

# PS 0500: The Bargaining Model of War

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[williamspaniel.com/classes/ir2021](http://williamspaniel.com/classes/ir2021)

# Outline

- Unitary Actor Assumption
- Algebraic Model
- Geometric Model
- Preventive War
- Information Problems
- Issue Indivisibility
- Preemptive War
- Understanding War
- Measuring Power
- Militarized Interstate Disputes
- Correlates of War and the Long Peace

Can two perfectly intelligent,  
perfectly unbiased leaders fight a war  
against each other?

# The Unitary Actor Assumption

- Assume that states are a single entity, and their leaders are only interested in maximizing the overall welfare of the state

# Our Recipe

1. Create some assumptions
2. Do some math
3. Reach logically valid conclusions

# The Unitary Actor Assumption

- Assume that states are a single entity, and their leaders are only interested in maximizing the overall welfare of the state
  - Is this true all of the time?
    - No
  - Is this true some of the time?
    - Maybe
- Leaders justify wars using the unitary actor assumption

# Things You Will Never Hear a Leader Say

- I really suck at running our domestic economy, so I'm going to fight a war to distract you from that

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- I really suck at running our domestic economy, so I'm going to fight a war to distract you from that
- The media is too interested in a sex scandal involving some intern I most definitely did not have sexual relations with, so I'm going to bomb some country you've never heard of













# Things You Will Hear a Leader Say

- This war is in the best interest of *our* national security

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- This war is in the best interest of *our* national security
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# Things You Will Hear a Leader Say

- This war is in the best interest of *our* national security
- *We* have a moral obligation to intervene
- Stabilizing the region will secure *our* economic interests
- In sum: It's about *we*, not me

# Justifying the Unitary Actor

- The unitary actor assumption allows us to analyze the validity of these explanations



# Justifying the Unitary Actor

- The unitary actor assumption allows us to analyze the validity of these explanations
- The war dynamics we will discuss also affect states that aren't unitary actors
  - But it will be easier to isolate these factors without those domestic cleavages

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Can war be mutually beneficial?

# Crisis!

- Saudi Arabia discovers an oil deposit worth \$80 billion

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- Kuwait 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

# Saudi Arabia's Perspective

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



# Kuwait's Perspective

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



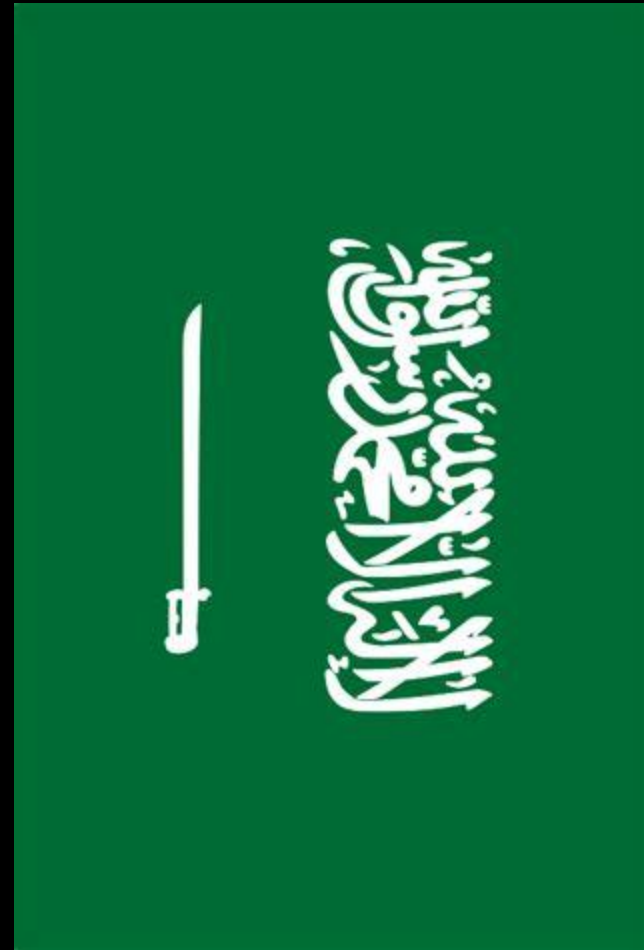


# Interactive Question

- Is war inevitable between these two countries?

# Saudi Arabia's Needs

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



# Kuwait's Needs

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



# A Rationalist Explanation for War?

- Both countries have positive expected payoffs from fighting
  - So war makes sense for both parties

# A Rationalist Explanation for War?

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

# Bargaining

- War does **not** make sense here
- Saudi Arabia's and Kuwait'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 does **not** make sense here
- Saudi Arabia's and Kuwait'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 Saudi Arabia's share of the settlement
- Then  $x$  satisfies Saudi Arabia if  $x > 36$
- And  $x$  satisfies Kuwait if  $80 - x > 17$ ,  
or  $x < 63$



# A Better Resolution

- Let  $x$  be Saudi Arabia's share of the settlement
- Then  $x$  satisfies Saudi Arabia if  $x > 36$
- And  $x$  satisfies Kuwait 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 Saudi Arabia is mutually preferable to war
  - Such settlements exist
  - Bargaining is mutually preferable to war

# This Is NOT Abstract

- Uqair Convention of 1922 created a neutral zone





Percy Cox

# This Is NOT Abstract

- Uqair Convention of 1922 created a neutral zone
- Oil discovered nearby in 1938
- Territory chopped up, multinational corporation created





Caribbean Sea

Martinique

St Lucia

St Vincent  
and the  
Grenadines

Barbados

Grenada

Aruba

Curaçao

Trinidad  
and Tobago

Venezuela

Colombia

Guyana

3D



**Iraq**

**Kuwait**









# War's Inefficiency Puzzle



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

# War's Inefficiency Puzzle

- Was this a quirk with the payoffs for Saudi Arabia and Kuwait?

# The Model

- Two states: A and B

# The Model

- 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)

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

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

# Is Peace Possible?

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- 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?

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- $x$  is mutually satisfactory if:

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- Such an  $x$  exists if:

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

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- Such an  $x$  exists if:

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



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

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- 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:

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

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

$$c_A + c_B \geq 0$$

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# The Model

- Two states: A and B

---

**A's  
Capital**

**B's  
Capital**

# The Model

- Two states: A and B
- Bargain over an object worth 1

**0**

**A's  
Capital**

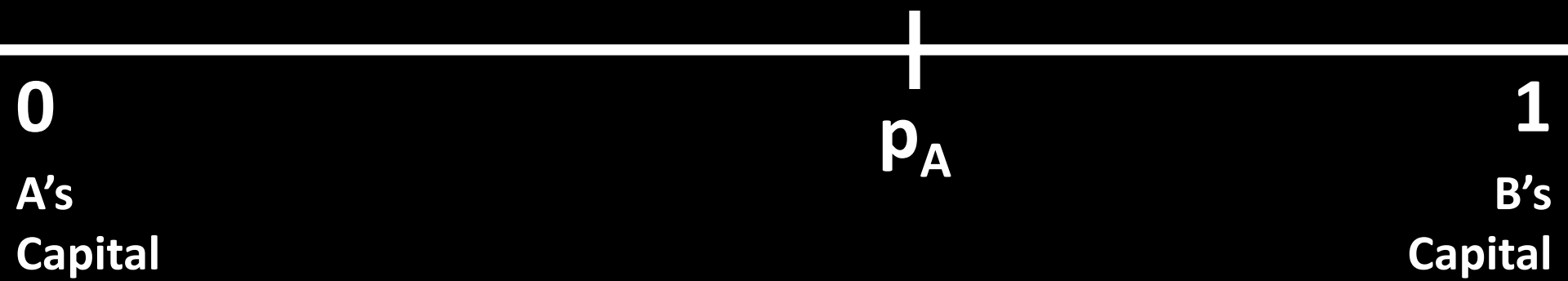
**1**

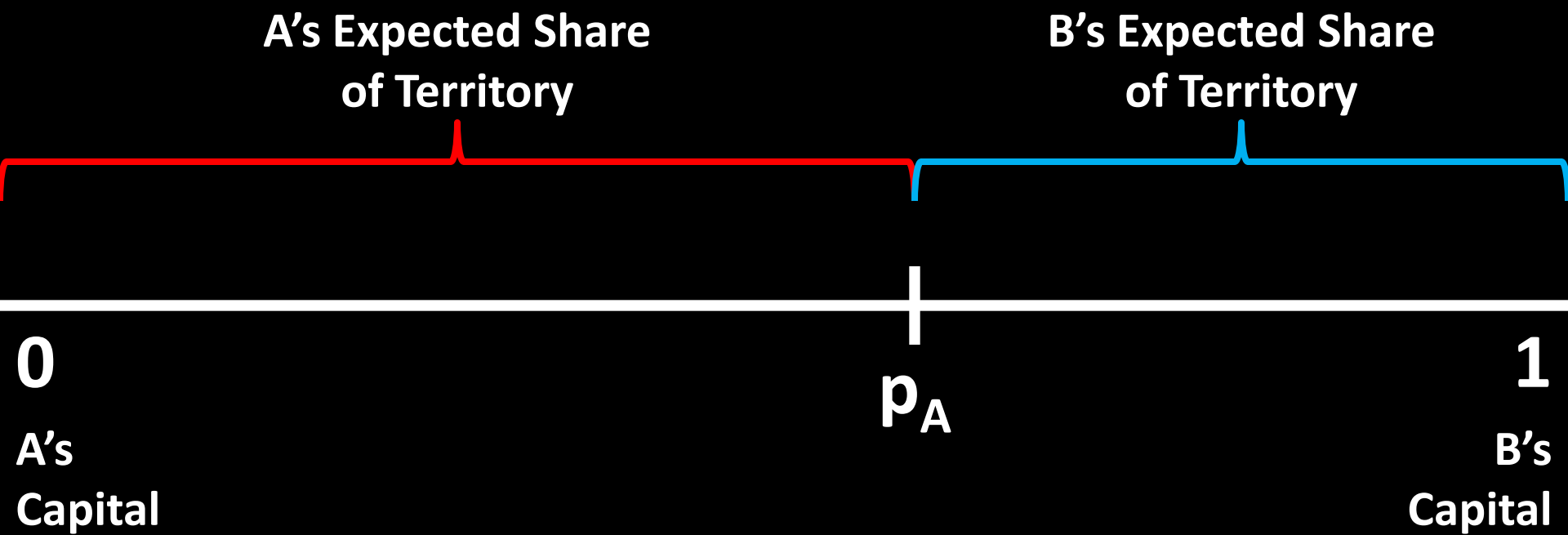
**B's  
Capital**

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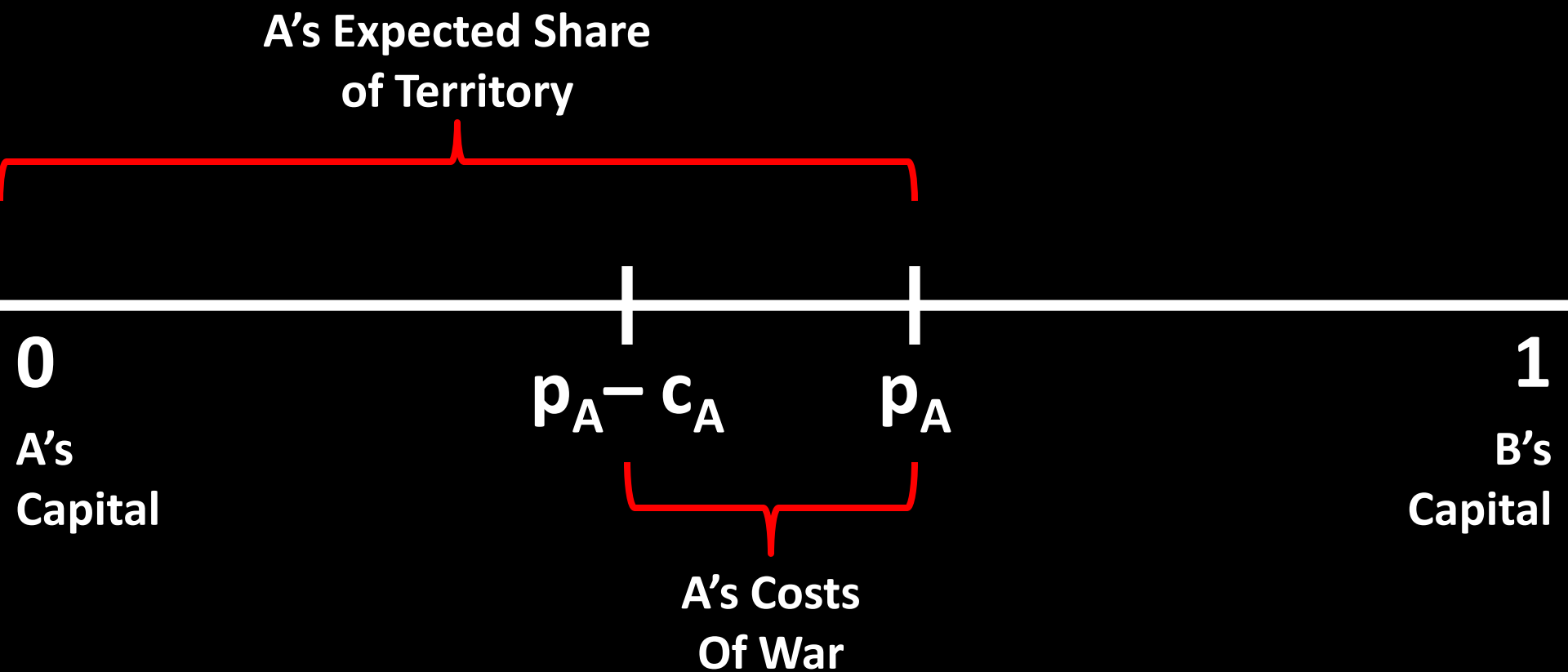


