Formal Analysis: Private information and war

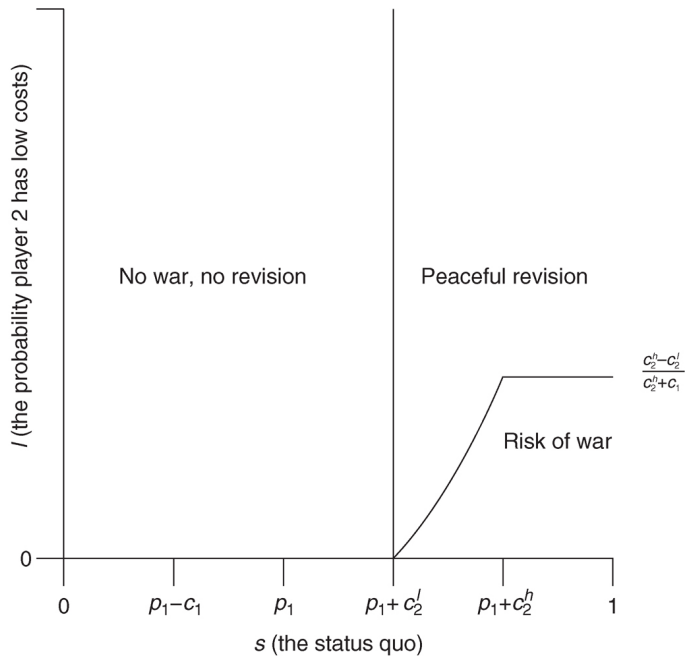
Andy Eggers

Week 4 Session 2

Quiz

Kydd Section 6.2 considers a bargaining game with uncertainty over the cost of conflict.

Player 1 does not know Player 2's cost of conflict, c_2: $c_2 = c_2^l$ with probability l and with probability $c_2 = c_2^h$ with probability $1 - l$, where $c_2^l < c_2^h$. The bargaining game is the standard bargaining game with linear payoffs: Player 1 makes a proposal x; Player 2 can accept (leading to payoffs $x, 1 - x$ for players 1 and 2, respectively), reject (leading to payoffs $s, 1 - s$), or attack (leading to expected payoffs $p_1 - c_1, 1 - p_1 - c_2$).



The figure shows the equilibria of the game in terms of l and s.

Question: Explain in 2-4 sentences why there is a risk of war in equilibrium when s is high and l is low.

Suggested quiz answers

Long answer: When s is high, player 1 must choose whether to make a *generous* proposal that would avert war even if player 2 has a low cost of fighting or a *stingy* proposal that averts war only if player 2 has a high cost of fighting. If player 2 actually is the high-cost type, the stingy proposal is better for player 1 because it leaves player 1 with a higher share of the resource; if player 2 is actually the low-cost type, the generous proposal is better for player 1 because it avoids a war. Thus player 1 faces the "risk-return tradeoff". If the probability of the low type (l) is low enough, then the stingy proposal is optimal for player 1 even though it involves a risk of war.

Shorter but still acceptable answer: When s is high and l is low, the optimal proposal by player 1 only avoids war if player 2 has a high cost of war. Thus there is a risk of war in equilibrium.

Fundamental theorem of crisis bargaining

Ramsay (2017) writes that bargaining theory has yielded

> *what might be called the fundamental theorem of crisis bargaining: The optimal diplomatic or bargaining strategy is not the one with no risk of war. That is, there is a prevalent risk–reward trade-off in the negotiation process when countries face uncertainty about their rival's willingness to fight.*

Same idea in forming a coalition, buying a house, seeking romantic partners (?), ...

Modeling mistrust

Prisoner's dilemma, Assurance game, or other?

\begin{center}**Preventive war game with mistrust** \

		Player 2	
		Not attack	Attack
Player 1	Not attack	s_1, s_2	$p_1^2 - c_1, p_2^f - c_2$
	Attack	$p_1^f - c_1, p_2^s - c_2$	$p_1 - c_1, p_2 - c_2$

Information asymmetry and separating equilibria

The problem with mutual optimism as an explanation for war

Setup: Alice and Bob play a game of dice. In private, each rolls one fair six-sided dice and decides whether to "fight" or not.

If both choose to fight, each player must pay a cost $c \in (0, 1/6)$. The player with the higher roll wins. The contest payoff is 1 for the winner, -1 for the loser, and 0 for both in the event of a tie.

If either decides not to fight, each get a payoff of 0.

Question:

1. Suppose Bob chooses to fight regardless of the value on the dice. Would "fight if 4 or more" be optimal for Alice?
2. Suppose Bob plays "fight if 4 or more". Would "fight if 4 or more" be optimal for Alice?
3. Suppose Bob plays "fight if 6 or more". Would "fight if 6 or more" be optimal for Alice?

Ask the experts

> *Always remember, however sure you are that you can easily win, that there would not be a war if the other man did not think he also had a chance. (Winston Churchill, 1930)*

But also remember: leaders need to be reminded of this.

Mechanism design and "game-free results"

"Game-free results"

[Crisis bargaining literatrue] resembles more a collection of theoretical anecdotes than a systematic body of organized reasoning linking uncertainty to the risk of costly war. The formal literature on international conflict contains a wide variety of modeling approaches. . . . [O]ur collective knowledge regarding the relationship between uncertainty, the incentive to misrepresent, and war is entangled with countless other assumptions about the type of uncertainty, the timing of actions, the bargaining protocol, and various other assumptions made for either practical or substantive reasons. While this diversity of models is not necessarily a cause for alarm, with some regularity we discover that central conclusions reached from the study of one particular model are overturned when new game forms are considered. (Fey and Ramsay, 2011)

Mechanism design approach

Revelation principle (Myerson, 1979): Suppose $s*$ is a Bayesian-Nash equilibrium of a crisis bargaining game. Then there exists an *incentive-compatible direct mechanism* yielding the same outcome.

Definitions: In the case of crisis bargaining games,

- a **direct mechanism** is a game in which each player's only action is to reports a **type** (e.g. "My cost of war is low"); the game assigns a probability of war and a payoff to each profile of actions/types
- an **incentive-compatible direct mechanism** is a direct mechanism in which the players report their true types

What does this mean? If they can show that there is no incentive-compatible direct mechanism yielding a given outcome, they can show that there is no game that would have that equilibrium.

What Fey and Ramsay (2011) show (in part)

If costs (c_1, c_2) are private information but power (p_1) is common knowledge,

- there is a crisis-bargaining game form that always yields peace in which player 1 gets $x = p_1$, player 2 gets $1 - x$.
- any crisis-bargaining game form and equilibrium in which payoffs depend on type has a positive probability of war