Discussion: Game Theory and the First World War by Roger Myerson

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Summary

- Many, many ideas packed into 24 pages!
- Behavioral Explanations (Ransom book): Overconfidence and risk-seeking might be a cause of war. A satisfactory theory should be falsifiable and also say when these factors do *not* apply. Conventional moral-hazard motives (e.g. risk of losing power if war fails) might also explain war continuation. Over-confidence may be a feature of "groupthink" which may confer evolutionary advantage.
- Roger focuses rational choice explanations as in Wolford book with some departures from standard assumptions.
- Main ideas: Inefficient war should *an* equilibrium outcome of a game (e.g. Stag Hunt). Inefficient war should be the *unique* outcome of the game (Prisoners' Dilemma, preventative war, pre-emptive war and incomplete information). Explaining war duration may require a multiple equilibrium arguments (war of attrition).

War Onset and Duration

- (1) *Preventative war*: Russia vs Germany pre-WW1. (2) *Pre-emptive war*: Statements by military and political leaders before WW1 are consistent with pre-emptive war though the actual war did not display these features.
- *Incomplete information*: Germany could know if it is a *pre-emptive type* who fears first-strike from a mobilized Russian military or a *safe type* who thinks it can withstand such an attack. Has incentives to bluff.
- Asymmetric information resolved by German invasion of Belgium (obviously the pre-emptive type). Russian revolution in 1917 meant Russia no longer a rising power but war continued.
- War of attrition - a dynamic game of Chicken - may explain long wars.

Comments

1. A Stag Hunt game with incomplete information has a unique equilibrium. It builds on insights of Hobbes, Schelling and Jervis. It resonates with some features of WW1.
2. Roger criticizes behavioral arguments because they are "just so" stories but don't multiple equilibrium arguments have a similar issue? But certain wars of attrition have a unique equilibrium. Perhaps they fit WW1.
3. I suggest a related but slightly different departure from common knowledge may be necessary to explain certain features of wars.

Hobbes and Schelling: Coordination and Uncertainty

- The *First Law of Nature:* "[A]s long as every man continues to have this natural right to everything—no man, however strong or clever he may be, can be sure of living out the time that nature ordinarily allows men to live. And consequently it is a command or general rule of reason that *every man ought to seek peace, as far as he has any hope of obtaining it*; and that *when he can't obtain it he may seek and use all helps and advantages of war*." (Hobbes Chapter 14, p. 60)
- "[I]f I go downstairs to investigate a noise at night, with a gun in my hand, and find myself face to face with a burglar who has a gun in his hand, there is a danger of an outcome that neither of us desires. Even if he prefers to leave quietly, and I wish him to, there is a danger that he may think I want to shoot, and shoot first. *Worse, there is danger that he may think that I think he wants to shoot. Or he may think that I think he thinks I want to shoot. And so on."* (Schelling, 1960, p. 207).

- "World War I was an unwanted spiral of hostility"...."World War II was not an unwanted spiral of hostility-it was a failure to deter Hitler's planned aggression."(Nye's textbook).
- Jervis (1976) uses Stag Hunt, Chicken as well as PD to illustrate conflict. Offensive or defensive advantage plays a key role: "When the offense has the advantage, a state's reaction to international tension will increase the chances of war. The incentives for preemption and the 'reciprocal fear of surprise attack' in this situation have been made clear."

1. Stag Hunt with Incomplete Information

- The Stag Hunt game is a key metaphor for conflict. Payoffs for player i the row player are:

$$\begin{array}{cc} \textit{Hare} & \textit{Stag} \\ -c_i & \mu - c_i \\ -d & 0 \end{array}$$

with $0 > \mu - c_i > -c_i > -d$. Note that this requires $\mu < d$.

- This has a peaceful equilibrium where both play *Stag* and an inefficient "war" equilibrium where they both play Hare.
- Suppose c_i is drawn independently from uniform distribution on $[0, 1]$ and $d > 1$.
- Notice if $c_i < \mu$ this is the Prisoners' Dilemma:

$$\mu - c_i > 0 > -c_i > -d.$$

- We claim that this has now has a unique equilibrium where both play *Stag*.