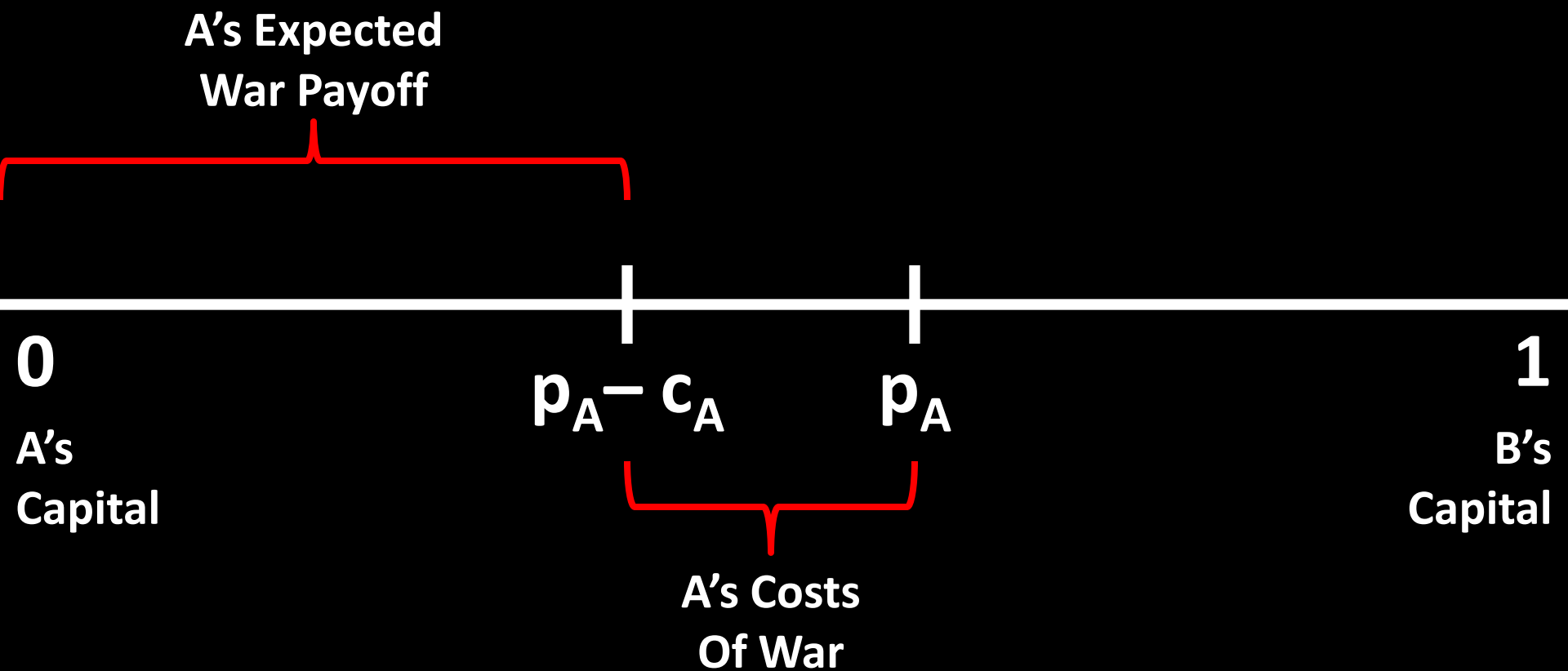


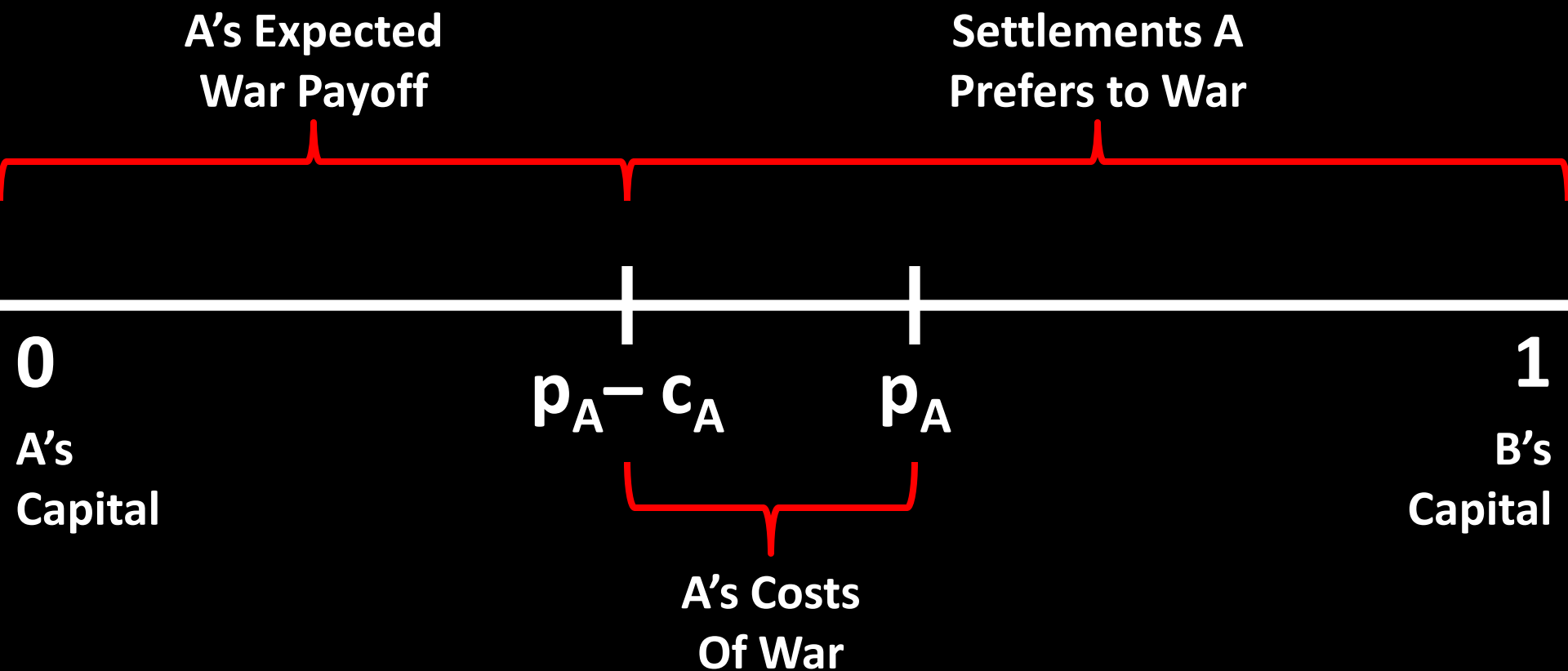


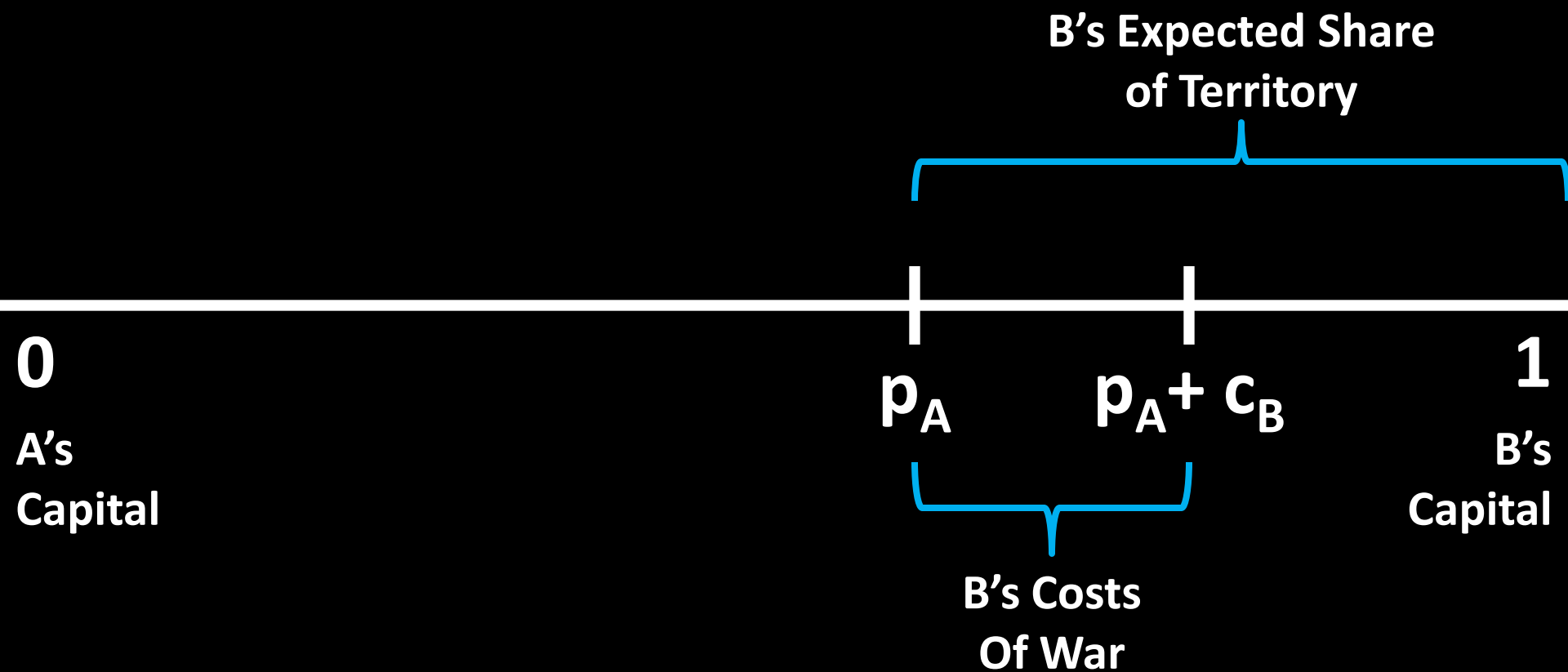
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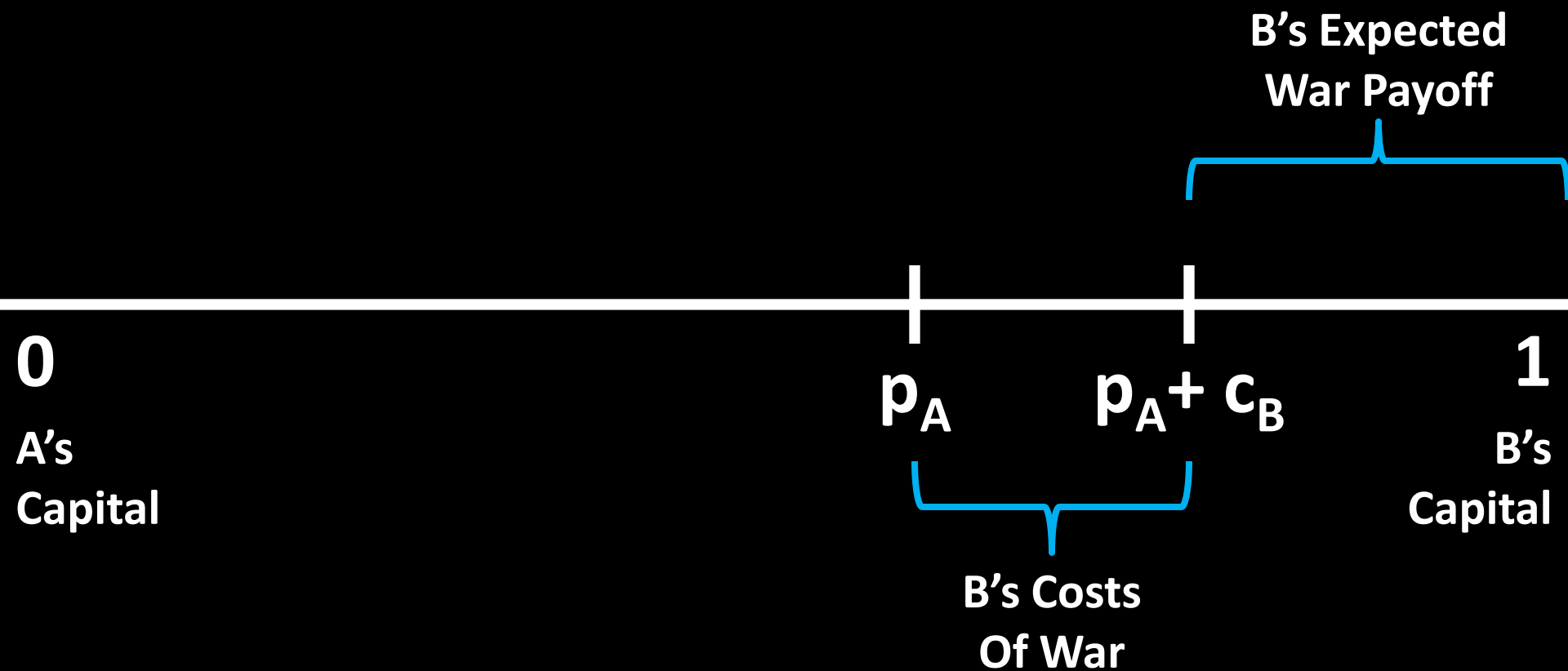
- If the states fight a war, they pay costs  $c_A > 0$  and  $c_B > 0$



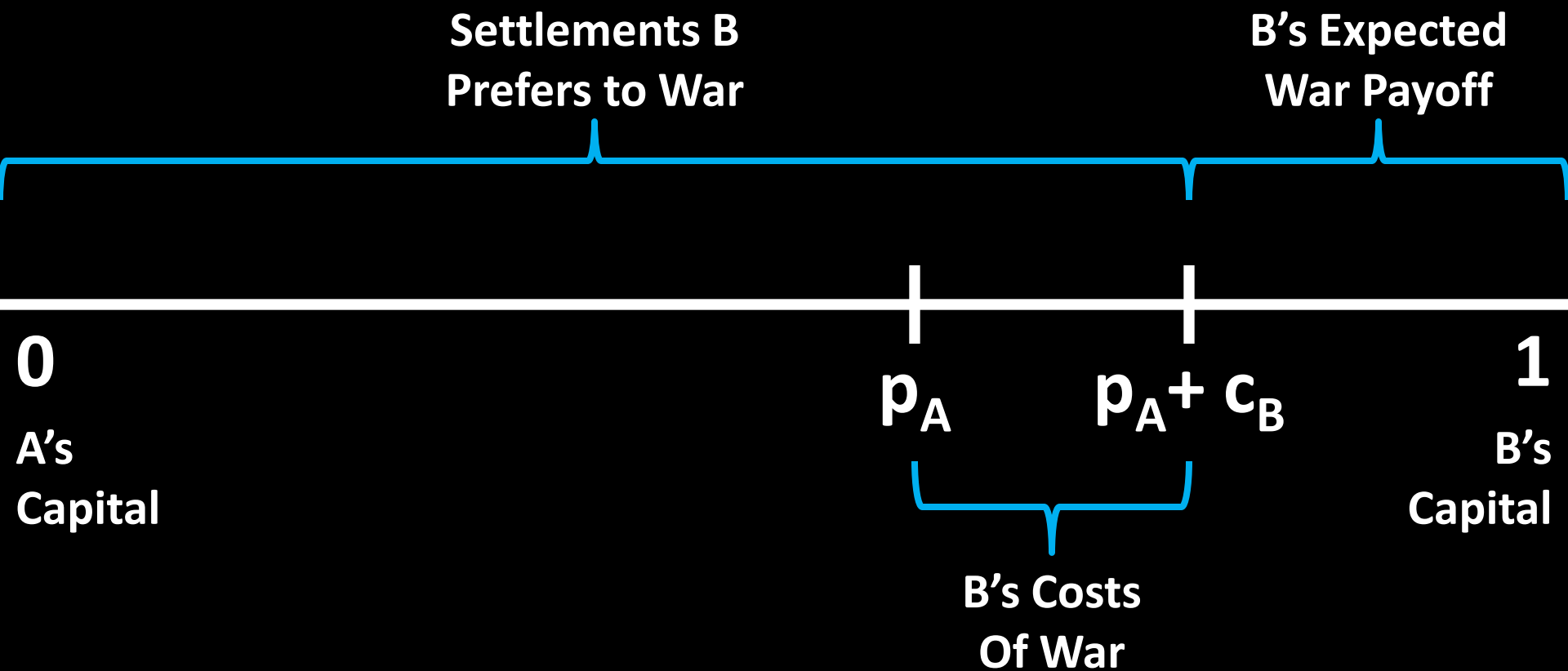


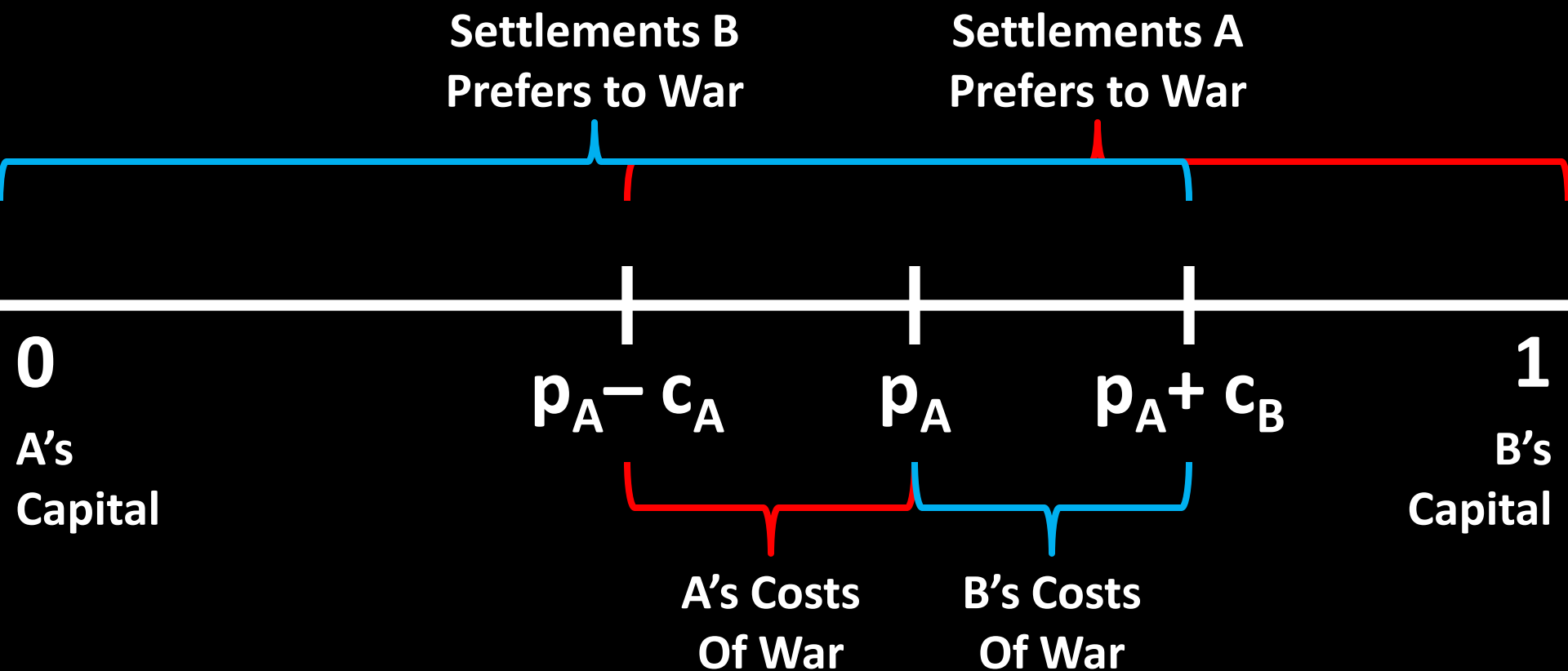


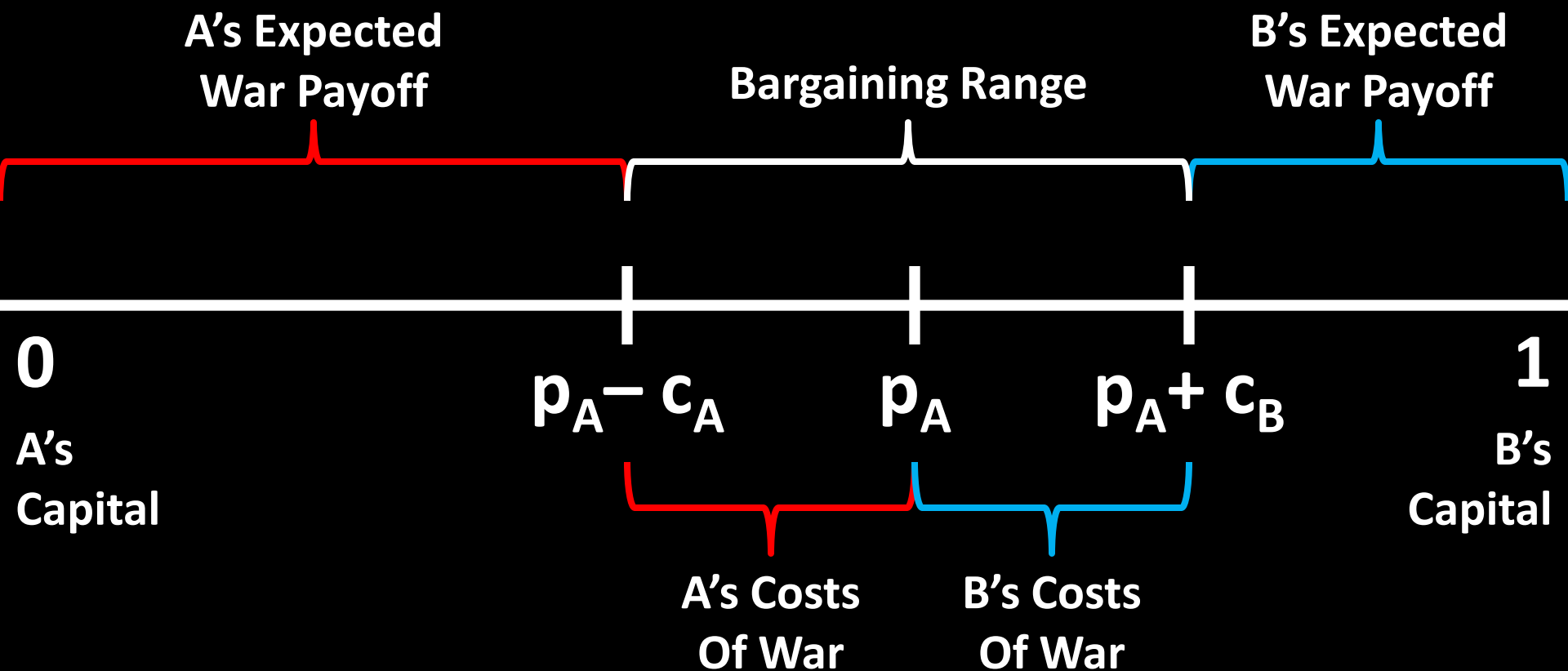












# Road Map

- All of our models have resulted in peace
  - But these models are simple!
  - Some strong assumptions:
    - Power remains stable through time
    - Everyone knows each other's strengths
    - Object is infinitely divisible
    - No first strike advantages

