Formal Analysis: Power change and war

Andy Eggers

Week 4 Session 1

Bargaining and war: re-cap

Underlying puzzle

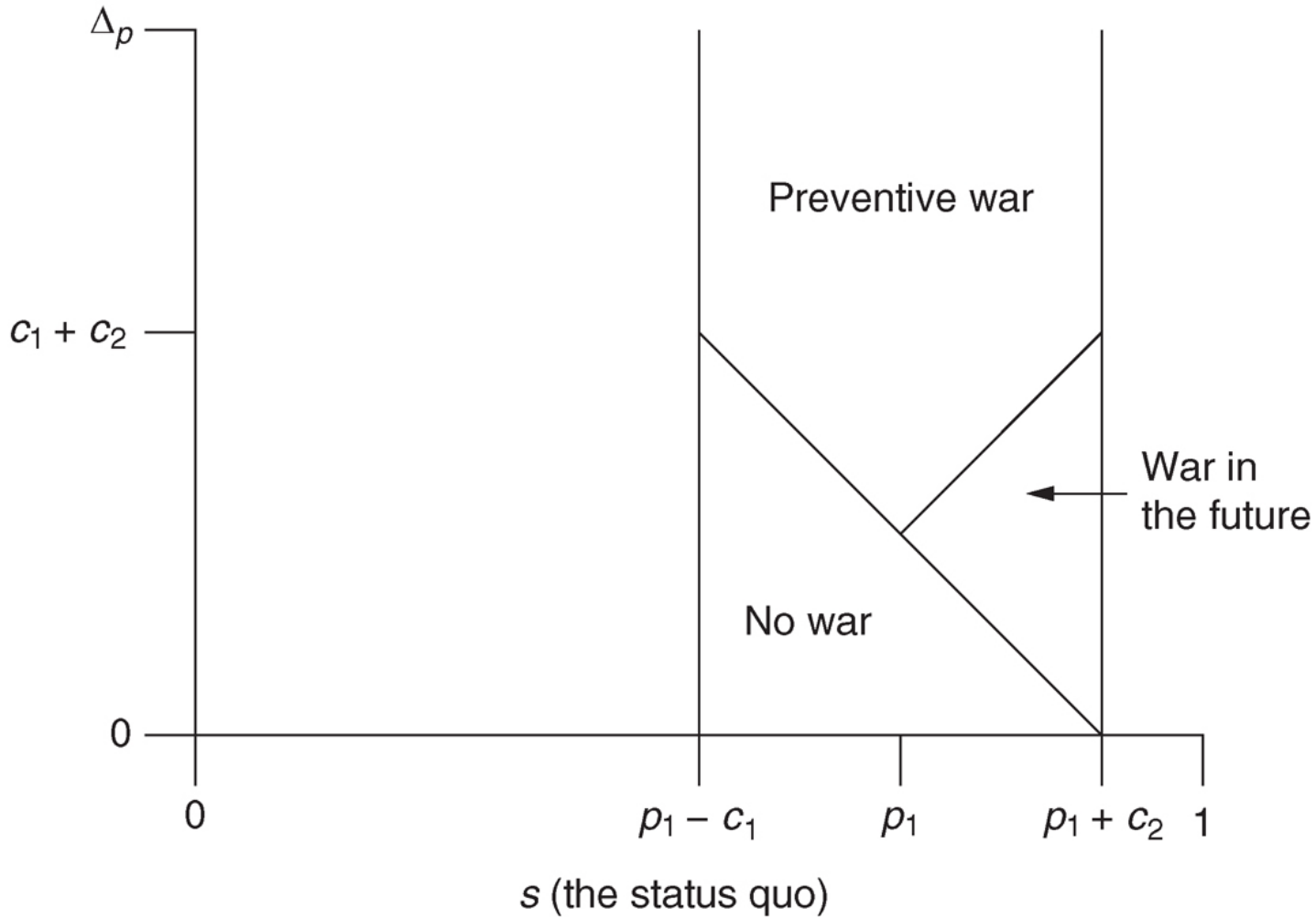
War is costly: it destroys some of the resource that states are fighting over. Why can't a peaceful allocation be found that makes everyone (weakly) better off?

