# International Relations 101: War as a Bargaining Problem

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# Parallel: Lawsuit

- A man trips and falls in your store and sues you for negligence.

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- A man trips and falls in your store and sues you for negligence.
- Your lawyer and his lawyer agree on the following:
  - There is a 60% chance the lawsuit will be successful.
  - If he wins, you will have to pay him $40,000.
  - Going to court will cost each of you $10,000 in lawyers fees.

# Possible Resolutions

1. Either you or him concede immediately.
2. You reach an out-of-court settlement.
3. You let the court decide the matter.

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   – How should we expect this matter to be resolved?

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    - Your expected payoff:
        - (-\$40,000)(.6) – \$10,000 = -\$34,000

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3. You let the court decide the matter.
    - Your expected payoff:
        - (-\$40,000)(.6) – \$10,000 = -\$34,000
    - His expected payoff:
        - (\$40,000)(.6) – \$10,000 = \$14,000

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   - If you concede, you lose $40,000.
   - If he concedes, he receives nothing.
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# Possible Resolutions

1. Either you or him concede immediately.
    - If you concede, you lose $40,000.
    - If he concedes, he receives nothing.
        - Each would rather go to court than concede.
2. You reach an out-of-court settlement.
3. You let the court decide the matter.

# Possible Resolutions

2. You reach an out-of-court settlement.
3. You let the court decide the matter.

# Possible Resolutions

2. You reach an out-of-court settlement.
    - A settlement x is better for you than court if x < $34,000.
    - A settlement x is better for him than court if x > $14,000.
    - Therefore, any settlement offer between $14,000 and $34,000 is better for both parties than court!
3. You let the court decide the matter.

# Conclusion

- Settlement should be the result!

# But This Is Just Like War…

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- Wars produce a winner and a loser, perhaps probabilistically.
- Fighting is costly because it kills people and destroys things.
- So why can't two states settle matters off the battlefield?
  – We call such a reason a "rationalist explanation for war."

Big question: Can war be mutually beneficial?

# Crisis!

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- But Colombia hears about this and declares the oil deposit to be on its side of the border.
- The sides call in their militaries and prepare for war.

# Venezuela’s Perspective

- Venezuela will win the war (and $80 billion in oil) 60% of the time.
- Cost of death, destruction, and lost oil: $12 billion.

# Colombia’s Perspective

- Colombia will win the war (and $80 billion in oil) 40% of the time.
- Cost of death, destruction, and lost oil: $15 billion.

# Interactive Question

- Is war inevitable between these two countries?

# Venezuela's Needs

- Expected payoff from war:
  $(80)(.6) - 12 = 36$
- Venezuela must receive $36 billion to be satisfied.

# Colombia's Needs

- Expected payoff from war:
  (80)(.4) – 15 = 17
- Colombia must receive $17 billion to be satisfied.

# A Rationalist Explanation for War?

- Both countries have positive expected payoffs from fighting.
  - So war is rational for both parties.

# A Rationalist Explanation for War?

- Both countries have positive expected payoffs from fighting.
  - So war is rational for both parties. Right?

# Bargaining

- War is **not** rational here.
- Venezuela’s and Colombia’s demands sum to $53 billion.
  - But there’s $80 billion in oil revenue to go around!
  - Where did the other $27 billion go?

# Bargaining

- War is **not** rational here.
- Venezuela’s and Colombia’s demands sum to \$53 billion.
  - But there’s \$80 billion in oil revenue to go around!
  - Where did the other \$27 billion go?
    - The costs of war (\$15 billion and \$12 billion) ate it up.

# A Better Resolution

- Let x be Venezuela's share of the settlement.
- Then x satisfies Venezuela if $x > 36$.
- Then x satisfies Colombia if $80 - x > 17$, or $x < 53$.

# A Better Resolution

- Let $x$ be Venezuela's share of the settlement.
- Then $x$ satisfies Venezuela if $x > 36$.
- Then $x$ satisfies Colombia if $80 - x > 17$, or $x < 63$.
  - Therefore, $x$ is mutually satisfactory if

$$36 < x < 63$$

# Conclusion

- Any settlement that gives \$36 billion but no more than \$63 billion to Venezuela is mutually preferable to war.
  - Such settlements exist.
  - Bargaining is mutually preferable to war.

# War’s Inefficiency Puzzle

- Why do states sometimes choose to resolve their differences with inefficient fighting when bargaining, in theory, leaves both better off?

# War’s Inefficiency Puzzle

- Was this a quirk with the payoffs for Venezuela and Colombia?

# The Model

- Two states: A and B.

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- Two states: A and B.
- Bargain over an object worth 1.
  - This 1 is 100% of the good—whether it is $80 billion in oil, 16 square miles of land, or whatever.
  - Object is infinitely divisible.

# The Model

- Two states: A and B.
- Bargain over an object worth 1.
- $p_A$ is the probability A wins a war.
- $p_B$ is the probability B wins a war.
  - No draws, so $p_A + p_B = 1$

# The Model

- If the states fight a war, they pay costs $c_A > 0$ and $c_B > 0$.
  - These costs reflect absolute costs (how many people will die) and “resolve” (how much the state cares about the issue).