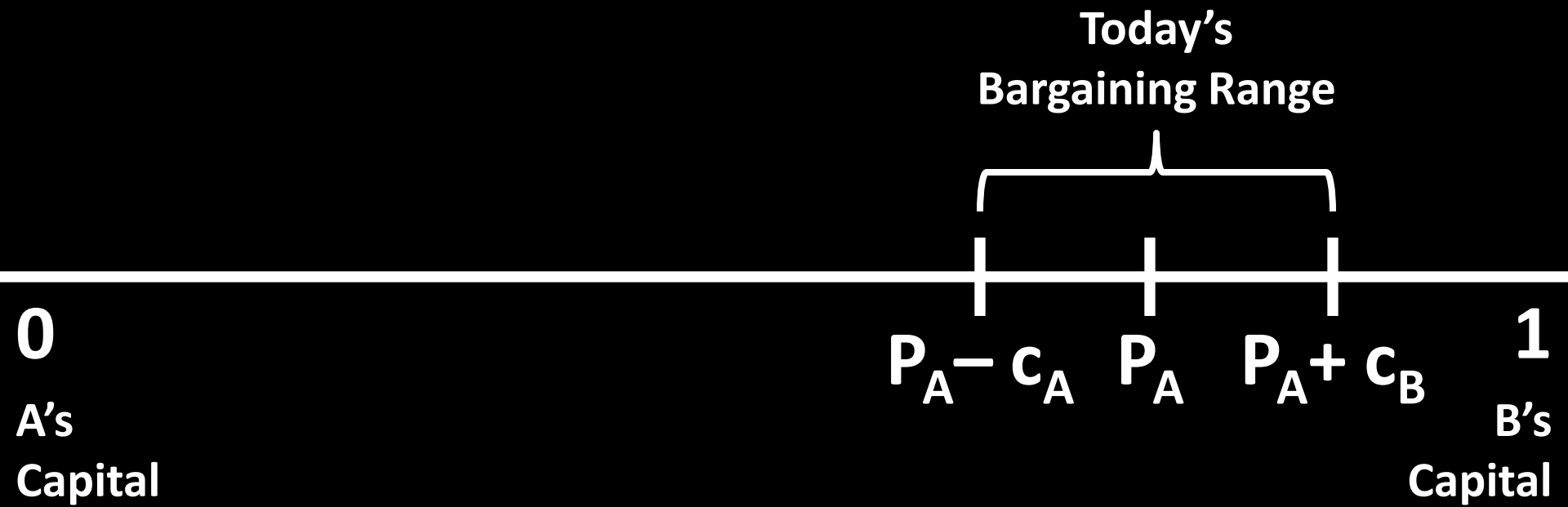
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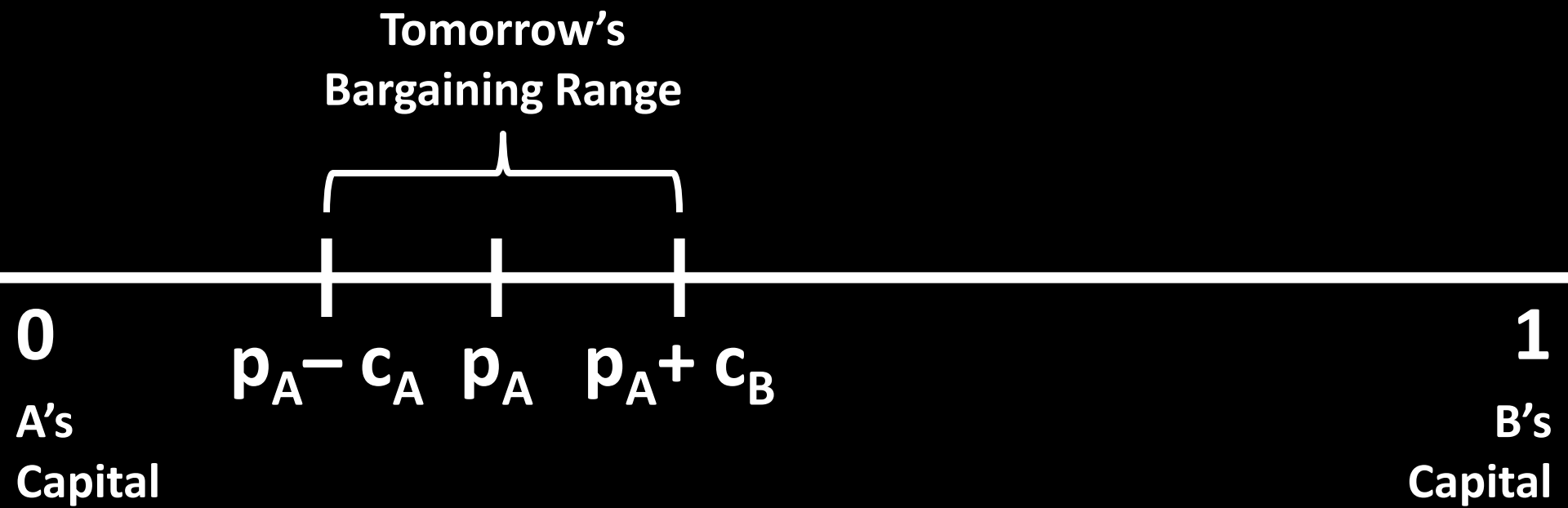
Why do power shifts lead to war?

# The Contenders

1. Rising states start wars after they have become strong to steal stuff from the declining states

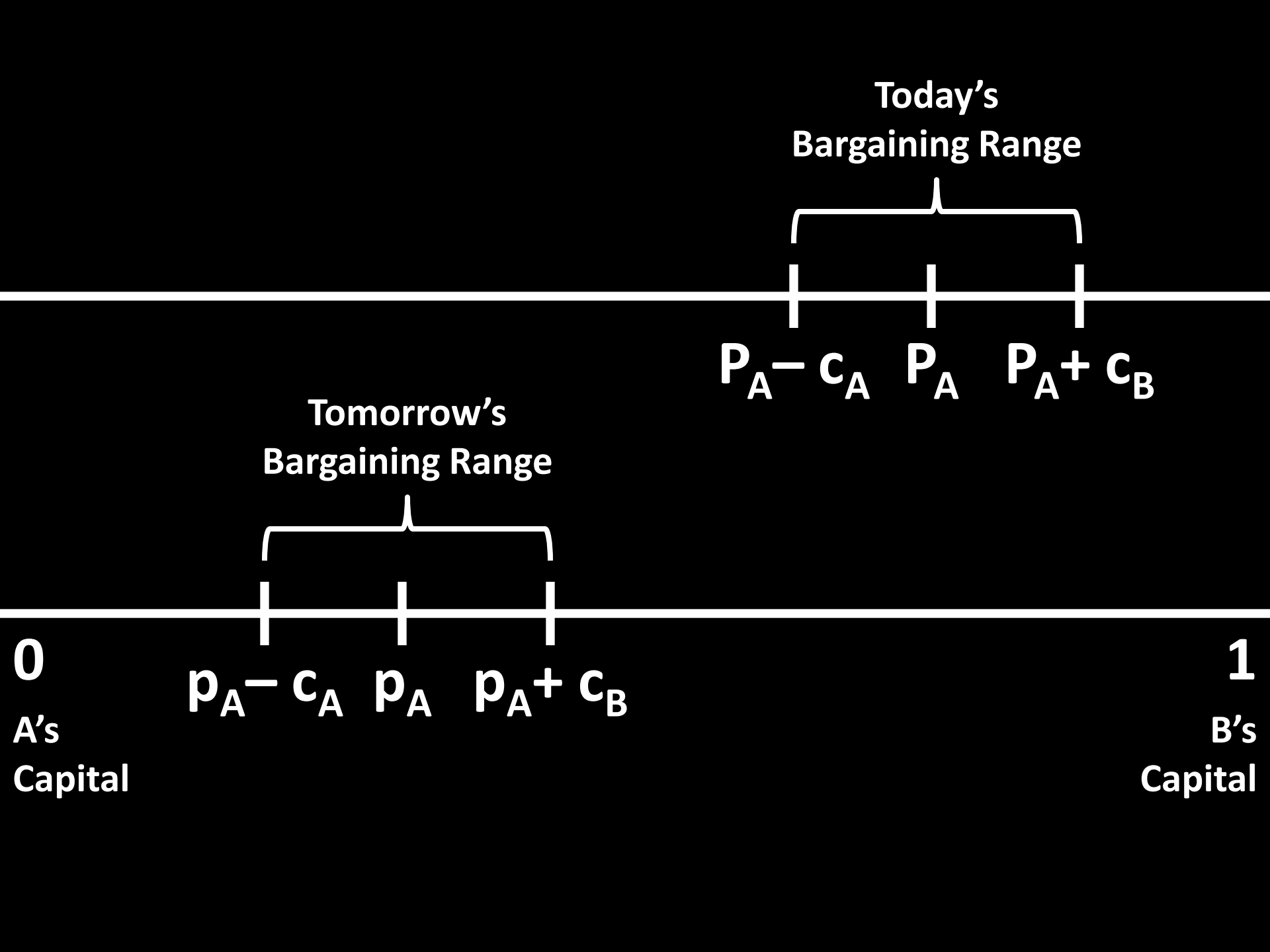






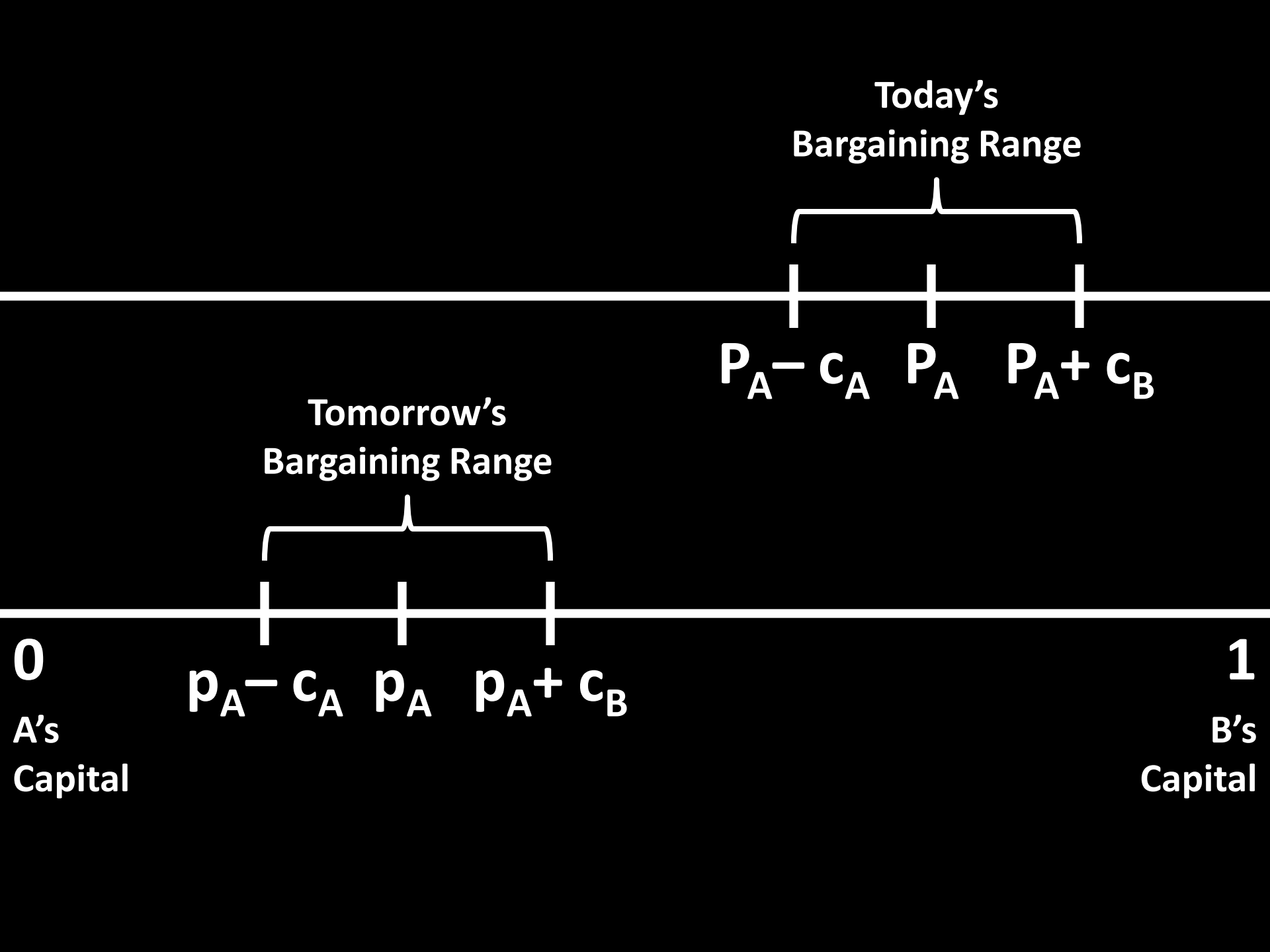
# The Contenders

- ~~1. Rising states start wars after they have become strong to steal stuff from the declining states~~
2. Declining states choose to fight because they prefer a costly war today to an efficient but disadvantageous peace tomorrow

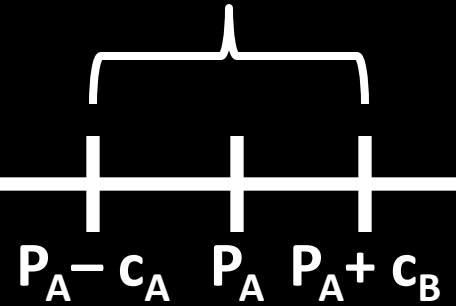


# The Contenders

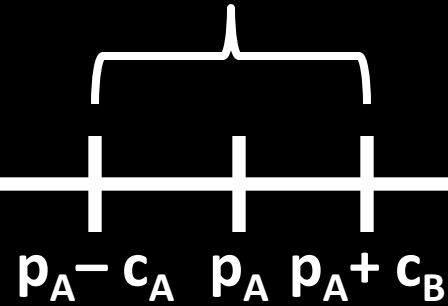
- ~~1. Rising states start wars after they have become strong to steal stuff from the declining states~~
2. Declining states choose to fight because they prefer a costly war today to an efficient but disadvantageous peace tomorrow
3. Power shifts only cause problems when the rising state surpasses the declining state in strength



Today's  
Bargaining Range



Tomorrow's  
Bargaining Range



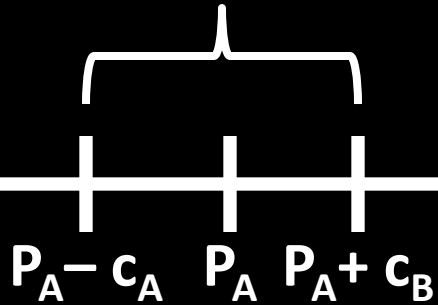
0

A's  
Capital

1

B's  
Capital

Today's  
Bargaining Range



Tomorrow's  
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# The Contenders

- ~~1. Rising states start wars after they have become strong to steal stuff from the declining states~~
2. Declining states choose to fight because they prefer a costly war today to an efficient but disadvantageous peace tomorrow
- ~~3. Power shifts only cause problems when the rising state surpasses the declining state in strength~~



# Preventive War

- Definition: When a declining state fights because it prefers a costly war today to an efficient but disadvantageous peace tomorrow