Takeaways from Kydd chapter 4

1. **Setup:** Proposal x followed by decision to accept, reject, or fight — what is captured, what is missing?
2. **Procedure:** approaches to solving the problem
   - backwards induction
   - working with *bottom lines* (allocations) rather than utilities
   - numerical examples (perhaps using `shiny` app)
3. **Substance:**
   - no war occurs when war is costly and intermediate outcomes sufficiently valued (e.g. linear payoffs)
   - war may occur if the resource at issue is much less valuable when divided.

Describing equilibria in terms of model parameters

From Kydd: war from changing power with no bargaining



Exercise: climate change

Make a figure to capture the following idea:

Depending on assumptions about the benefits and costs of climate change abatement, climate change policy can be seen as a symmetric two-player game in which

- the only equilibrium has neither player restricting emissions,
- the only equilibrium has both players restricting emissions,
- there are two equilibria, in each of which only one player restricts emissions,
- there are two equilibria, one with both players restricting emissions and one with neither player restricting emissions.

My solution (1)

Let b_j denote the benefit of being in a world with $j \in \{0, 1, 2\}$ players restricting emissions, and normalize so that $b_0 = 0$.

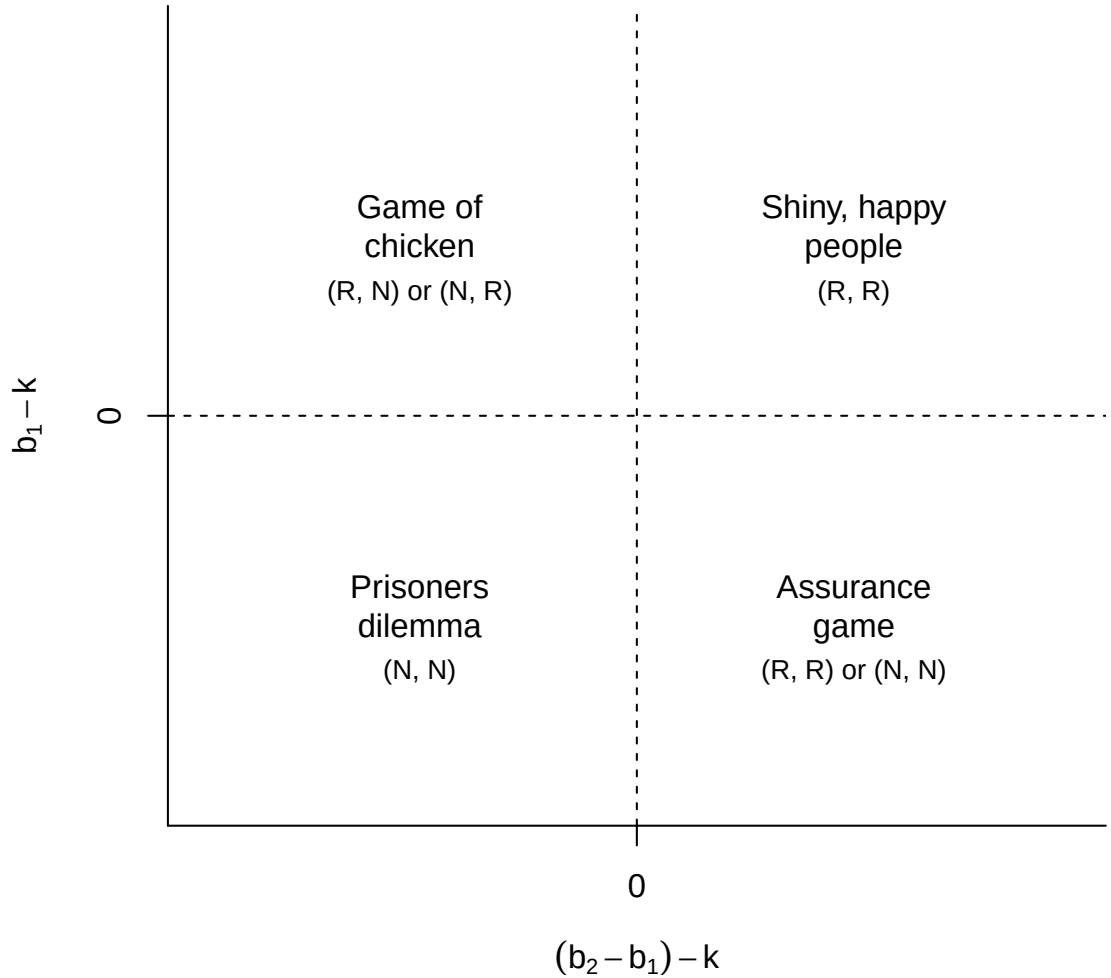
Let k denote the cost of restricting emissions.