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- If the states fight a war, they pay costs $c_A > 0$ and $c_B > 0$.
  - These costs reflect absolute costs (how many people will die) and “resolve” (how much the state cares about the issue).
  - The costs can take any functional form, as long as they are positive.

# The Model

- If the states fight a war, they pay costs $c_A > 0$ and $c_B > 0$.
- Question: Is bargaining always an effective means of resolving the dispute?

# A’s Peace Constraint

- Let x be A’s share of the bargained settlement.
- A is satisfied if:

$$x \geq p_A(1) - c_A$$

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$$x \geq p_A - c_A$$

# B’s Peace Constraint

- 1 – x is B’s share of a peaceful settlement.
- B is satisfied if:

$$1 - x \geq p_B(1) - c_B$$

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- $1 - x$ is B's share of a peaceful settlement.
- B is satisfied if:

$$1 - x \geq p_B(1) - c_B$$

$$1 - x \geq p_B - c_B$$

$$x \leq 1 - p_B + c_B$$

# Is Peace Possible?

- A is satisfied if: $x \geq p_A - c_A$
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# Is Peace Possible?

- A is satisfied if: $x \geq p_A - c_A$
- B is satisfied if: $x \leq 1 - p_B + c_B$
- x is mutually satisfactory if:

$$p_A - c_A \leq x \leq 1 - p_B + c_B$$

# Is Peace Possible?

- A is satisfied if: $x \geq p_A - c_A$
- B is satisfied if: $x \leq 1 - p_B + c_B$
- x is mutually satisfactory if:

$$p_A - c_A \leq x \leq 1 - p_B + c_B$$

- Such an x exists if:

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- A is satisfied if: $x \geq p_A - c_A$
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- x is mutually satisfactory if:

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- Such an x exists if:

$$p_A - c_A \leq 1 - p_B + c_B$$

  - $p_A + p_B = 1$
  - $p_B = 1 - p_A$

# Is Peace Possible?

- A is satisfied if: $x \geq p_A - c_A$
- B is satisfied if: $x \leq 1 - p_B + c_B$
- x is mutually satisfactory if:

$$p_A - c_A \leq x \leq 1 - p_B + c_B$$

- Such an x exists if:

$$p_A - c_A \leq 1 - (1 - p_A) + c_B$$

# Is Peace Possible?

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- B is satisfied if: $x \leq 1 - p_B + c_B$
- x is mutually satisfactory if:

$$p_A - c_A \leq x \leq 1 - p_B + c_B$$

- Such an x exists if:

$$p_A - c_A \leq 1 - (1 - p_A) + c_B$$

$$p_A - c_A \leq p_A + c_B$$

$$c_A + c_B \geq 0$$

# Conclusions

- Peace is possible.
- But how do we interpret this result?
  - Geometric model will help us understand what’s going on here.

# The Model

- Two states: A and B.