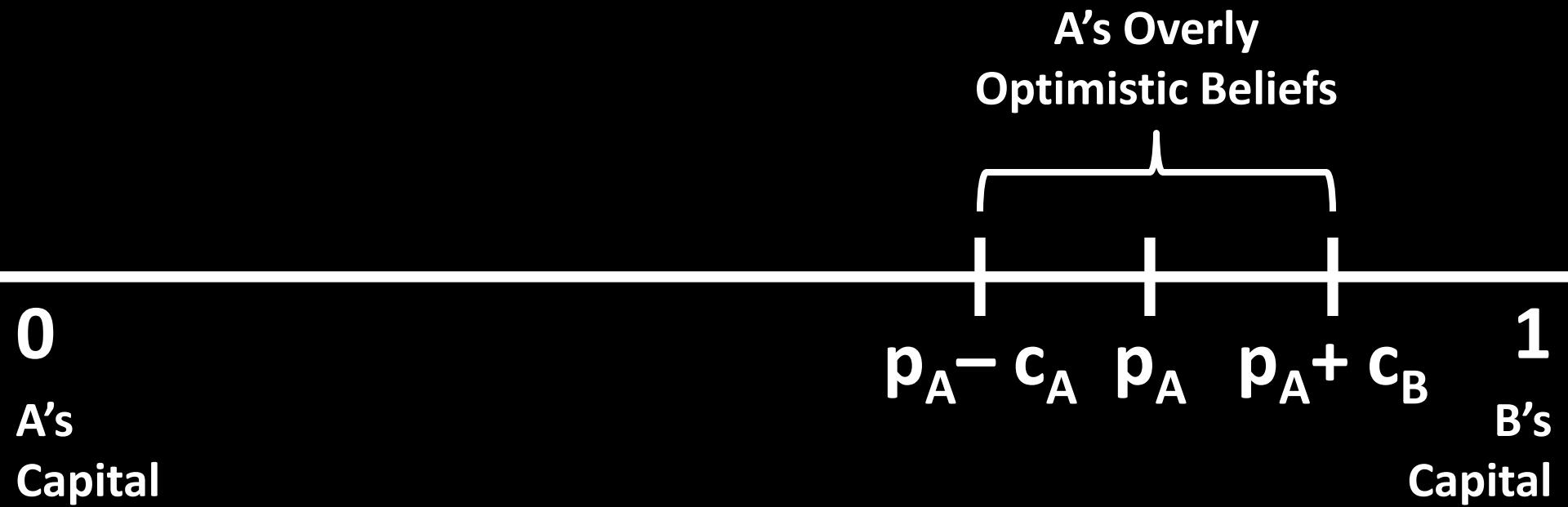
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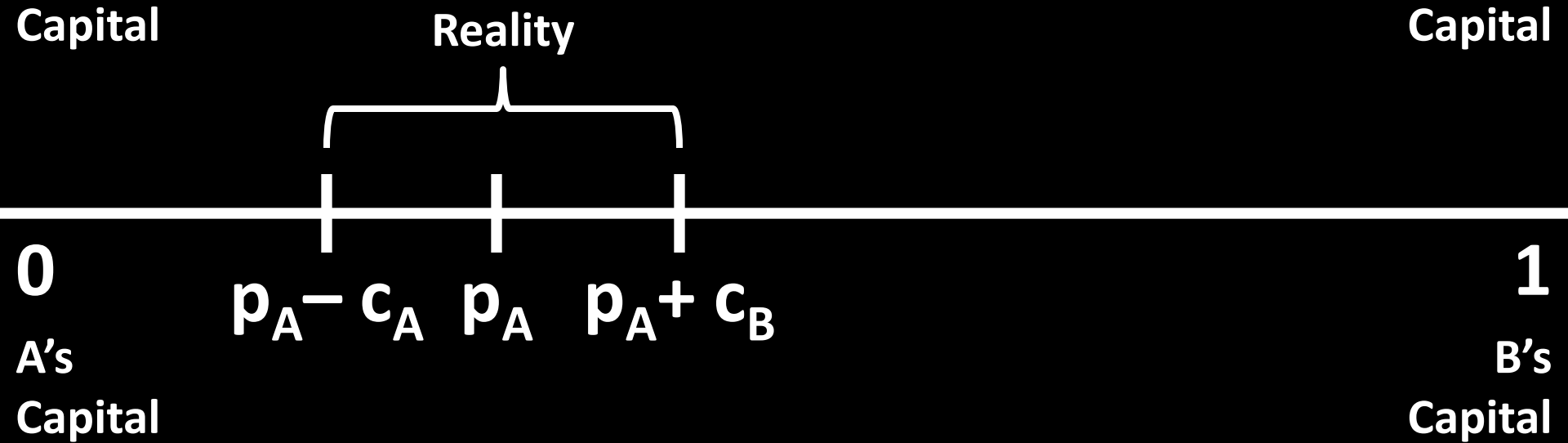
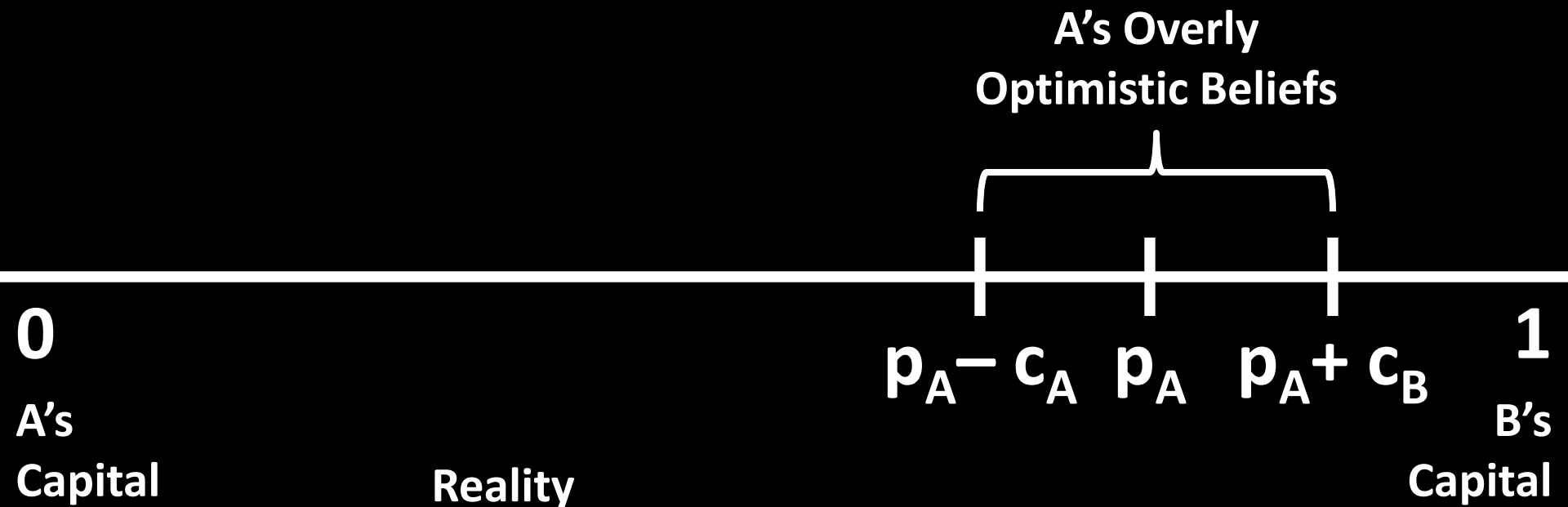
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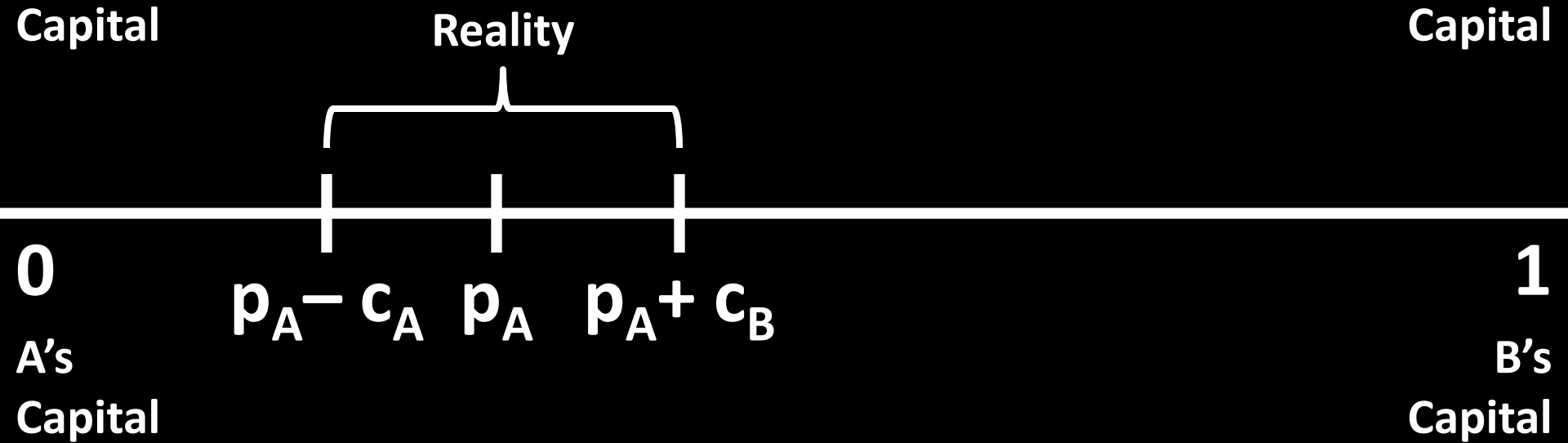
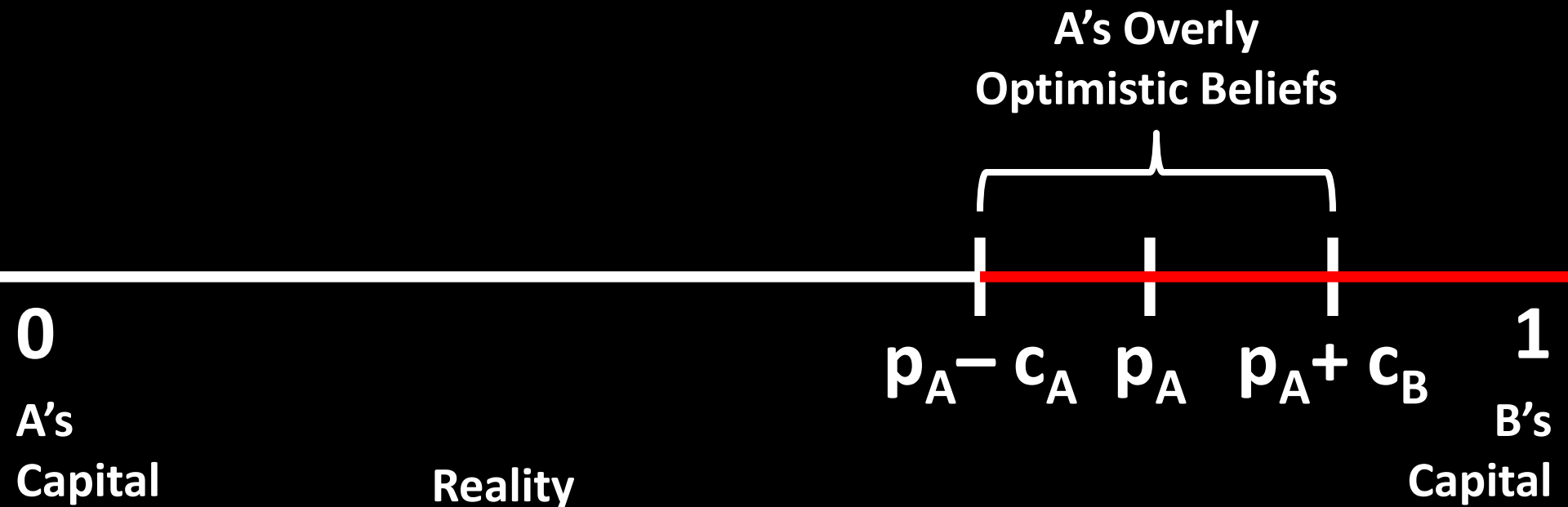
How does uncertainty cause war?

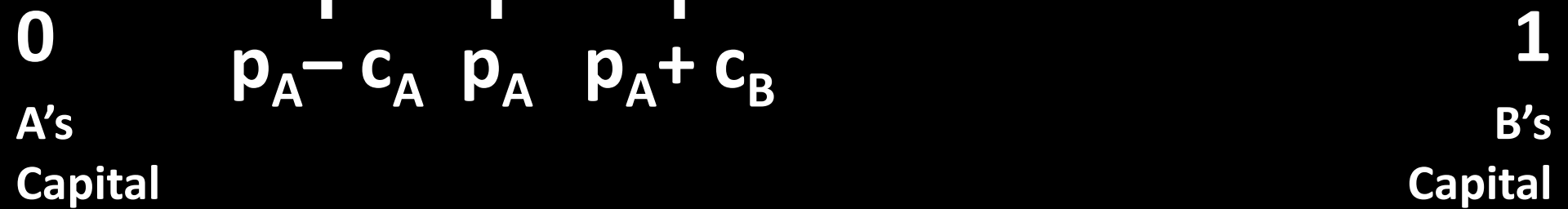
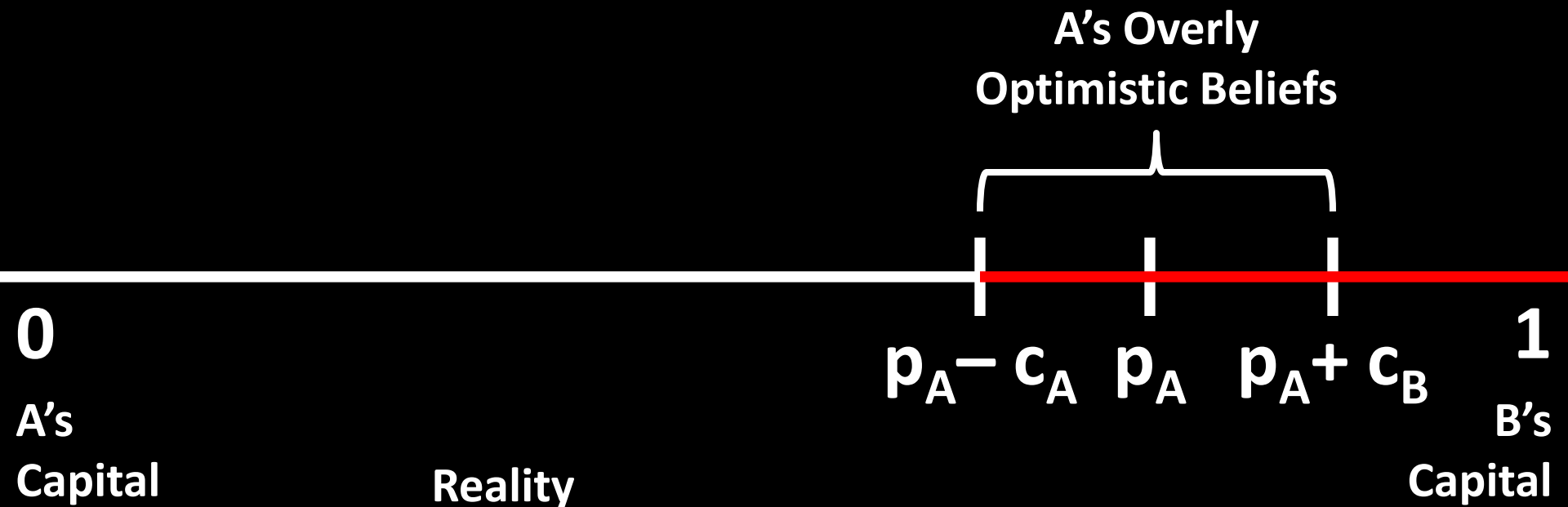
# Two Reasons