Then we have a two-by-two like this:

		Player 2	
		Restrict (R)	Do not restrict (N)
Player 1	Restrict (R)	$b_2 - k, b_2 - k$	$b_1 - k, b_1$
	Do not restrict (N)	$b_1, b_1 - k$	$0, 0$

And for best responses, what matters is whether $b_2 - k > b_1$ and $b_1 - k > 0$.

My solution (2)



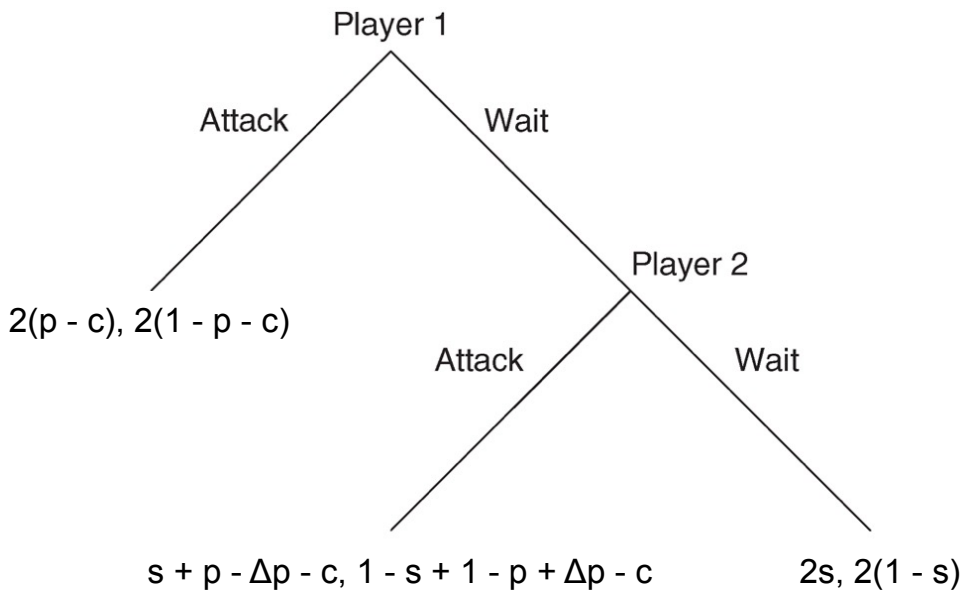
Think about effect of change in k, b_2, b_1.

Changing power as a cause of war

Changing power with no bargaining

Consider simplest game in chapter 5, and simplify further:

- $p_1 = 1 - p_2 = p$ (binary lottery)
- $c_1 = c_2 = c$ (symmetric costs of war)
- $u_1(x) = x$; $u_2(x) = 1 - x$ (linear payoffs)



Under what conditions can we expect war in this game?