A’s Capital

B’s Capital

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0

A's

Capital

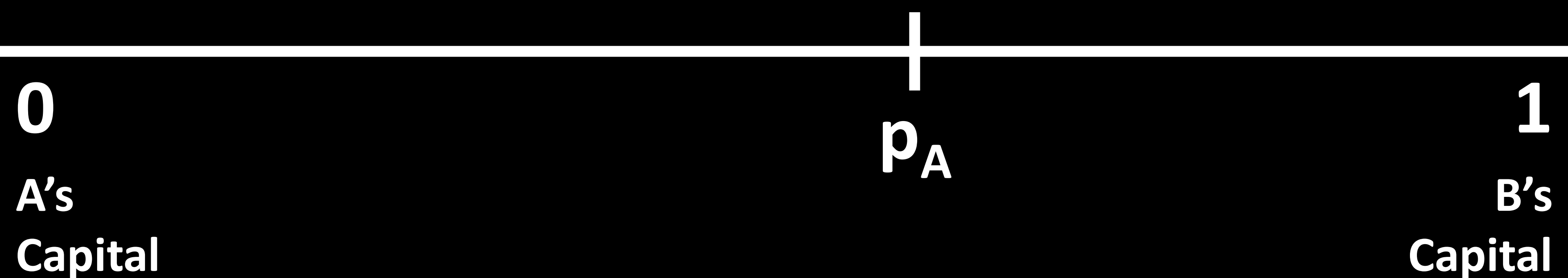
1

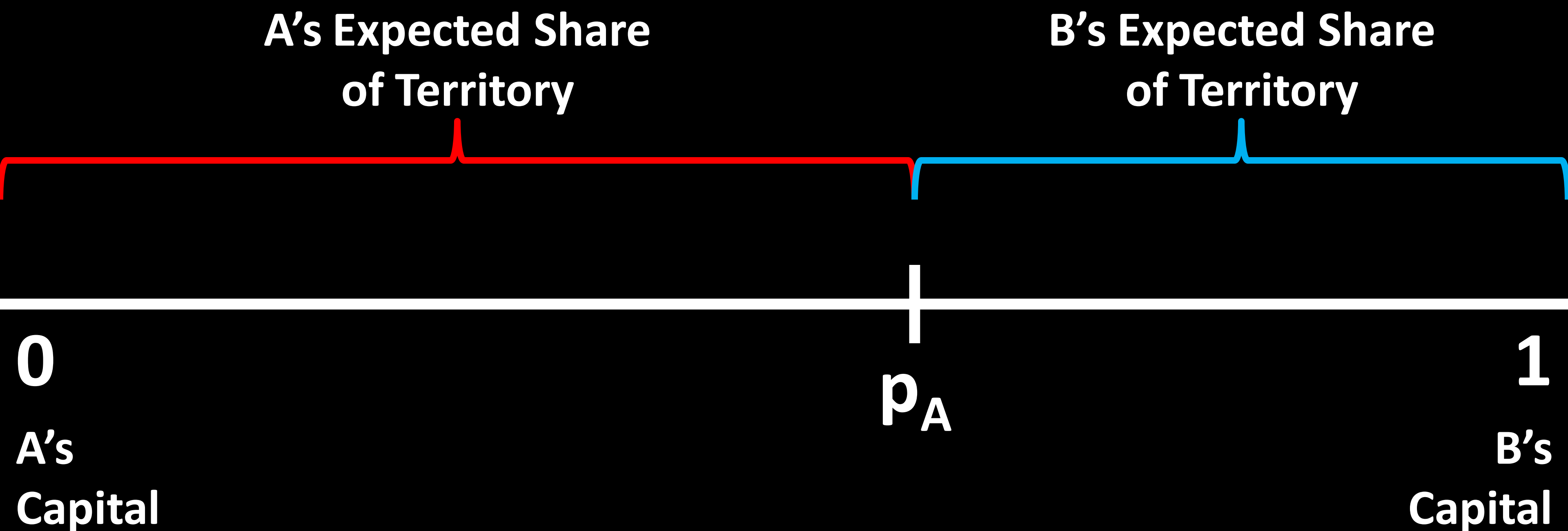
B's

Capital

# The Model

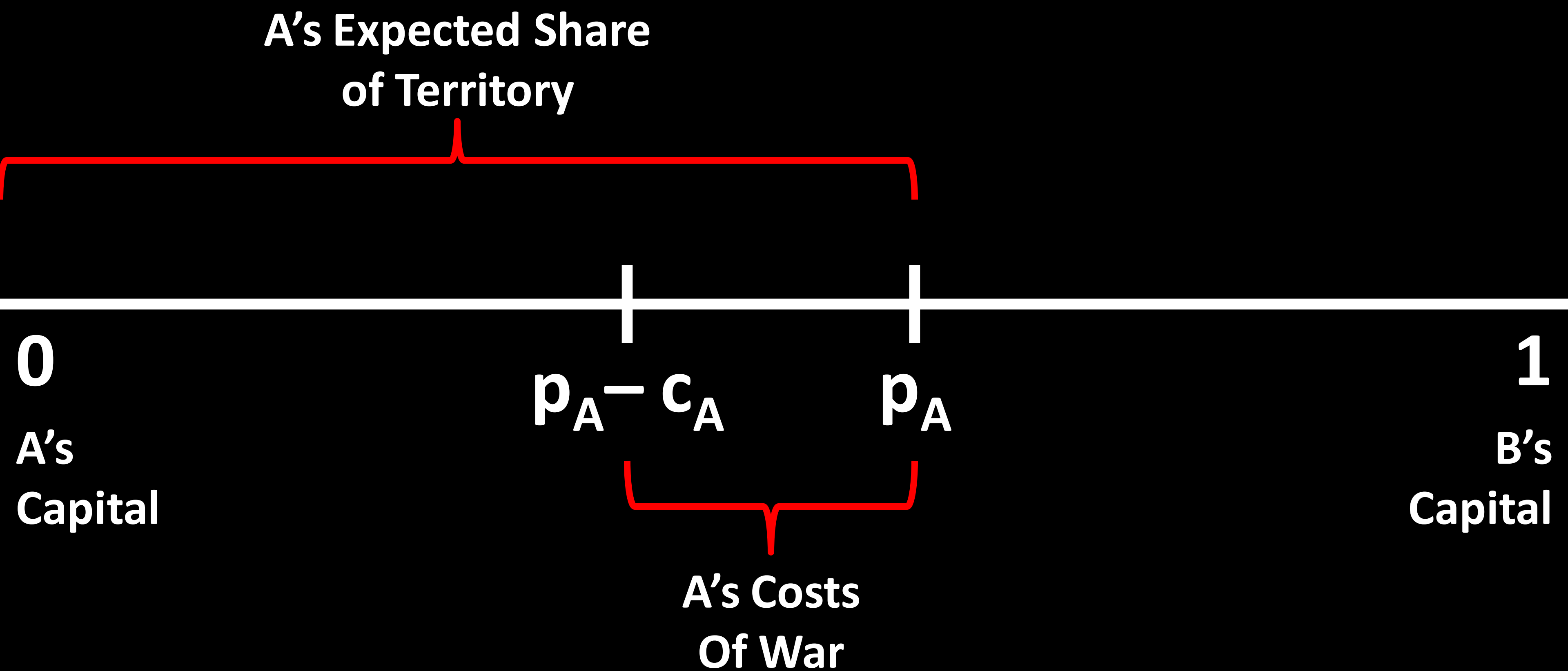
- Two states: A and B.
- Bargain over an object worth 1.
- $p_A$ is the probability A wins a war.
- $1 - p_A$ is the probability B wins a war.