1. Disagreement over who will win
  - Suppose B is weak or strong
2. Uncertain resolve





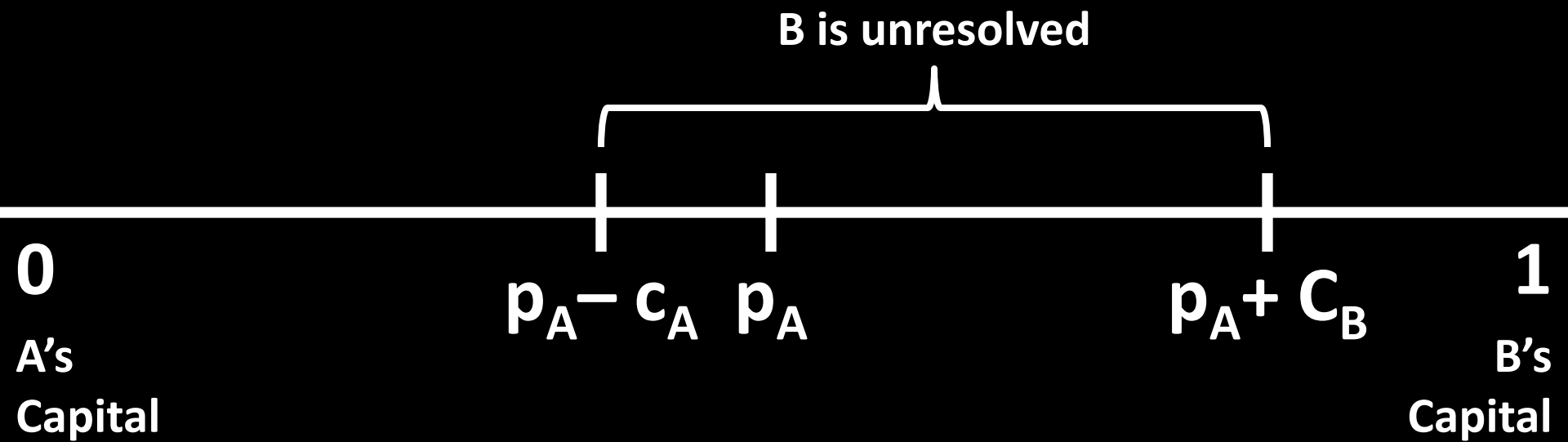


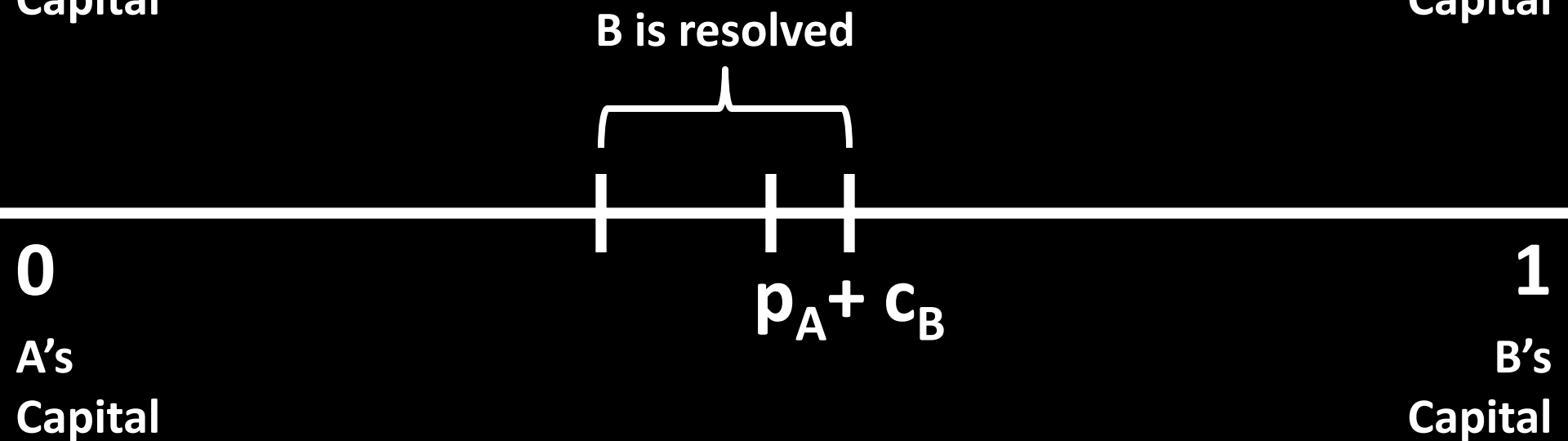
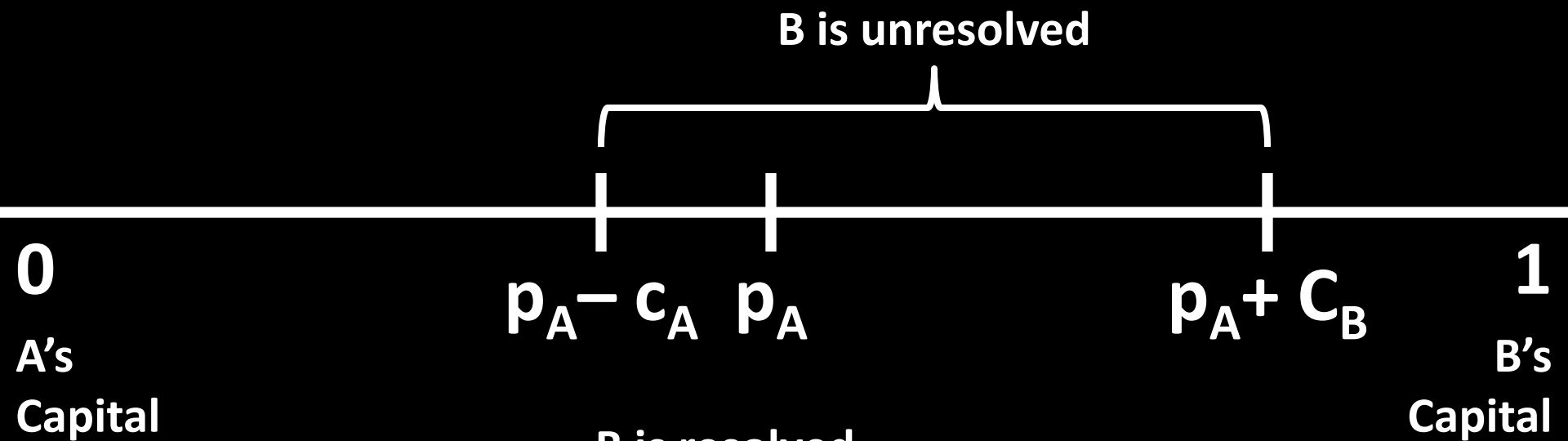


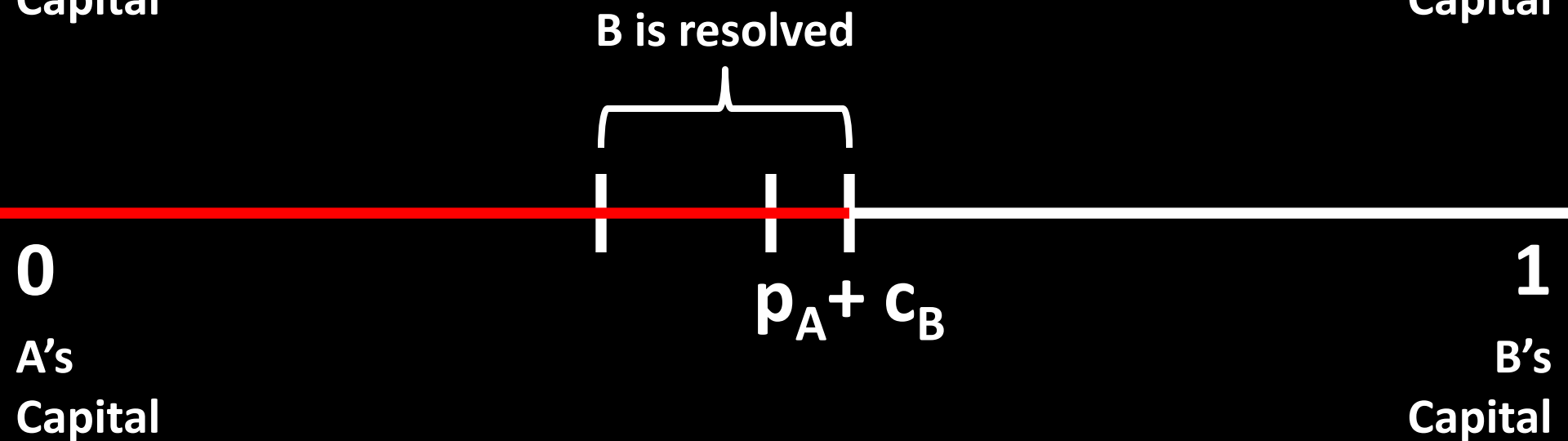
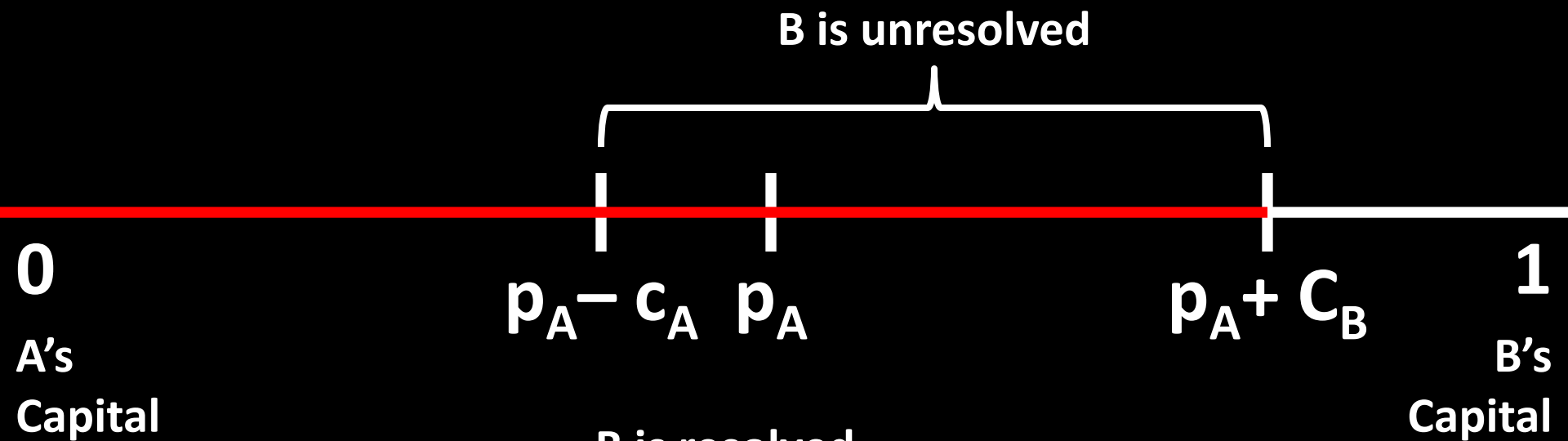


# Two Reasons

1. Disagreement over who will win
2. Uncertain resolve
  - Suppose B is resolved or unresolved







# Incentives to Misrepresent

- If war is costly, why can't the states simply tell their opponents their demands and avoid the costs of war?

# Incentives to Misrepresent

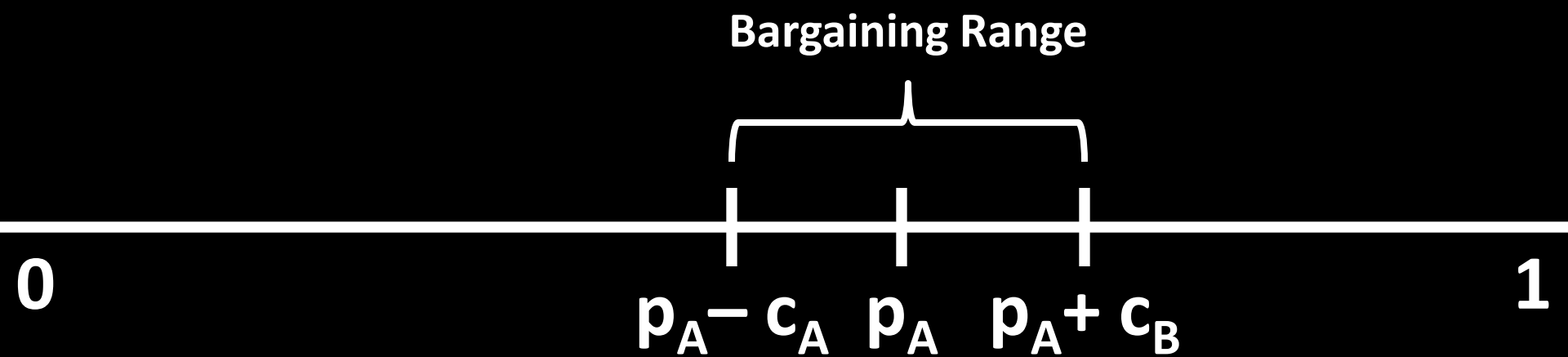
- If war is costly, why can't the states simply tell their opponents their demands and avoid the costs of war?
  - Claims about power and resolve are not inherently credible
- What can you communicate?
  - How much you prefer one issue to another
  - Whether you prefer a moderate outcome to an extreme outcome

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How can bargaining indivisibilities  
lead to war?



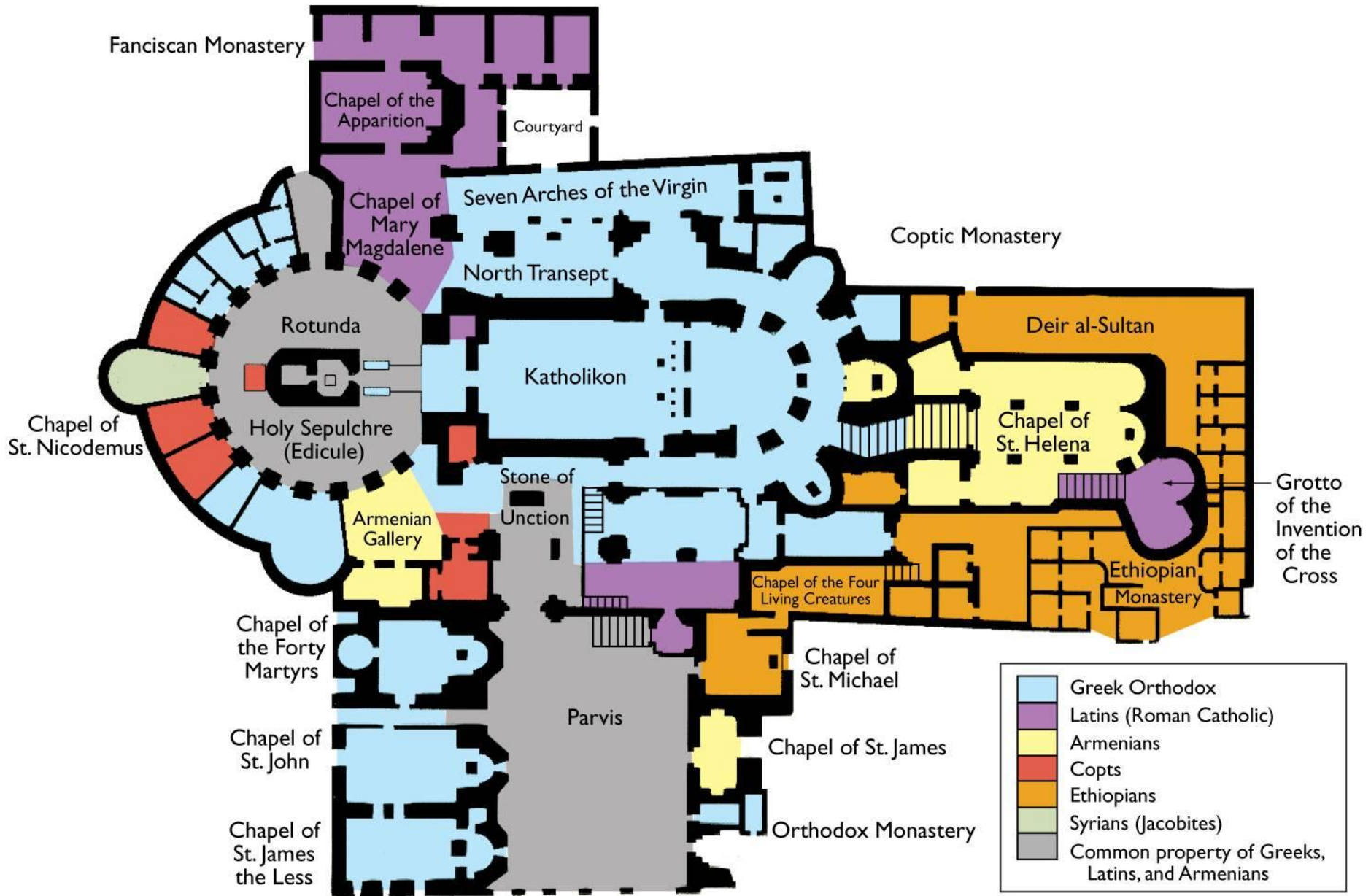


# Side Payments

- Bargaining usually takes place on many dimensions
- Why can't one state buy the island from the other?
  - U.S. and the Philippines
- War is only rational if value of the good is much larger than possible side payments