Changing power with no bargaining (3)

Player 2 attacks if

$$1 - s + 1 - p + \Delta p - c > 2(1 - s)$$

$$\text{Cond A:} \quad \Delta p > p + c - s$$

Player 1 attacks if

Given $\Delta p > p + c - s$ (2 attacks):

$$2(p - c) > s + p - \Delta p - c$$

$$\text{Cond B.1:} \quad \Delta p > -p + c + s$$

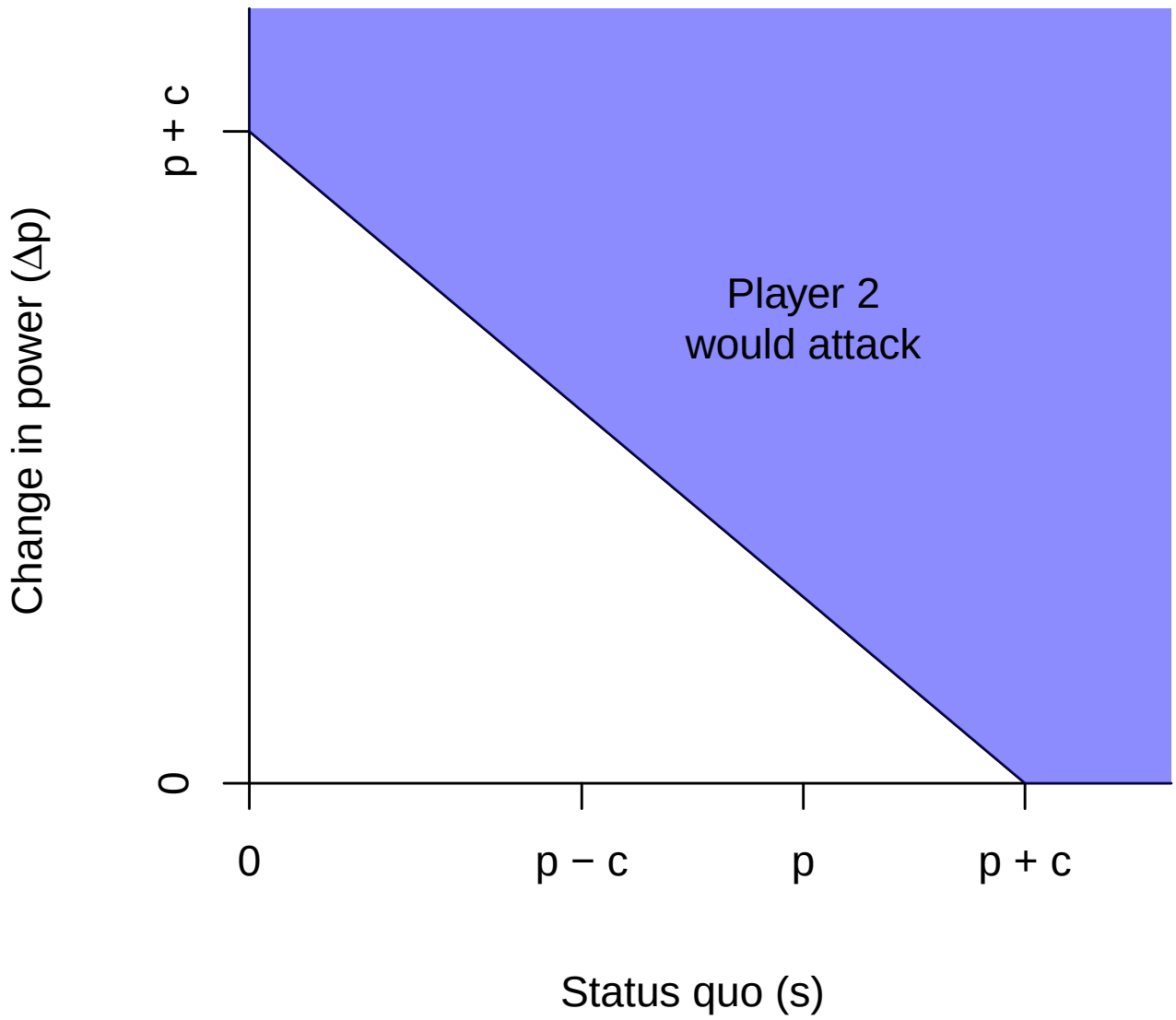
Given $\Delta p \leq p + c - s$ (2 waits):