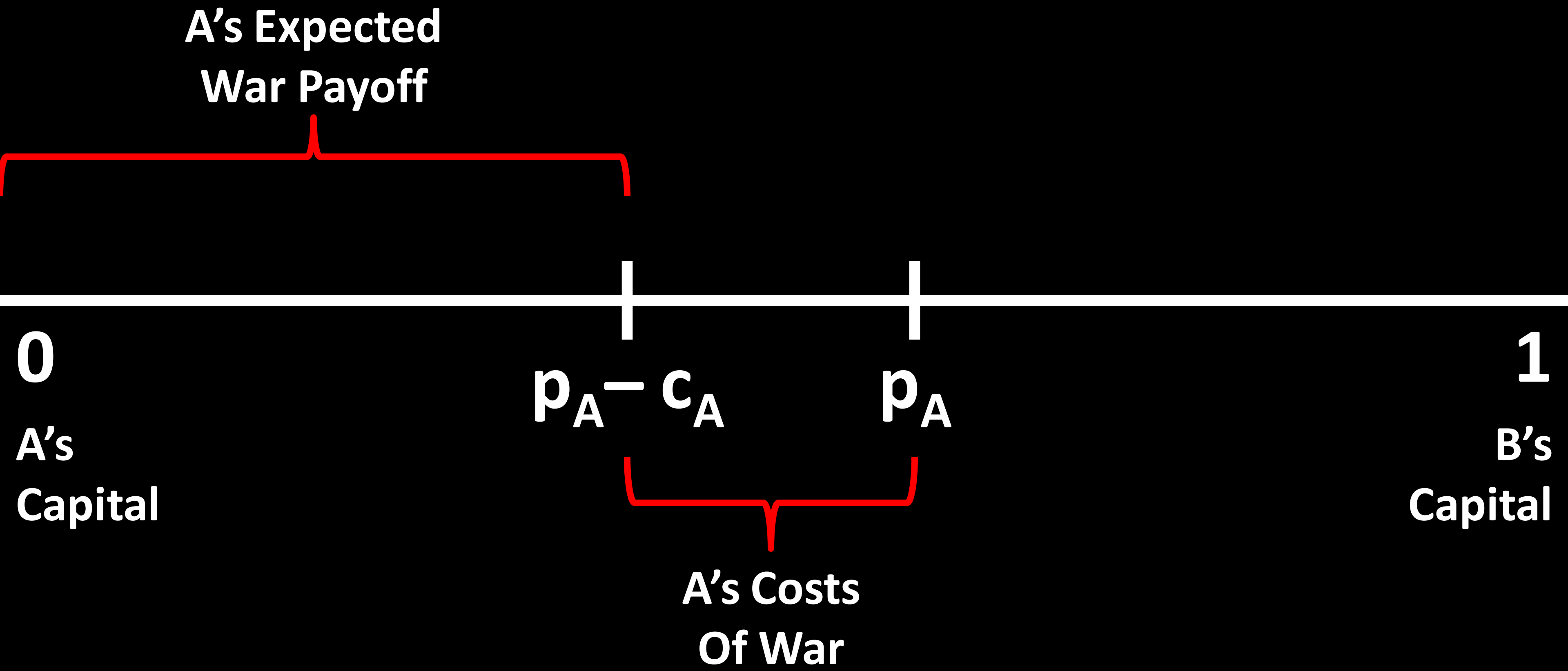

0
A’s
Capital
$p_A$
1
B’s
Capital


A's Expected Share of Territory
B's Expected Share of Territory
0
$p_A$
1
A's Capital
B's Capital