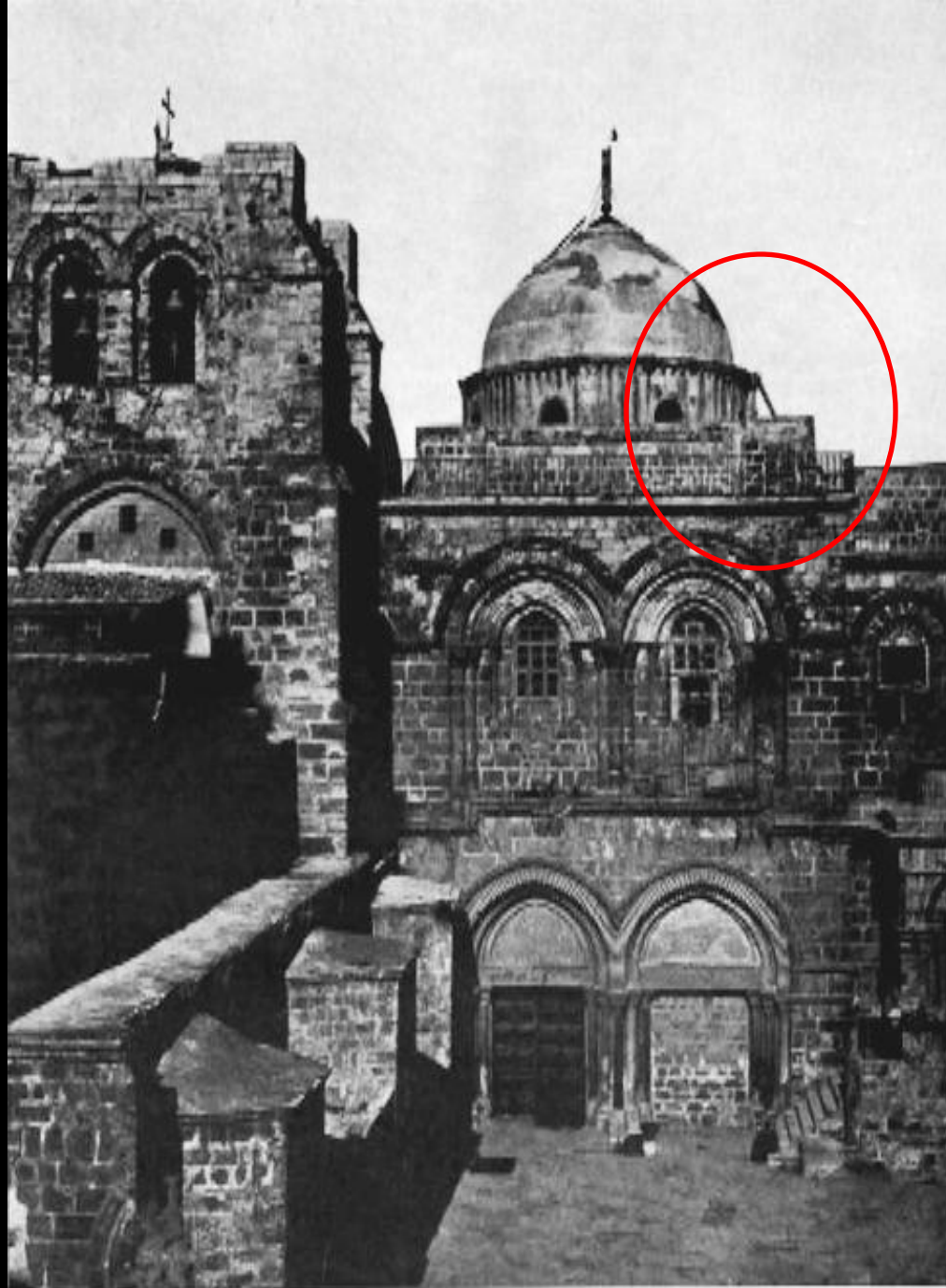


# Church of the Holy Sepulchre









THE CHURCH OF THE HOLY SEPULCHER



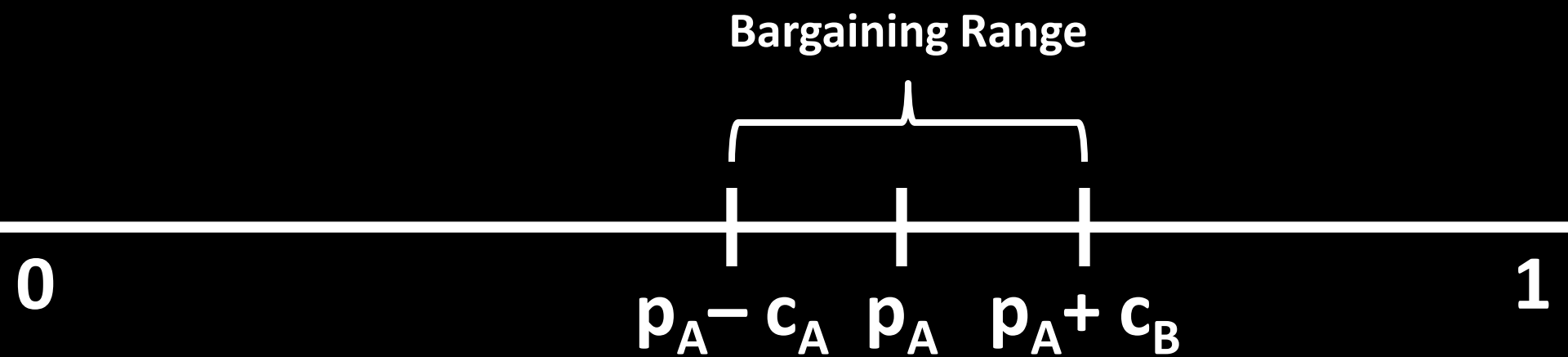


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How do first strike advantages  
lead to war?



# Building the Model

- The probability of victory remains constant regardless of who starts the war
  - But first strike advantages exist: element of surprise, choice of where to fight

# Building the Model

- The probability of victory remains constant regardless of who starts the war
  - But first strike advantages exist: element of surprise, choice of where to fight
- Do first strike advantages lead to war?
  - Yes, if they are sufficiently large

# The Model

- Suppose the states must choose whether to preempt or bargain
  - If both preempt or both bargain (and bargaining fails), A wins with probability  $p_A$
  - If A preempts but B bargains, the states fight, and A wins with probability  $p_A + \Delta_A$ 
    - $1 - p_A + \Delta_B$  if B preempts and A bargains

# The Modeling Question

- Suppose  $x$  is the outcome of bargaining.
- Does there exist an  $x$  such that the states individually prefer the bargained outcome to preemption?

# A's Dilemma

- Assume the other guy wants to bargain
- $u(\text{preempt}) = p_A - c_A + \Delta_A$
- $u(\text{bargain}) = x$
- Bargaining acceptable if:
  - $x \geq p_A - c_A + \Delta_A$

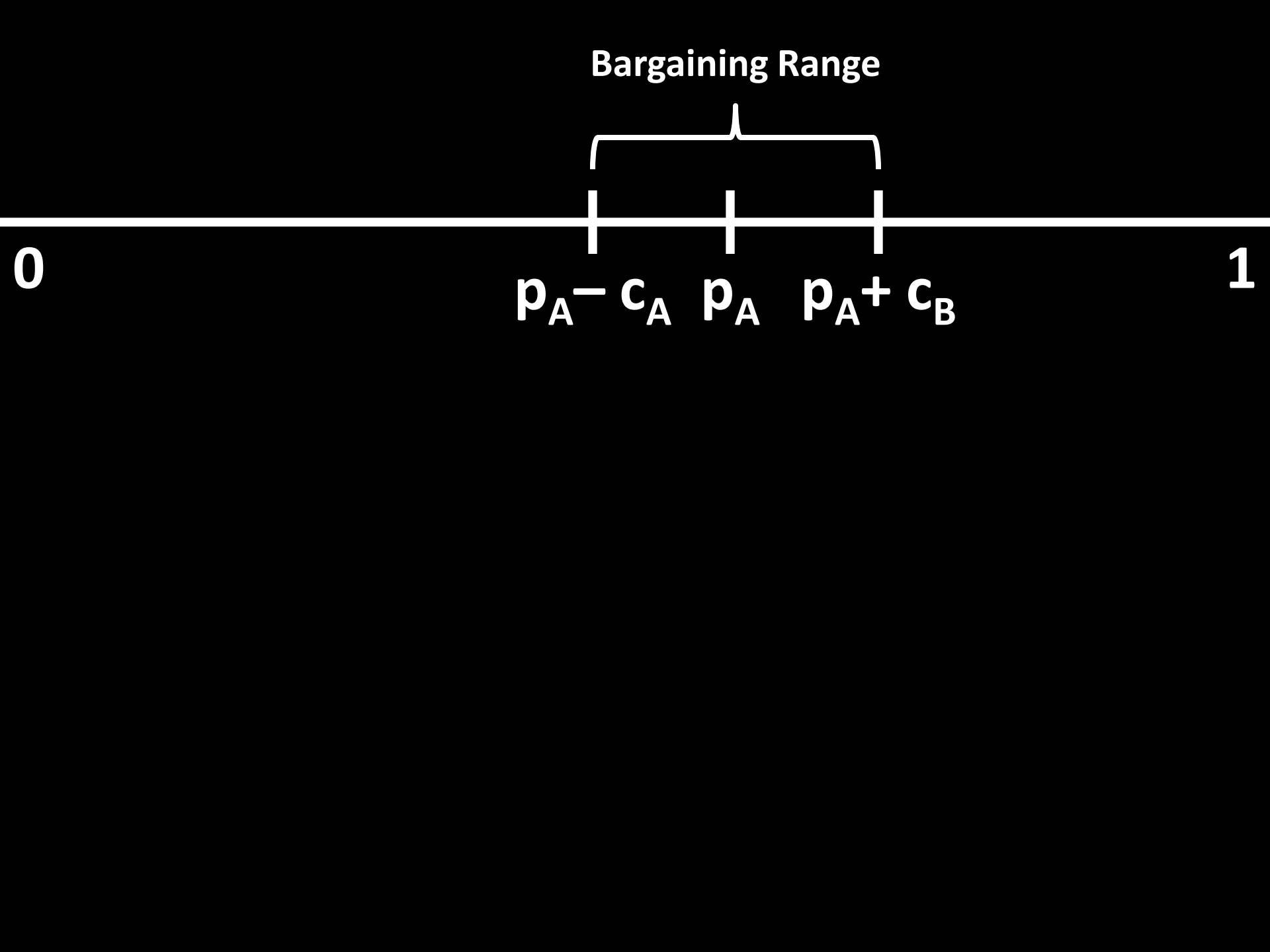
# B's Dilemma

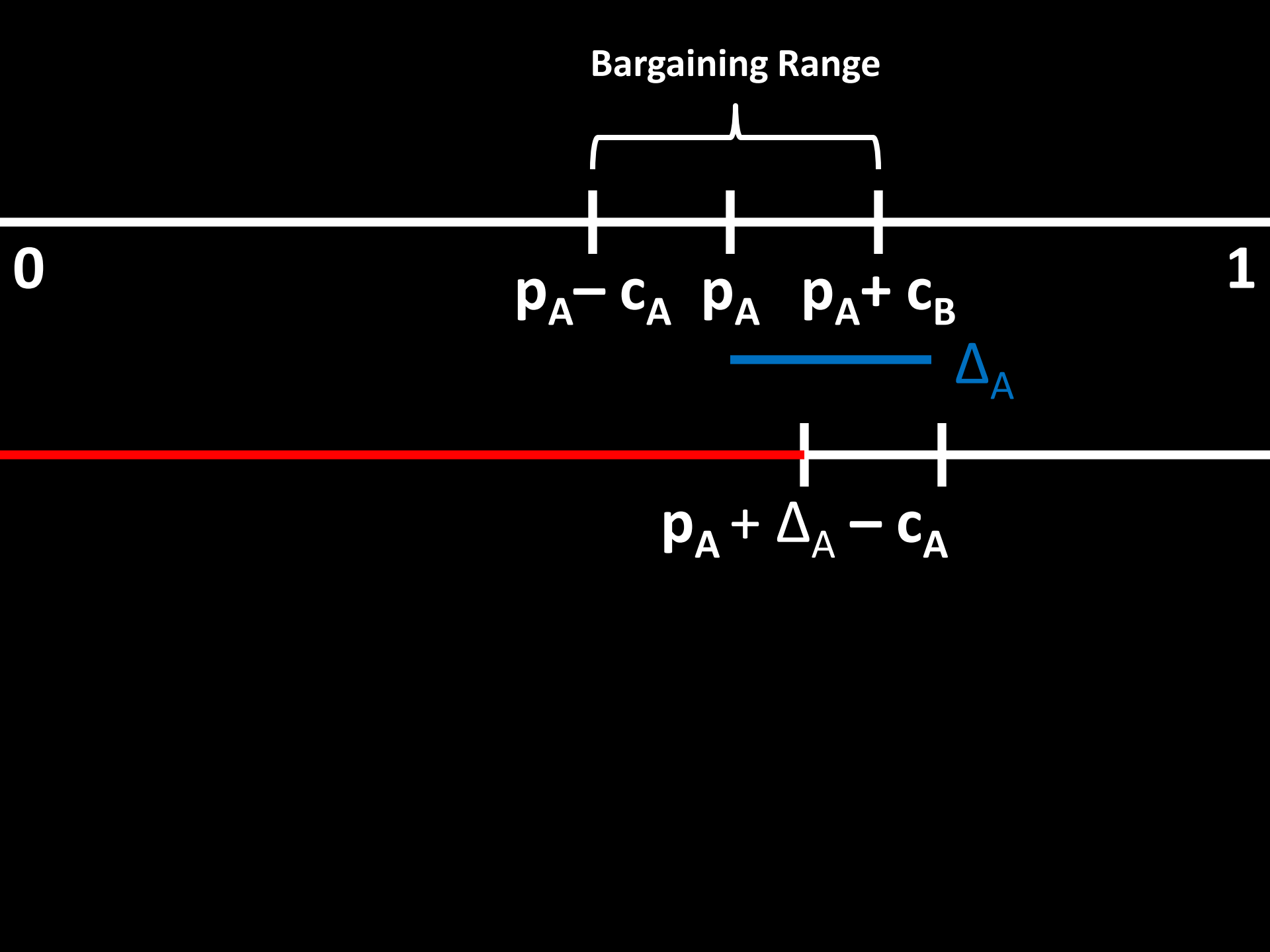
- Assume the other guy wants to bargain
- $u(\text{preempt}) = 1 - p_A - c_B + \Delta_B$
- $u(\text{bargain}) = 1 - x$
- Bargaining acceptable if:
  - $1 - x \geq 1 - p_A - c_B + \Delta_B$
  - $x \leq p_A + c_B - \Delta_B$



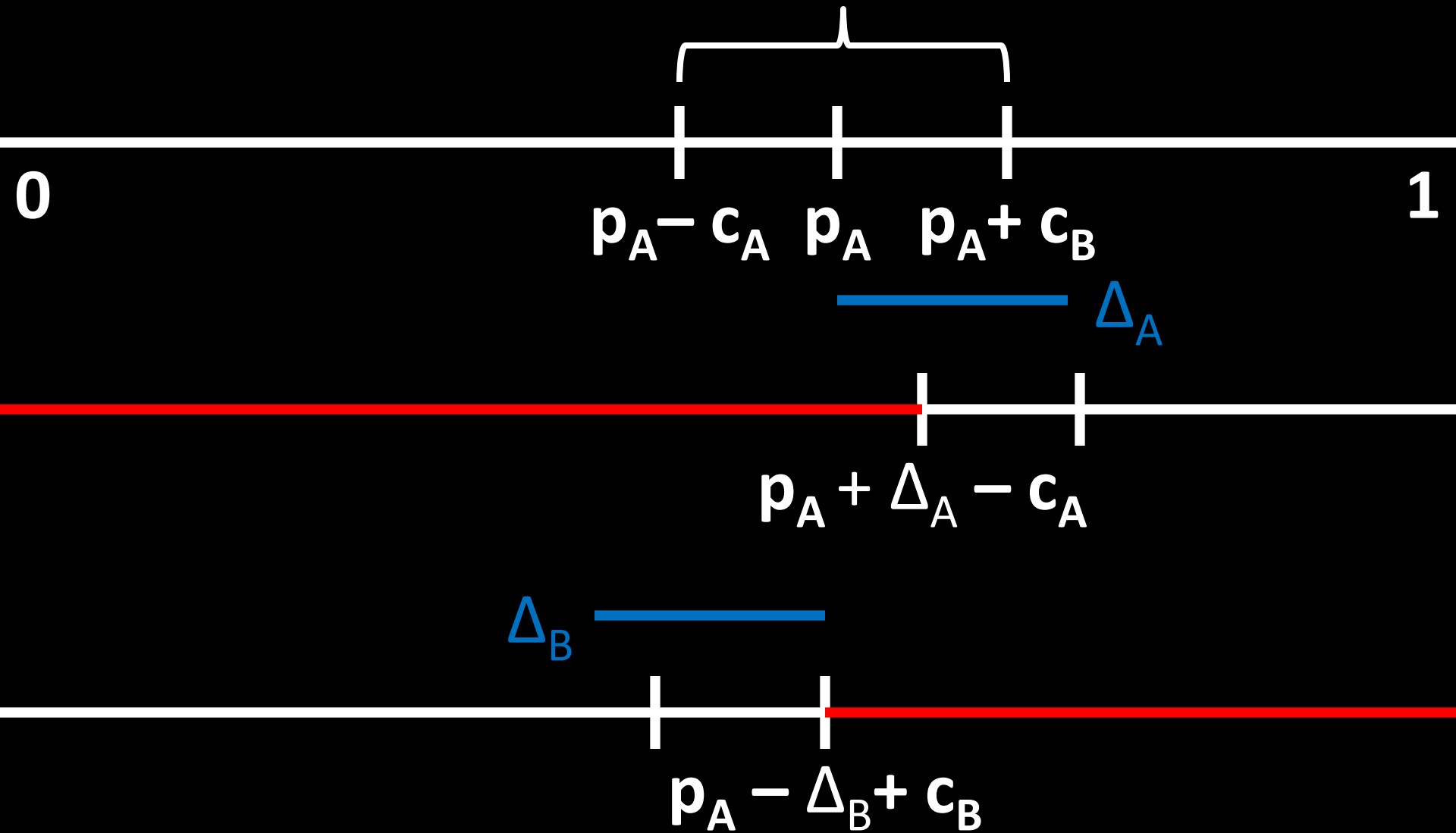
# Mutually Acceptable Bargains?