$$2(p - c) > 2s$$

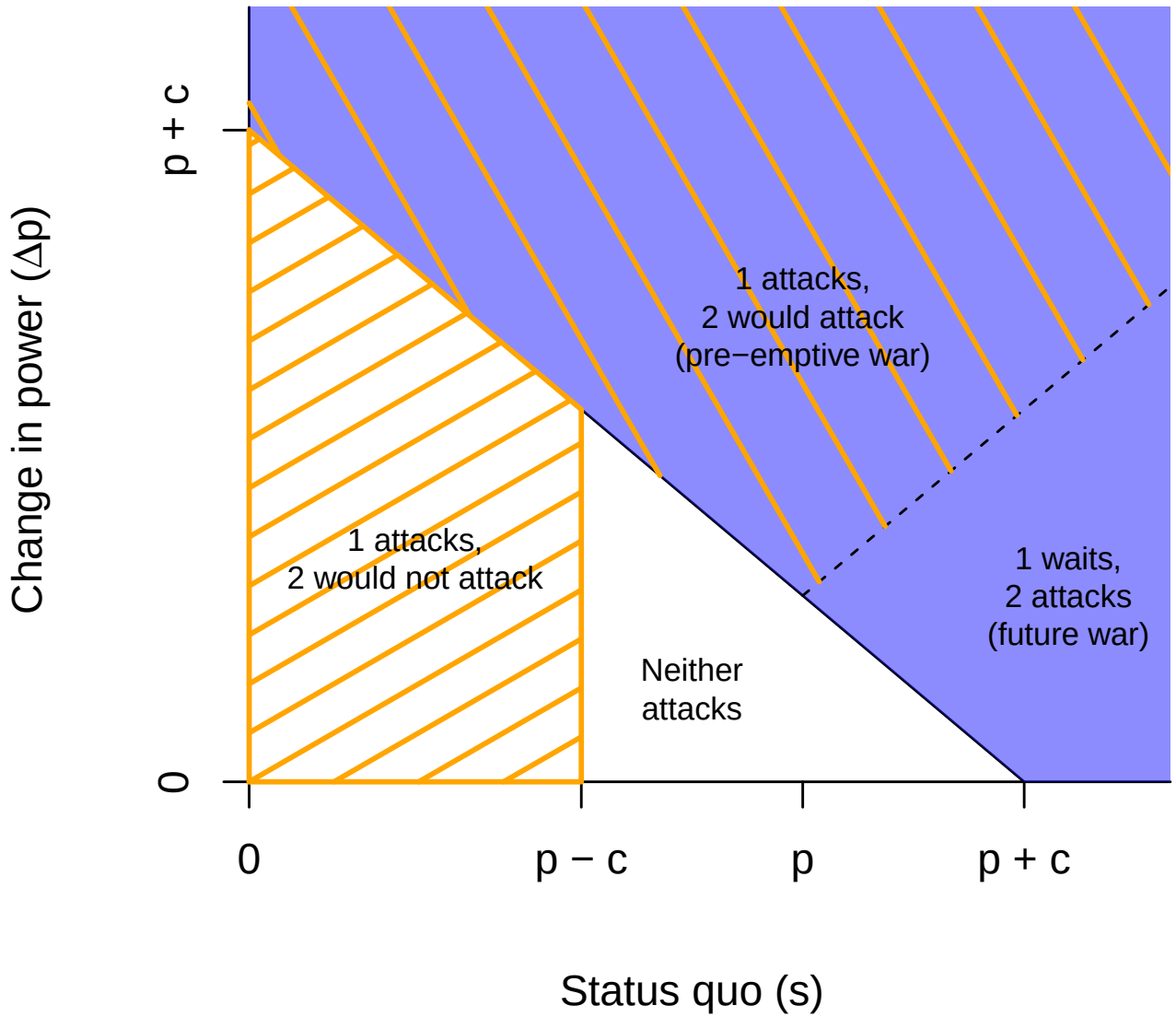
$$\text{Cond B.2:} \quad s < p - c$$

Making a diagram: condition A

Condition A: player 2 attacks if $\Delta p > p + c - s$



Making a diagram: adding conditions B.1 and B.2

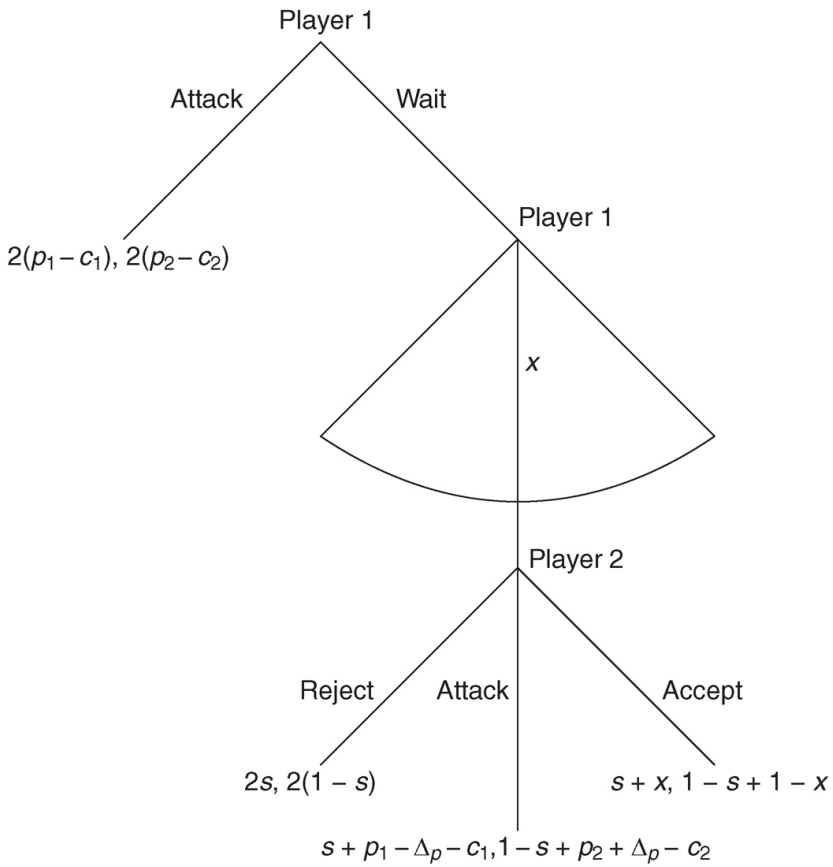


Another `shiny` app