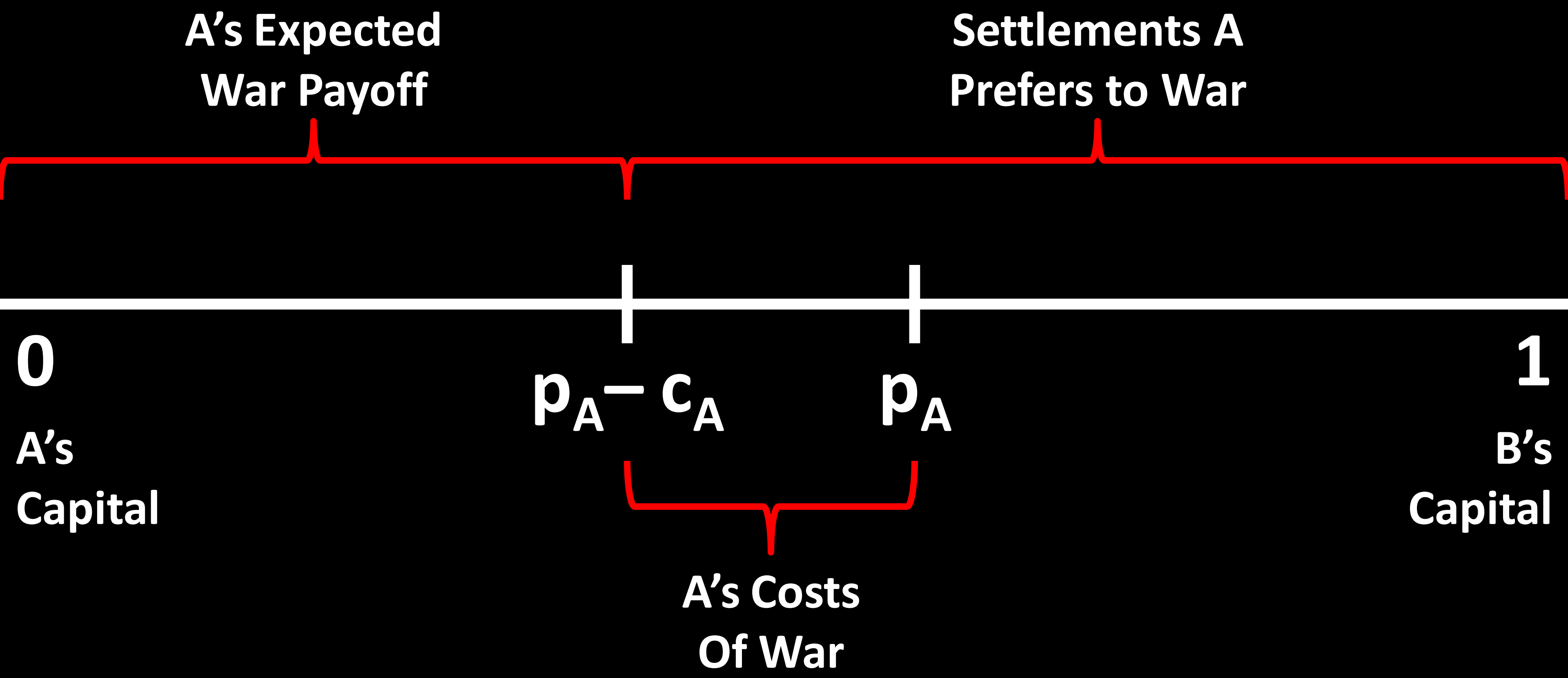
# The Model

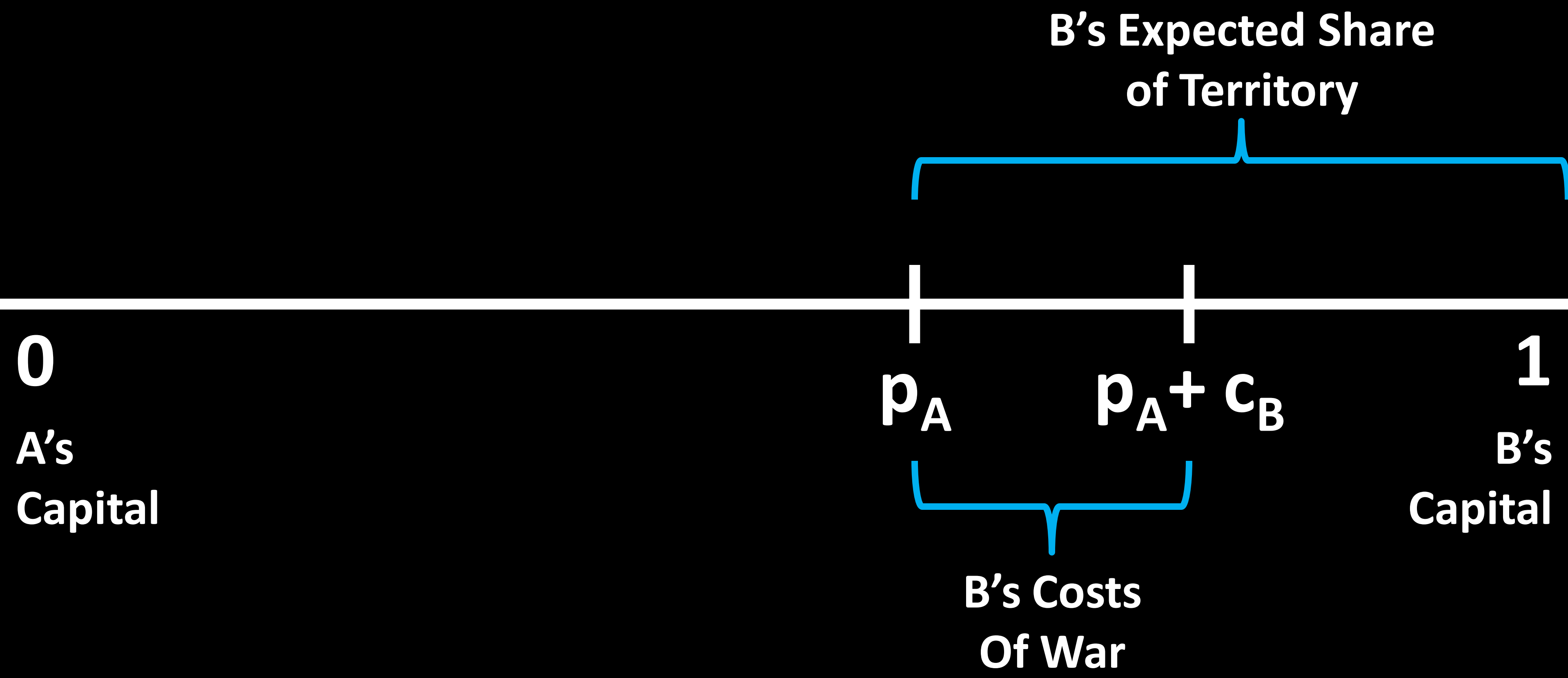
- If the states fight a war, they pay costs $c_A > 0$ and $c_B > 0$.