- $p_A - c_A + \Delta_A \leq x \leq p_A + c_B - \Delta_B$
- An  $x$  exists if:
  - $p_A - c_A + \Delta_A \leq p_A + c_B - \Delta_B$
  - $\Delta_A + \Delta_B \leq c_A + c_B$
  - That is, the first strike advantages are smaller than the costs of fighting

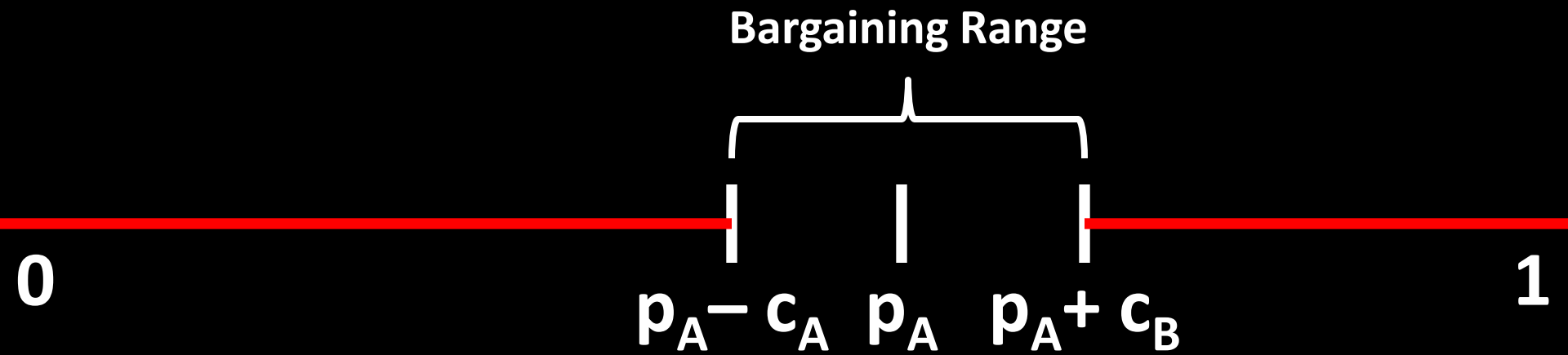




# Bargaining Range







# Realistic?

- Wars tend to be really costly. Do first strike advantages really outweigh costs?

# Realistic?

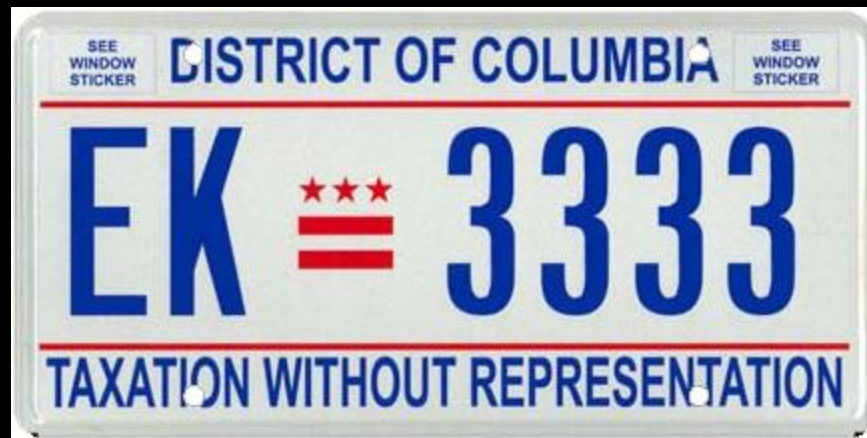
- Wars tend to be really costly. Do first strike advantages really outweigh costs?
  - Probably not
  - But presence of any first strike advantage shrinks the bargaining range, perhaps making it easier for other bargaining frictions to cause problems



# Outline

- Unitary Actor Assumption
- Algebraic Model
- Geometric Model
- Preventive War
- Information Problems
- Issue Indivisibility
- Preemptive War
- **Understanding War**
- Measuring Power
- Militarized Interstate Disputes
- Correlates of War and the Long Peace











REMEMBER YOUR WEEKLY PLEDGE

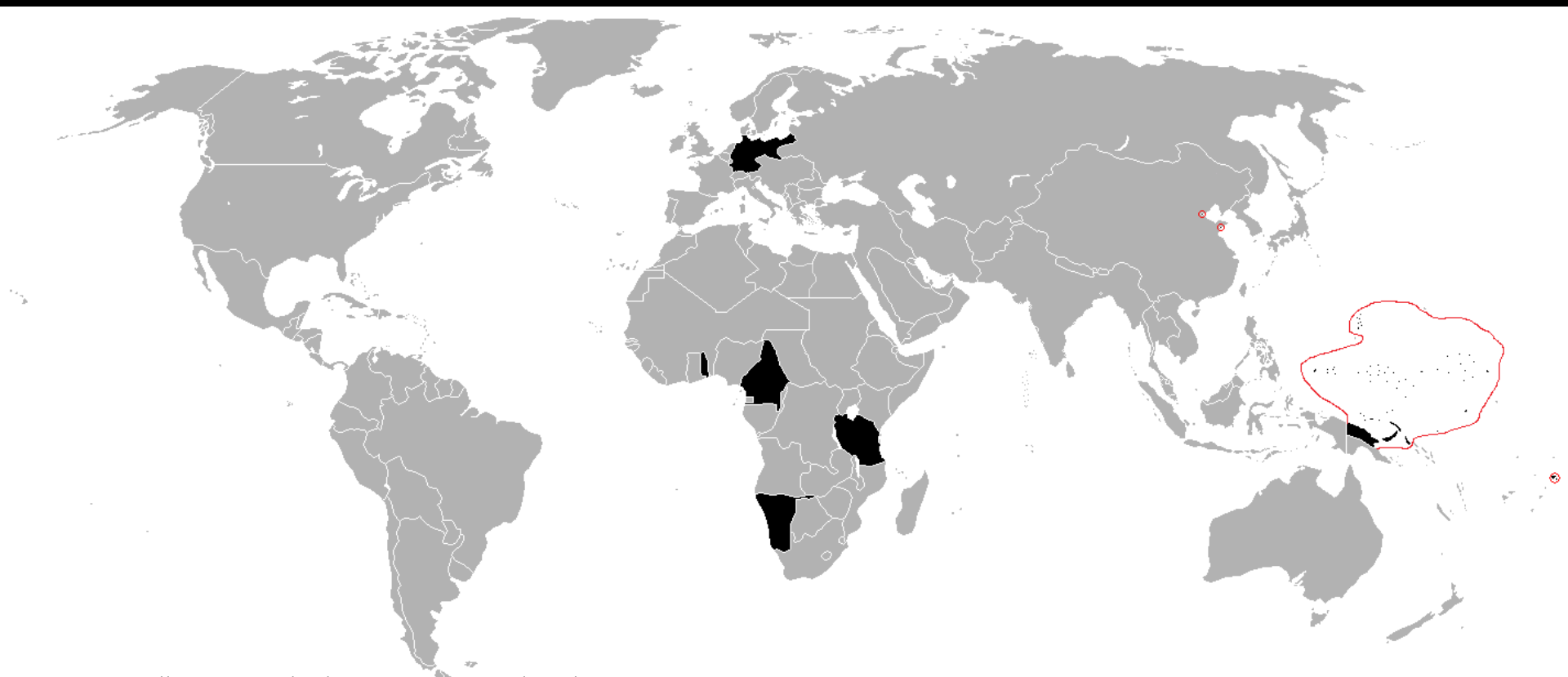


"Upon the first day of the week let every one of you lay by him in store, as GOD hath prospered him." *The Apostle Paul's charge to the Corinthians.*  
1 Cor. xvi. 1.

TO THE M.A.S.  
A.S. SOCIETY.







Andrew0921: [https://en.wikipedia.org/wiki/German\\_colonial\\_empire#/media/File:German\\_colonial.PNG](https://en.wikipedia.org/wiki/German_colonial_empire#/media/File:German_colonial.PNG)



















# Why Not Bargain?

- None of these explanations are sufficient for war
- Why couldn't the states reach a mutually preferable bargain?

# Recipe for War

- We need two things for war:
  1. Grievance (taxation without representation, slavery, territorial ambitions, etc.)
  2. Bargaining problem (incomplete information, shifting power)
- With only one, we do not get conflict
  - High school history classes are lacking here

# Understanding War

- Our research focuses on the bargaining problems, not grievances
- There are only two(?) types of bargaining problems
- There are too many types of grievances to count



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# Data on Power

- We measure data on power with CINC (Composite Indicator of National Capability) scores
- There are strengths and weaknesses
- You will learn more about these in the data analysis

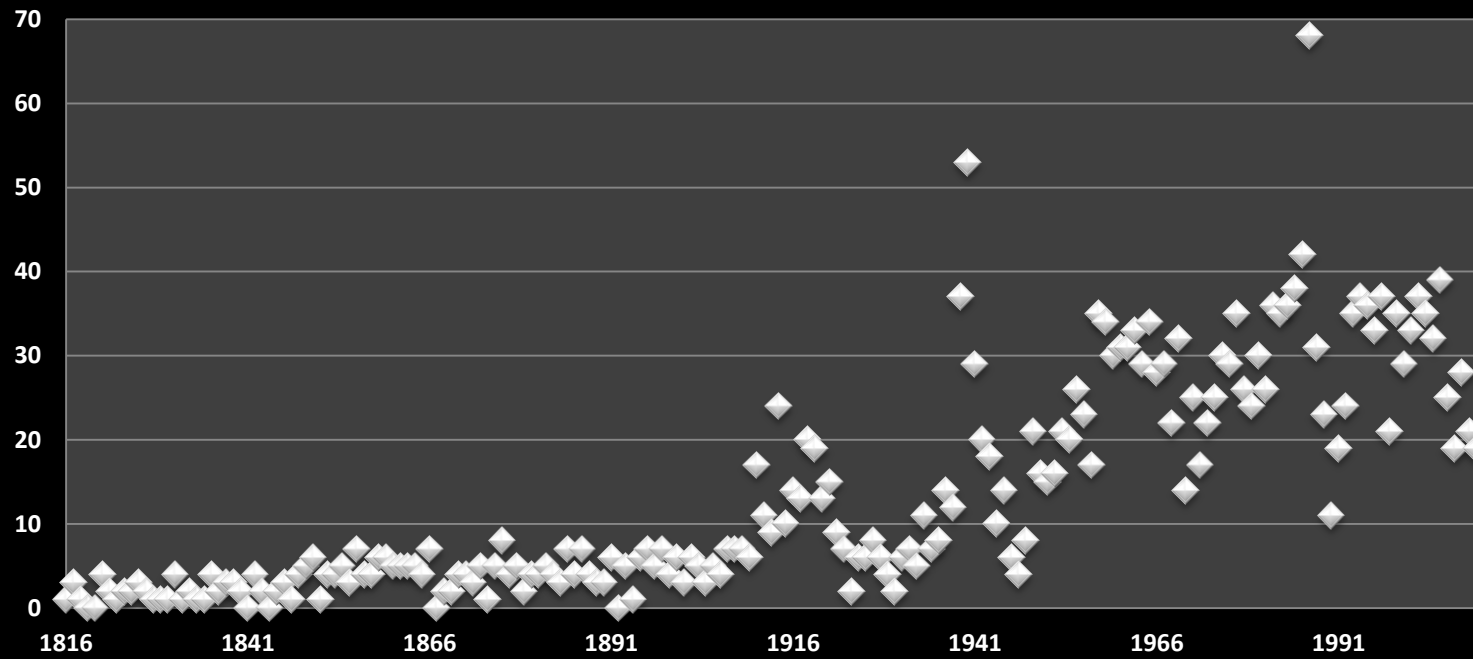
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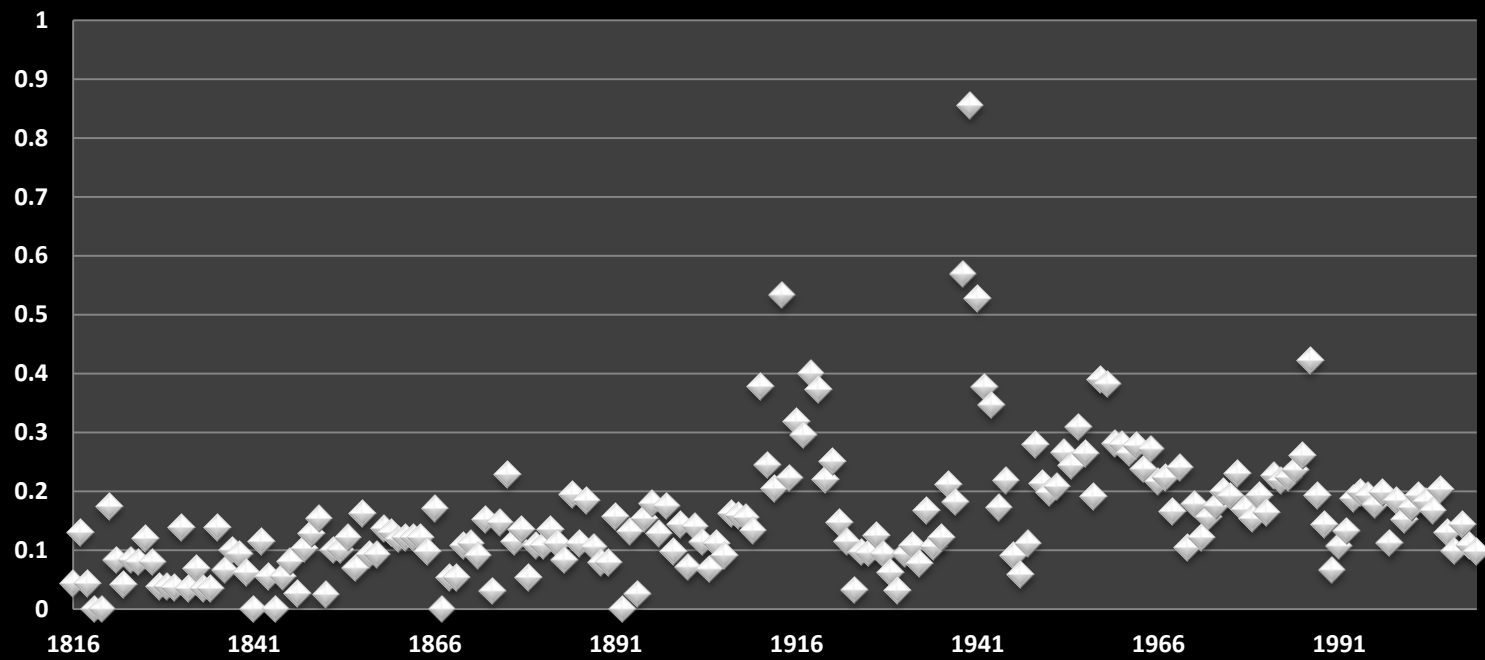
# Militarized Interstate Disputes (MIDs)

- “cases of conflict in which the threat, display or use of military force short of war by one member state is explicitly directed towards the government, official representatives, official forces, property, or territory of another state”
- 1816-2010: 2586 (known) instances