	Hare	*Stag*
Hare	$-c_i$	$\mu - c_i$
Stag	$-d$	0

- Any equilibrium is symmetric and in threshold strategies. Suppose player j uses threshold c^*. The player i's expected payoff from playing *Hare* net of payoff from playing *Dove* is

$$\mu\left(1-c^*\right)-c^*-\left(-dc^*\right)=\mu\left(1-c^*\right)+c^*\left(d-1\right)>0.$$

- So unique equilibrium is $(Stag, Stag)$ for any $\mu > 0$. Can be found via iterated deletion of dominated strategies in style of reciprocal fear of surprise attack.
- This game has a more hopeful message: although it might look like a PD, there is an underlying coordination game. Perhaps diplomacy or signaling can achieve coordination on the good equilibrium.
- Alternative version has highly correlated type and is a global game (Carlsson and van Damme, Morris-Shin)

2. War Of Attrition: Reputational Bargaining

- Abreu and Gul (Eca, 2000) building on Myerson (1991) textbook!
- Suppose *both* players have commitment types who do not concede unless they achieve some minimum share. A player could be a commitment type or a rational type. Who will concede first when demands are incompatible? The game becomes a *war of attrition.*
- Let r^i be commitment type of player i and suppose $r^1 + r^2 > 1$. Let q^i be the probability of type r^i. Player i's rate of time preference is s^i. At time 0, player 1 makes demand r^1, Player 2 either accepts or makes a demand r^2 such that $r^1 + r^2 > 1$. Player 1 can concede or a war of attrition ensues.
- A strategy for player i is a cumulative distribution $F^i(t)$ with $t \geq 0$ which is his probability of conceding by time t. $F^i(0)$ is the probability that i concedes immediately

Theorem

The unique sequential equilibrium is (F^1, F^2)

- Player i's payoff is

$$F^j(0)r^i + (1 - F^j(0)\left(1 - r^j\right).$$

  As $r^i > 1 - r^j$, a player prefers to be conceded to than concede.

- Player i is in stronger position if: *more likely to be the commitment type (higher* q^i*), his opponent is impatient (higher* s^j*), and the less his commitment type demands (lower* r^i*).*

- Unique equilibrium and natural comparative statics.
- Does this model help make sense of WW1 or other wars?
- Issues: (1) With one-sided incomplete information, no inefficiency. Were players other than Germany "irrational"? (2) With rich set of types, as probability of commitment types goes to zero, inefficiency disappears as players mimic types where $r^i + r^j \approx 1$. Not true in model Roger studies.
- Self promotional aside: Working on a bargaining model of "Long Wars" where information concerns one player's strength in a war and this affects both players payoffs in a war. In this model, the Coase conjecture does not go through and there can be delay

3. Relaxing Game Theory Assumptions

- Equilibrium analysis in game theory relies on rational players and common knowledge of rationality, the game and strategies.
- German Chief of Staff Helmuth von Moltke implemented Schlieffen Plan attacking France via Belgium and drawing in Great Britain when Russia attacked in the east. Seemed to have no alternative plan and was perhaps driven to outdo his uncle who successfully prosecuted the Franco-Prussian war.
- Interpreted as aggressive expansionist type by Britain and Britain's response seen as unjustified by German leadership who know their plan was an error. Rationality questioned
- German invasion of Belgium violated international norms to some and Russia's mobilization violated norm to Germany. Common knowledge of strategies violated.
- It was also violated at end of war with Germany undefeated but excluded peace negotiations. Laid the seeds for next war.

3. Relaxing Game Theory Assumptions, continued

- Jervis: "Bismarck's wars surprised statesmen by showing that the offense had the advantage, and by being quick, relatively cheap, and quite decisive. *Falling into a common error, observers projected this pattern into the future*....Of course the war showed these beliefs to have been wrong on all points. Trenches and machine guns gave the defense an overwhelming advantage. ...The politics of the interwar period were shaped by the memories of the previous conflict and the belief that any future war would resemble it. And because Britain and France expected the defense to continue to dominate, they concluded that it was safe to adopt a more relaxed and nonthreatening military posture. The expected high costs of war, however led the Allies to believe that no sane German leader would run the risks entailed in an attempt to dominate the Continent, and discouraged them from risking war themselves." [My interpretation: They assumed Hitler was "rational".]

- One theory for reaching equilibrium: players choose best responses to last period's strategies ("best response dynamic"): Generals are always prepared to fight the last war (e.g. Maginot Line).
- Technology of war may change (e.g. planes and tanks). Preferences of leaders may change (Hitler).
- War onset caused by changing parameters of the game. War duration is learning phase till new equilibrium is reached.

Conclusion

- Much to like in the paper.
- I have added other games (Stag Hunt with Incomplete Information, Reputational Bargaining) as other candidates to consider. I also suggested the best-response dynamic as an alternative to equilibrium.