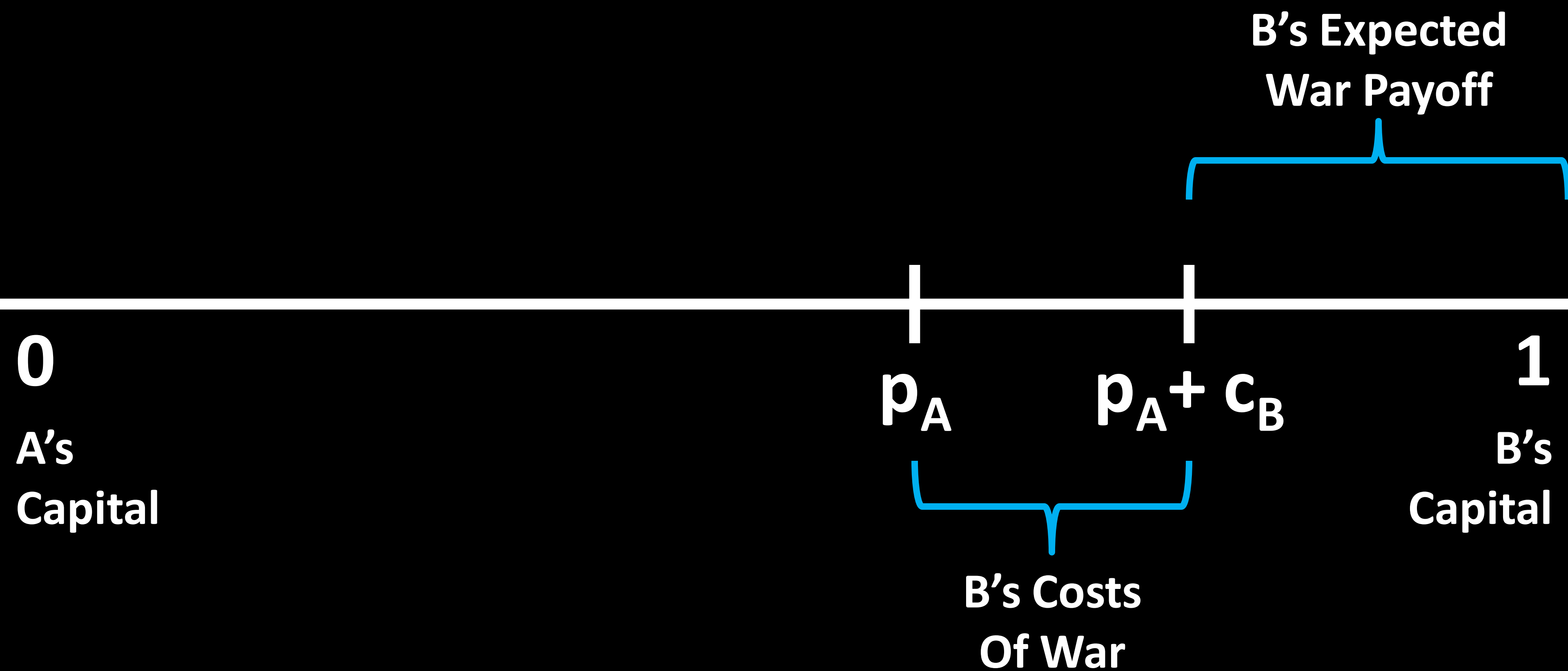

A's Expected Share of Territory
0
A's Capital
$p_A - c_A$
$p_A$
1
B's Capital
A's Costs Of War