https://andyeggers.shinyapps.io/preventive_war/

War from changing power with bargaining

Key points from power-change-with-bargaining model

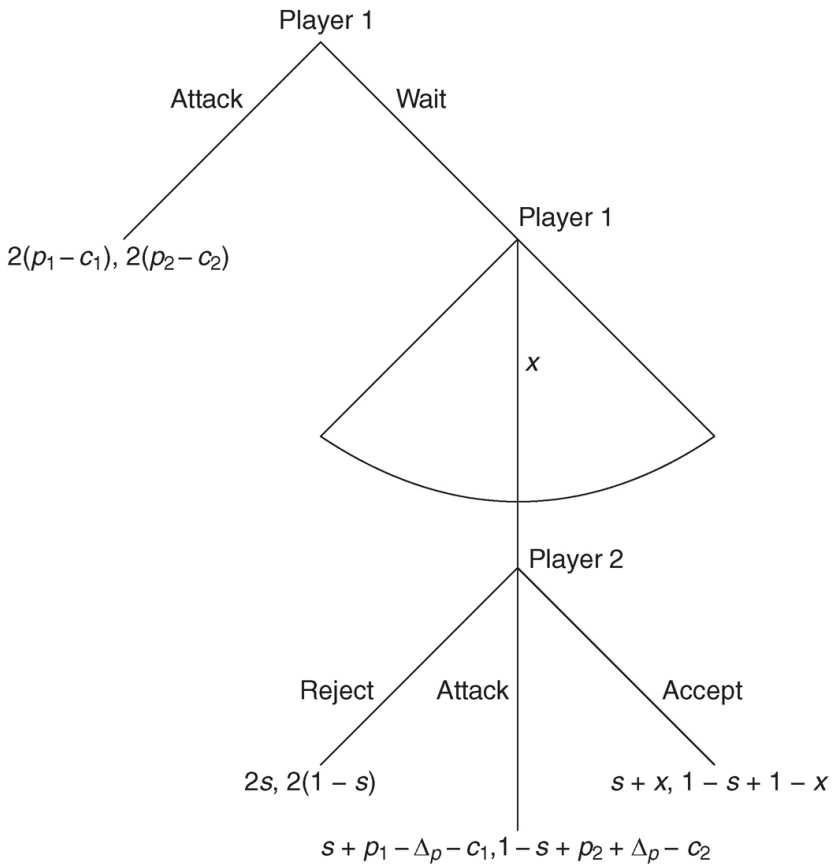


Key question for 1: war now, while strong, or crisis bargaining in future when weak.

Kydd assumes linear payoffs so we know what happens in the crisis bargaining subgame:

- it is always optimal for player 1 to make a proposal that makes 2 indifferent between attacking and accepting (i.e. b_2'), so 2 never attacks
- if $s < b_2'$, then player 2 rejects and wasn't going to fight anyway (no "credible threat to fight")

Key points from the power-change-with-bargaining model (2)