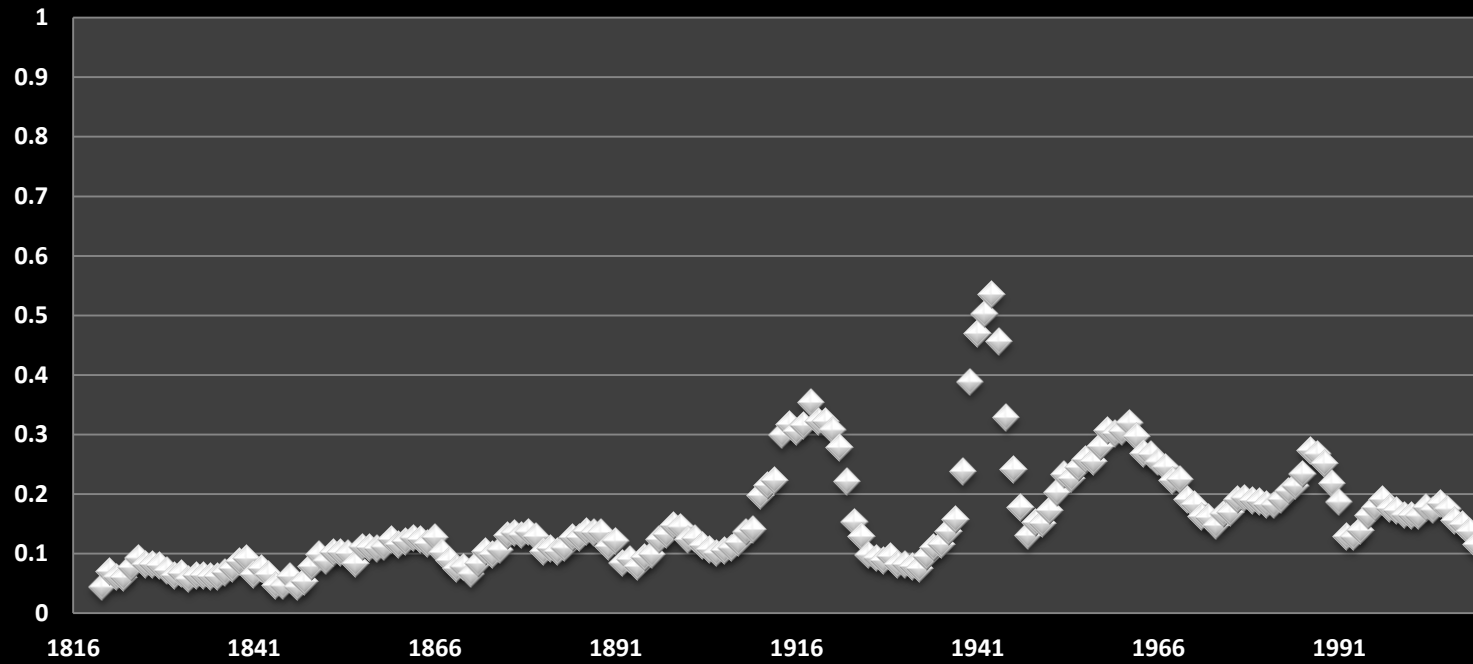
## MIDs Per Year



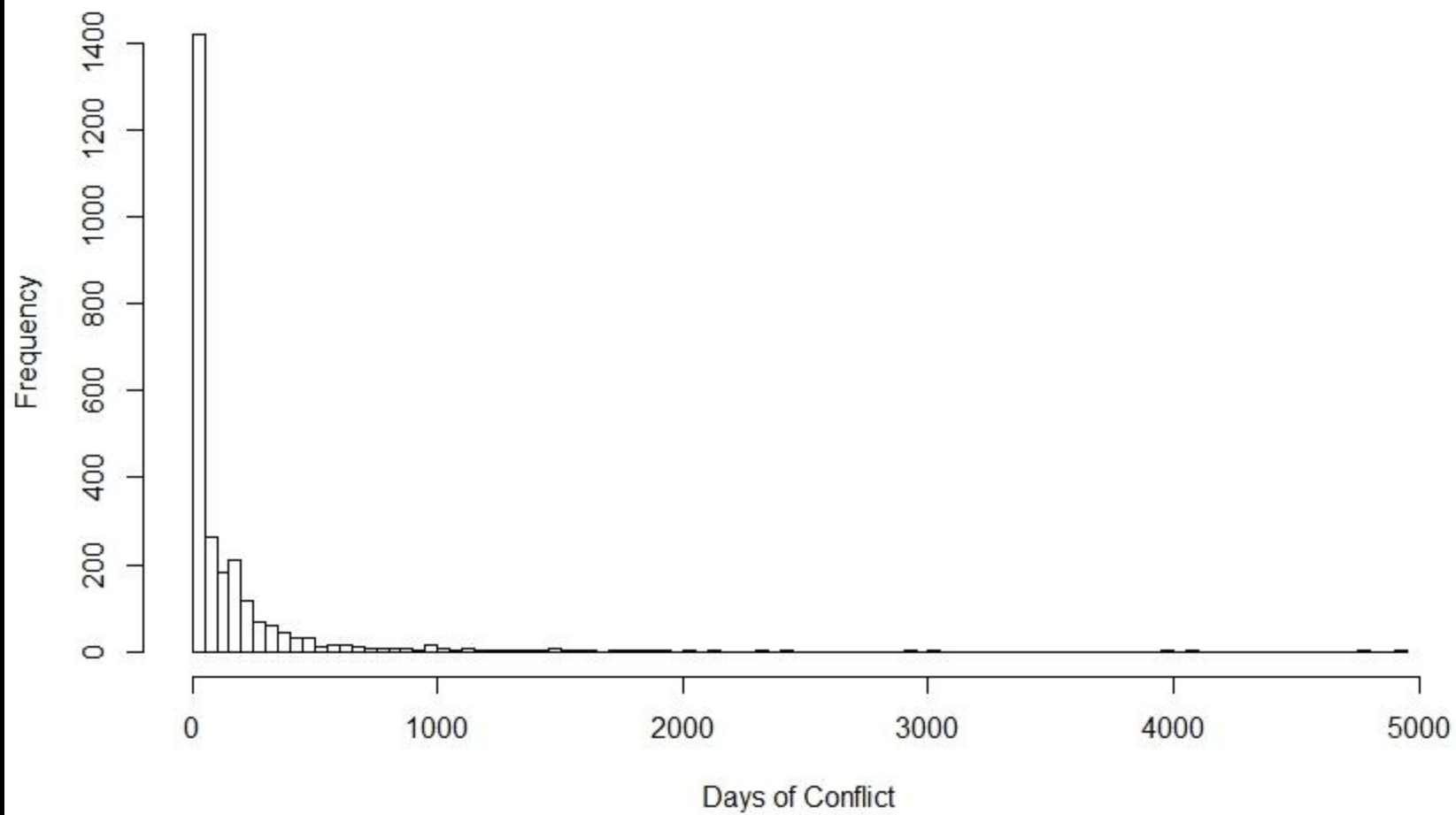
## MIDs Per Year Per State



MIDs Per Year Per State (5 Year Avg)



**Distribution of Conflict Lengths**





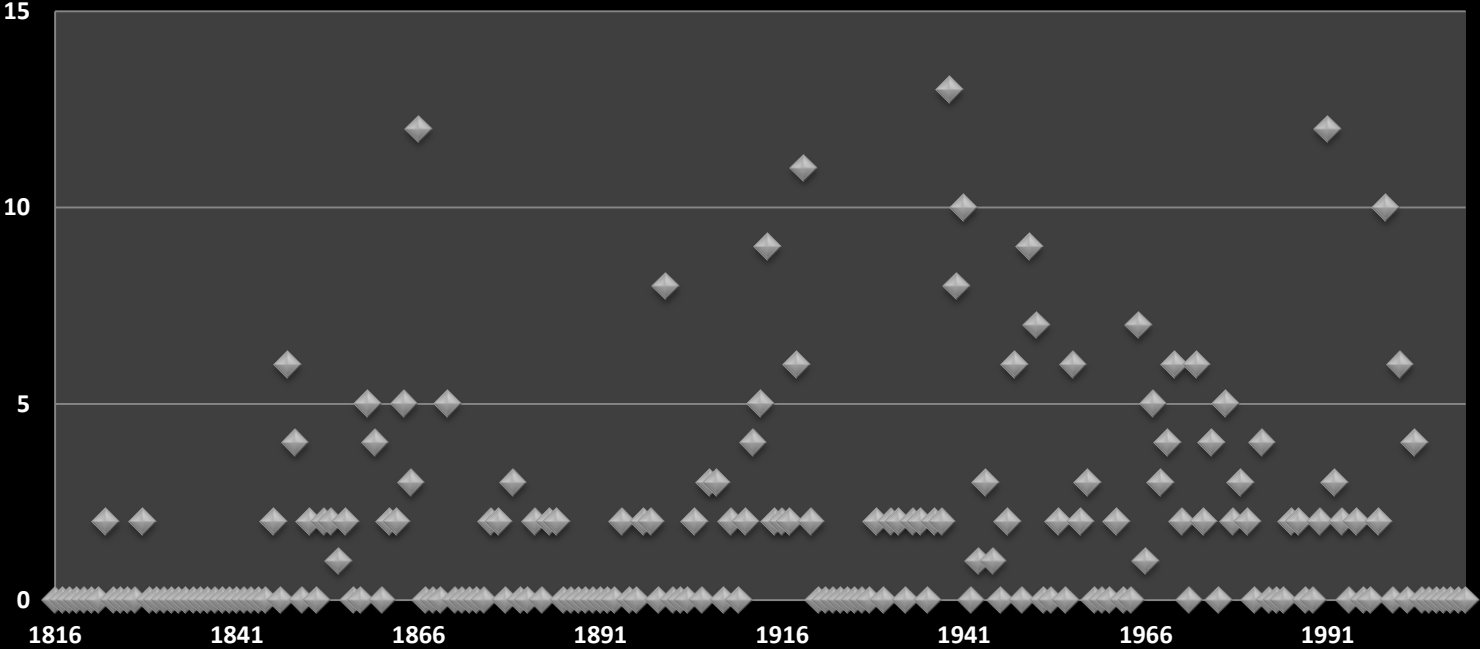
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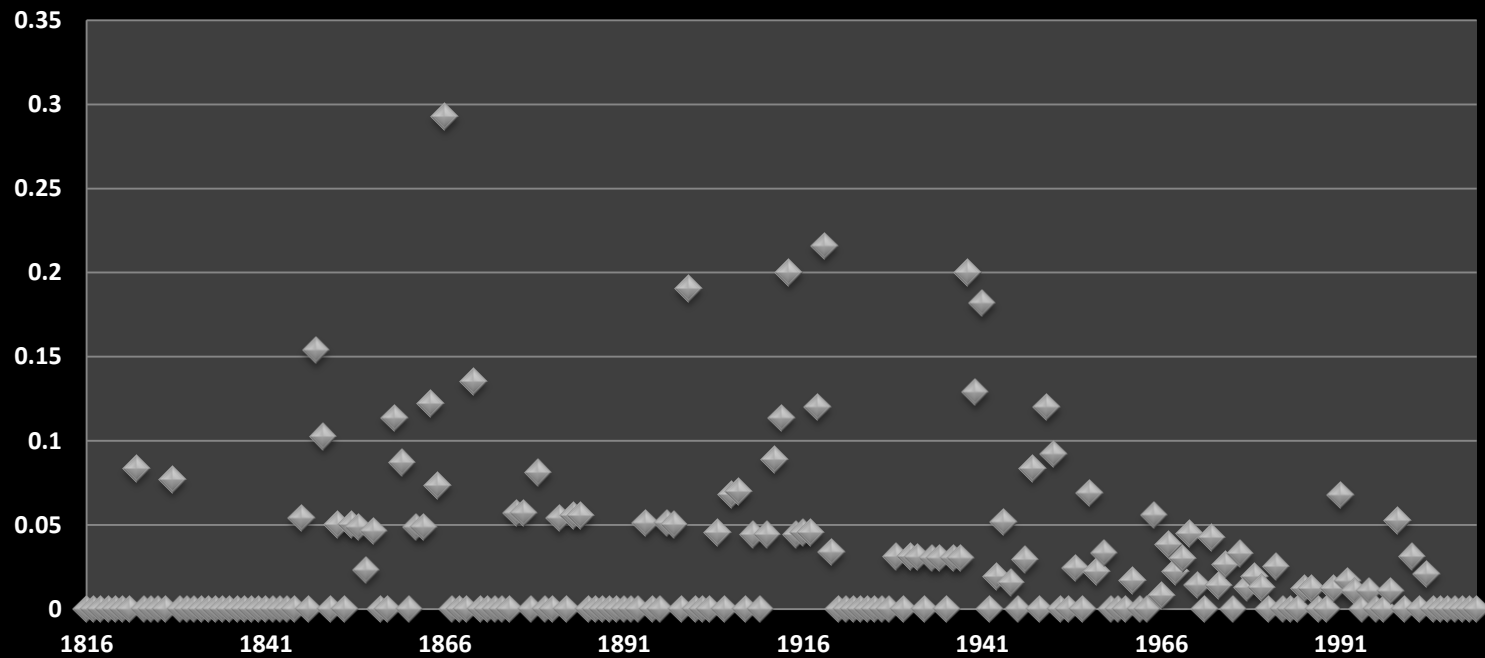
# Correlates of War

- Sustained combat between regular armed forces of two states
- At least 1000 combat fatalities total
- Each side has at least 100 combat fatalities or at least 1000 armed forces

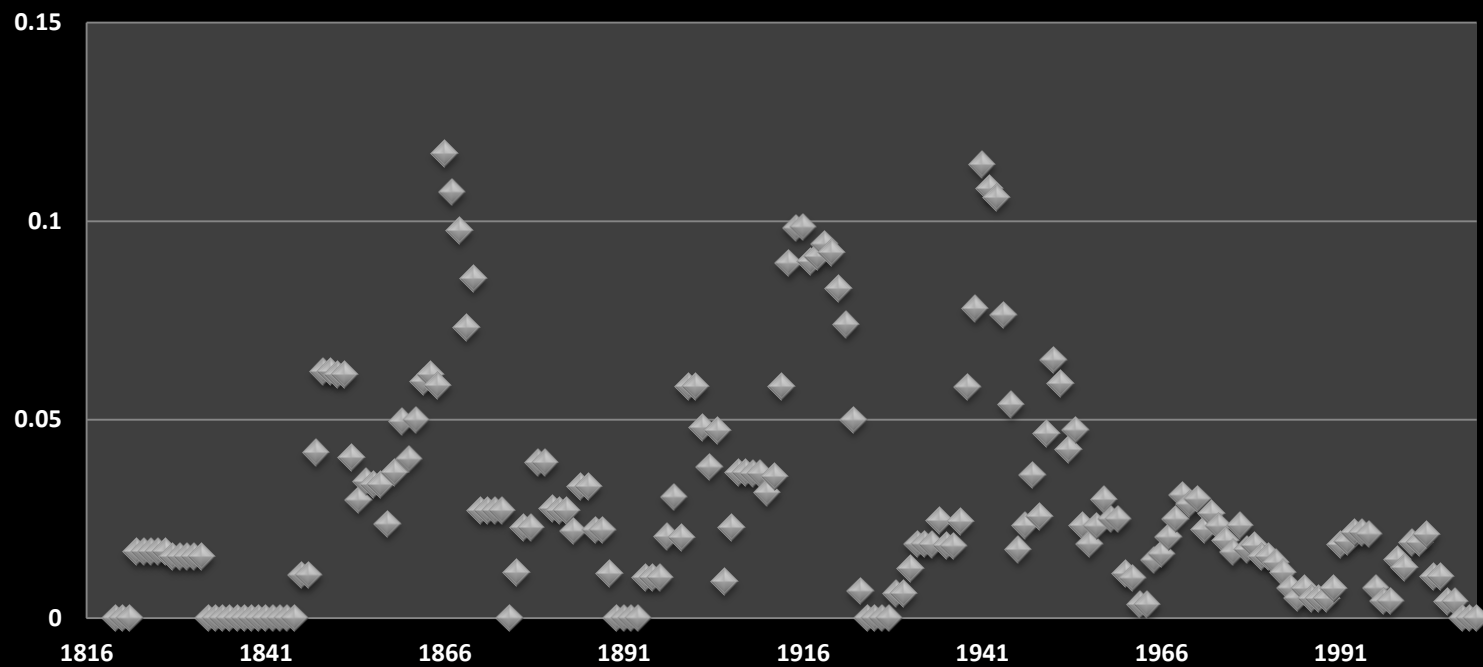
States Starting War Per Year



## Portion of States Starting War



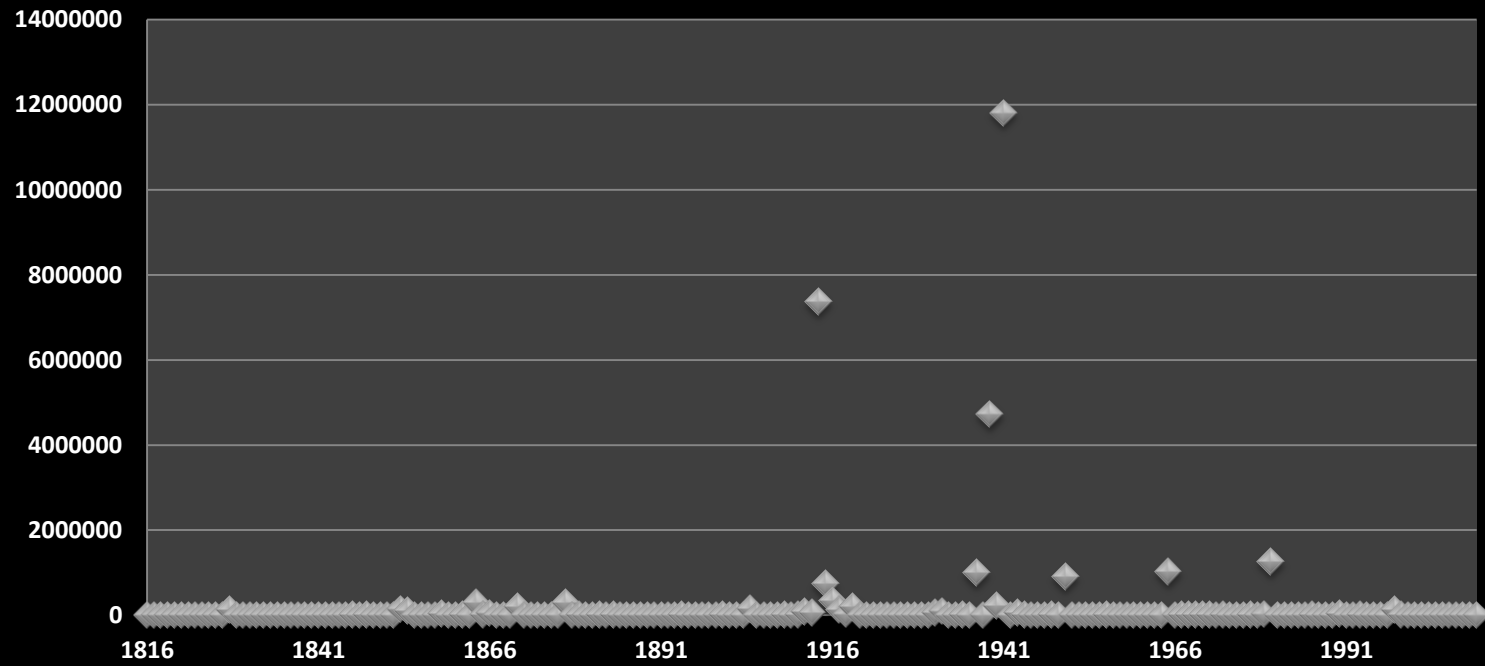
Portion of States Involved (5 Year Avg)



# The Long Peace

- Wars have been trending downward following World War II
- There have been 0 wars between major powers in that period
  - Unclear if it is a product of chance
  - Many theories assume that peace is growing more prevalent

## Battle Deaths Per Year



**Battle Deaths Per Year (20 Year Avg)**