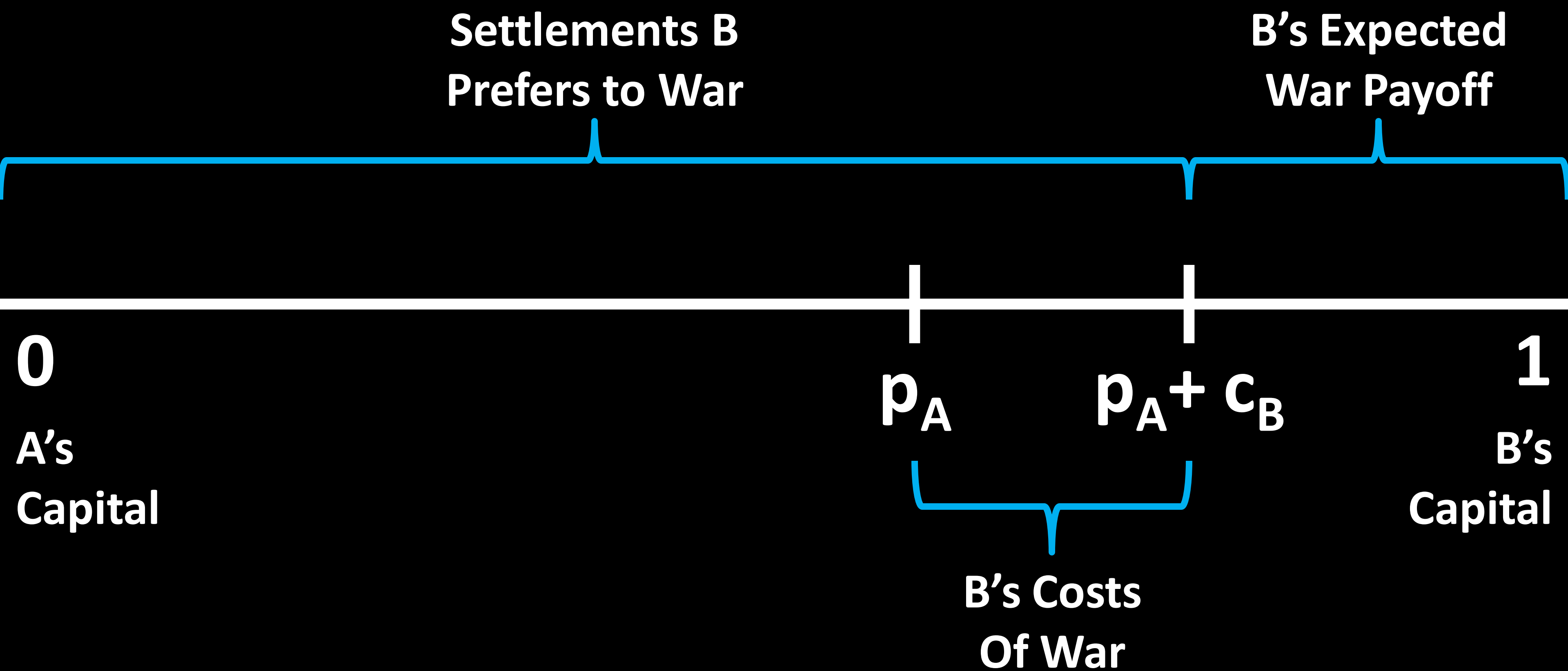


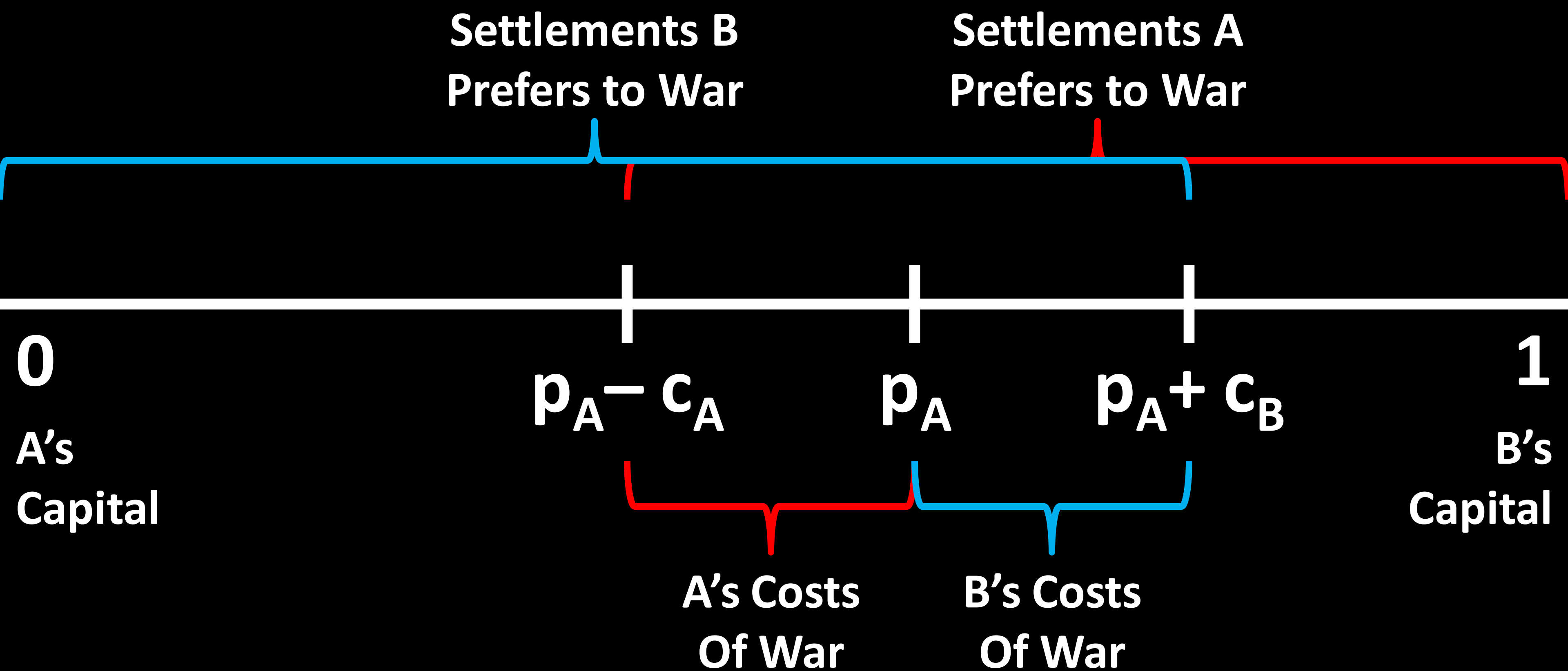
A's Expected War Payoff
0
A's Capital
$p_A - c_A$
$p_A$
1
B's Capital
A's Costs Of War