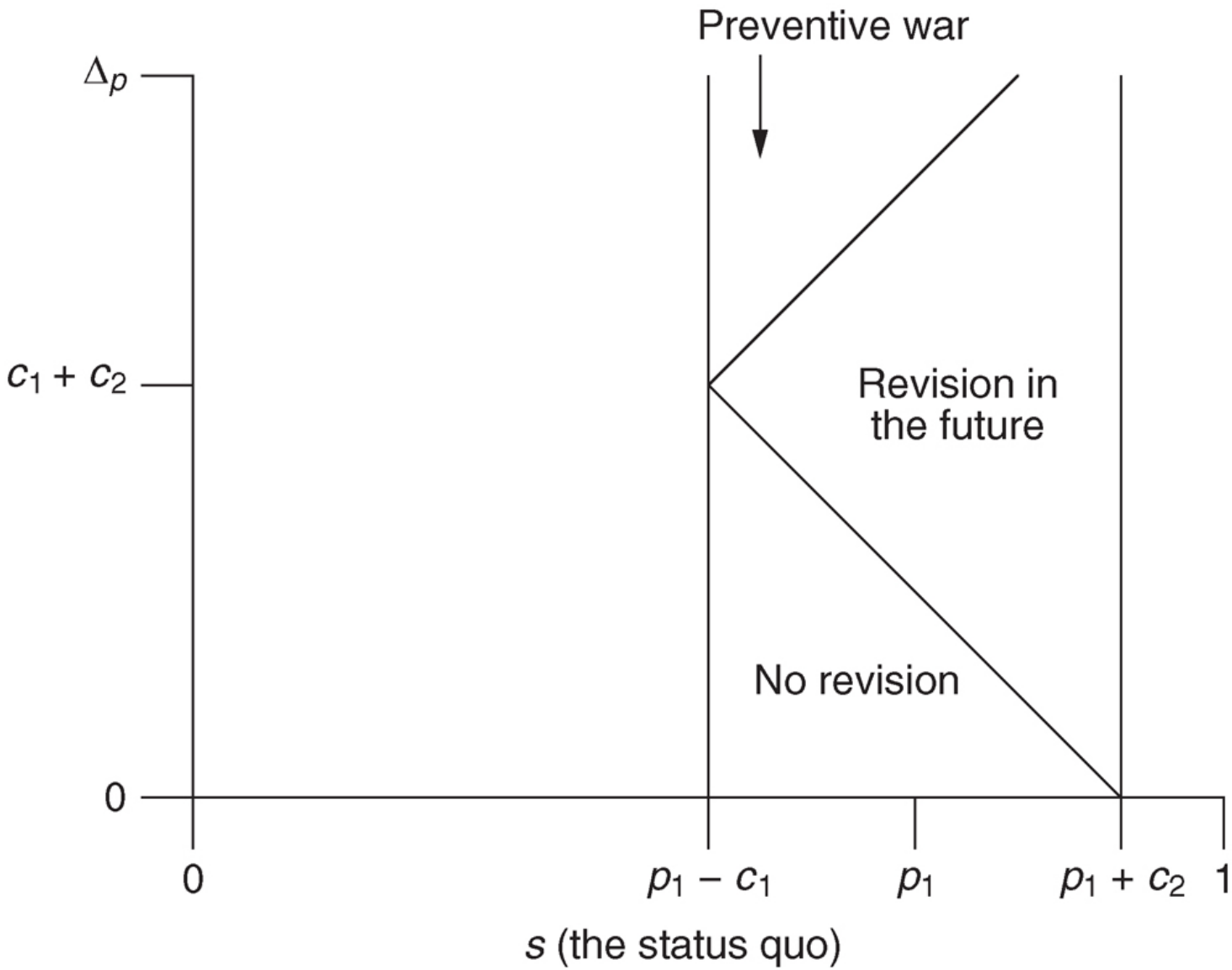


So war does not happen in the future. And Kydd assumes $s > p_1 - c_1$, i.e. player 1 wouldn't attack in the absence of power change.

So the whole question is whether 1 prefers attacking now to making concessions in the future.

- the proposal 1 must make to appease 2 is $x = b_2' = p_1 + c_2 - \Delta p$
- 1 prefers attacking to making concessions if $2(p_1 - c_1) > s + b_2'$ i.e. if $\Delta p > s - (p_1 - c_1) + c_1 + c_2$

Equilibria with bargaining in period 2



Recap

Big picture

We are looking at rationalist explanations for war one by one.

Each toy model aims to isolate a single mechanism (cf one model with all mechanisms) while **shutting down** other channels so we know what is producing the war.

Big picture: a table

	Bargaining?	Power change?	Credible threat w/o change?	Credible threat post-change?	Linear payoffs?	Outcome
	None	No	No	-	-	No war
	None	No	Yes	-	-	War
4.4	Yes	No	No	-	-	No concession, no war
4.4	Yes	No	Yes	-	Yes	Concession, no war
4.6	Yes	No	Yes	-	No	War if intermediate outcomes undervalued
5.1	None	Yes	No	No	-	No war
5.1	None	Yes	No	Yes	-	Preventive or future war
5.2	2nd rd.	Yes	No	No	Yes	No concession, no war
5.2	2nd rd.	Yes	No	Yes	Yes	Concession or preventive war
5.3	Both rd.	Yes	No	No	Yes	No concession, no war
5.3	Both rd.	Yes	No	Yes	Yes	Concession (once/twice) or preventive war if 2 can't buy off 1