.

. In arbitration, L-type IC and H-type interim IR constraints bind.

. In mediation, L-type IC* and H-type ex-post IR constraints bind.

. L-type IC $=$ L-type IC*, because a L type never fights after exaggerating strength in solution of optimal mediation program.

. H-type interim IR arbitration constraint is weaker than the two H-type ex-post IR mediation constraints.

. Arbitration solution would violate H-type ex-post IR constraints.

. Mediator "confuses" self-reported H types to lower their payoff, and recovers the probability of peace of the arbitration solution.

Summary

. I have focused on conflict caused by asymmetric information

. Mechanisms that reduce asymmetric information
and build trust among disputants reduce the risk of war.

. Bargaining through diplomatic channels may be effective.

. Peace talks act as a coordination device on possible aggreements,
and improve the chance of peace.

. Mediation further improves chances of peace when asymmetric
information is of interdependent value.

. Arbitration need not improve over mediation.

. Peace cannot be achieved with probability one.