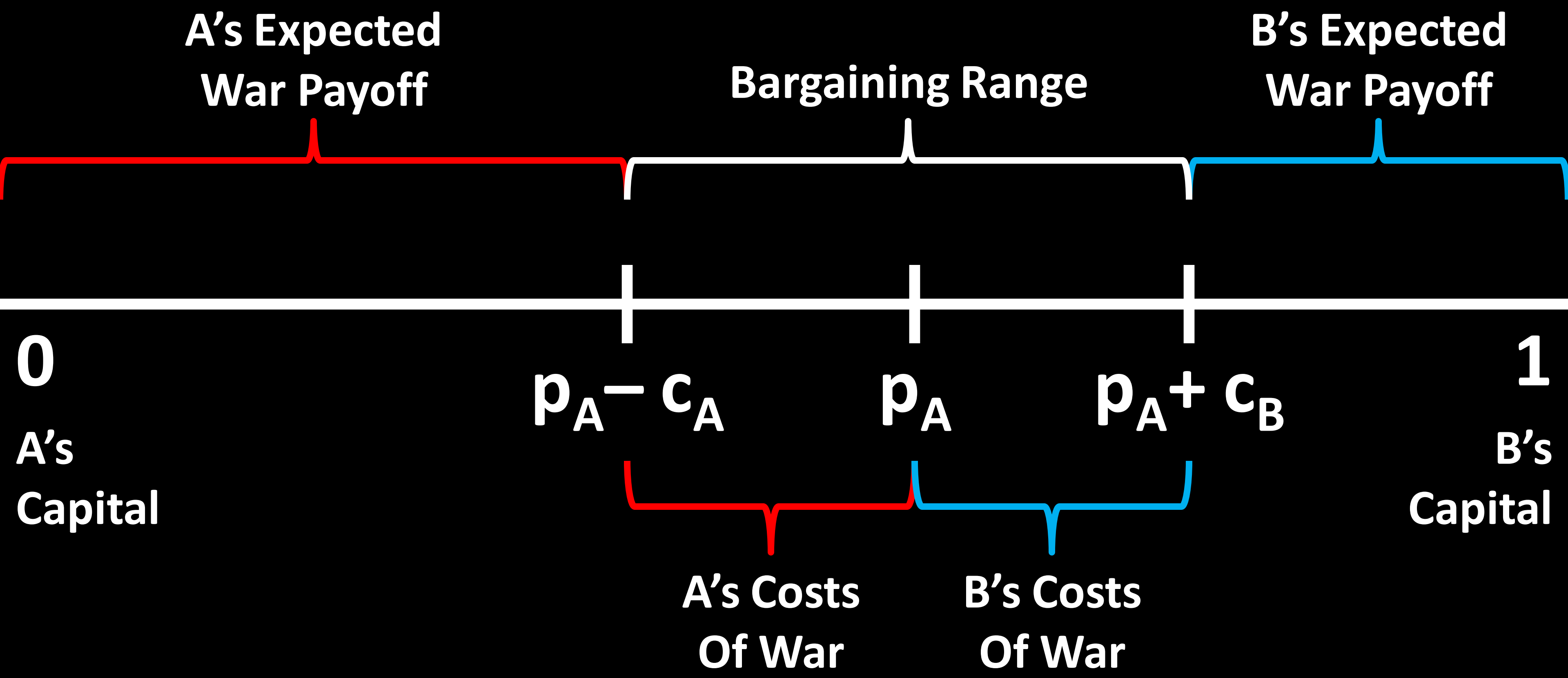

A's Expected War Payoff
Settlements A Prefers to War
0
$p_A - c_A$
$p_A$
1
A's Capital
B's Capital
A's Costs Of War


B's Expected Share
of Territory
0
A's
Capital
$p_A$
$p_A + c_B$
1
B's
Capital
B's Costs
Of War


B's Expected
War Payoff
0
$p_A$
$p_A + c_B$
1
A's
Capital
B's
Capital
B's Costs
Of War


Settlements B
Prefers to War
B's Expected
War Payoff
0
$p_A$
$p_A + c_B$
1
A's
Capital
B's
Capital
B's Costs
Of War


Settlements B
Prefers to War
Settlements A
Prefers to War
0
A's
Capital
$p_A - c_A$
$p_A$
$p_A + c_B$
1
B's
Capital
A's Costs
Of War
B's Costs
Of War


A's Expected War Payoff
Bargaining Range
B's Expected War Payoff
0
A's Capital
$p_A - c_A$
$p_A$
$p_A + c_B$
1
B's Capital
A's Costs Of War
B's Costs Of War