PS 0500: Nuclear Weapons

William Spaniel

Outline

• The Nuclear Club
• Mutually Assured Destruction
• Obsolescence Of Major War
• Nuclear Pessimism
• Why Not Proliferate?
• Mixed Strategies
• The Iraq War
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United States (1945)

- Manhattan Project
- Hiroshima and Nagasaki bombings
- Would have been a lot worse if the Nazi scientists had won the race
  - ...but fortunately the Nazis were Naziing
Soviet Union (1949)

• Manhattan Project spies
• US knew the Soviets were developing a bomb but chose not to launch preventive war
  – Immediately after WWII
  – No intelligence
• Cold War starts in earnest
United Kingdom (1952)

- Tube Alloys
- Agreement with the United States
France (1960)

- France and the United States do not have as intimate a relationship as the U.S. and the U.K.
- France sought strategic independence
  - Therefore, nukes
China (1964)

- Sino-Soviet split
India (1974)

• India does not like Pakistan very much
• Tested the “Smiling Buddha,” a “peaceful nuclear explosion,” in 1974
• Remained mostly dormant until 1998. (Hold that thought...)
Israel (1979)

- Israel does not have nuclear weapons
South Africa (1979)

- The Vela Incident
  - A US satellite (Vela Hotel) detected a flash in the Atlantic Ocean between South Africa and Antarctica
- Built due to concerns of civil war spillover from Angola
- Dismantled at the end of Apartheid
Soviet Successor States

- Ukraine, Kazakhstan, and Belarus had nuclear weapons on their soil during the Soviet Union’s breakup
- Moscow still had command control
- Countries accepted cash to dismantle the weapons and forgo native nuclear development
Pakistan (1998)

• Five weeks after India’s nuclear tests in 1998, Pakistan tested six bombs
• Pakistan is now “too nuclear to fail”
• A.Q. Khan network
The 1998 Ig Nobel Prize Winners

The 1998 Ig Nobel Prizes were awarded at the 8th First Annual Ig Nobel Prize Ceremony, at Harvard's Sanders Theatre. The ceremony was webcast live.

SAFETY ENGINEERING: Troy Hurtubise, of North Bay, Ontario, for developing, and personally testing a suit of armor that is impervious to grizzly bears. [REFERENCE: "Project Grizzly", produced by the "National Film Board of Canada. ALSO: Bear Man: The Troy Hurtubise Saga, by Troy Hurtubise, Raven House Publishing, Westbrook, ME, USA, 2011.]

BIOLOGY: Peter Fong of Gettysburg College, Gettysburg, Pennsylvania, for contributing to the happiness of clams by giving them Prozac.


PEACE: Prime Minister Shri Atal Bihari Vajpayee of India and Prime Minister Nawaz Sharif of Pakistan, for their aggressively peaceful explosions of atomic bombs.

CHEMISTRY: Jacques Benveniste of France, for his homeopathic discovery that not only does water have memory, but that the information can be transmitted over telephone lines and the Internet. [NOTE: Benveniste also won the 1991 Ig Nobel Chemistry Prize.]

[REFERENCE: "Transatlantic Transfer of Digitized Antigen Signal by Telephone Link," J. Benveniste, P. Jurgens, W. Hsueh and J. Aissa, "Journal of Allergy and Clinical Immunology - Program and abstracts of papers to be presented during scientific sessions AAAAI/AAI.CIS Joint Meeting February 21-26, 1997"]

SCIENCE EDUCATION: Dolores Krieger, Professor Emerita, New York University, for demonstrating the merits of therapeutic touch, a method by which nurses manipulate the energy fields of ailing patients by carefully avoiding physical contact with those patients.
North Korea (2006)

- Conducted a (relatively crummy) explosion in 2006, 2009, and 2013
North Korea (2006)

- Conducted a (relatively crummy) explosion in 2006, 2009, and 2013
- But a crummy bomb on Seoul...
- At one point agreed to trade us their bombs for a billion pounds of food (seriously)
Iran (2018)

• ?
Questions

Macro
• How do nuclear weapons affect the world system?
• Do nuclear weapons promote peace?
• Would the Cold War been a hot war without nuclear weapons?

Micro
• Why do states choose to proliferate?
• What can we do to stop it?
• How do we best handle North Korea and Iran today?
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Mutually Assured Destruction

States live in a world of *mutually assured destruction* if:

1. Both states are self-preserving
2. Both states have large stockpiles of nuclear weapons
3. Each state has a secure second strike; no state achieve a “splendid” first strike
The United States had three methods of nuclear retaliation:

- Strategic bombers
- Intercontinental ballistic missiles
- Submarine-launched ballistic missiles
Everyone, Calm Down

• Under these conditions, no side would want to start a large-scale war
  – If I start a war, I face enormous nuclear retaliation
    • Worse than a disadvantageous peace
  – If my opponent starts a war, he faces enormous nuclear retaliation
    • Worse than a disadvantageous peace
Bargaining Model of War

- Larger costs: easier to reach bargained settlement
Bargaining Range

\[ p_{USA} - c_{USA} \quad p_{USA} \quad p_{USA} + c_{USSR} \]
Bargaining Range

\[ \rho_{\text{USA}} - c_{\text{USA}} \quad \rho_{\text{USA}} \quad \rho_{\text{USA}} + c_{\text{USSR}} \]
Policy Implication

- Promoting nonproliferation may be a waste of time
  - If we really just want to stabilize the world and minimize the number of wars, spreading nuclear weapons might be the way to do it
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Alternate Hypothesis

• War between major powers is obsolete
  – Two major powers cannot fight wars with one another because the costs will outweigh whatever possible benefit there is
Alternate Hypothesis

• Nuclear weapons do not change this
  – Mueller: “A jump from a fiftieth-floor window is probably quite a bit more horrible to think about than a jump from a fifth-floor one, but anyone who finds life even minimally satisfying is extremely unlikely to do either.”
Most Deadly Wars

1. World War II: 16.6 million dead
2. World War I: 8.5 million dead
3. Iran-Iraq: 1.3 million dead
4. Vietnam: 1 million dead
Bargaining Range
Before Modern Era

$p_{USA} - c_{USA}$

$p_{USA}$

$p_{USA} + c_{USSR}$
Bargaining Range with Nukes

\( p_{USA} - c_{USA} \)

\( p_{USA} \)

\( p_{USA} + c_{USSR} \)
Policy Prescription

• Suppose mutually assured destruction is not necessary to maintain peace
• Should we have nukes?
  – Accidents?
  – Costs?
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If nuclear weapons aren’t very useful, should we have them?
Nuclear Downsides

1. Costs of nuclear weapons
2. Accidental nuclear warfare
3. Rogue nuclear weapons
Costs of a Nuclear Program

• Nukes are not cheap
  – Costs of development
  – Costs of delivery
  – Costs of maintenance

• Total cost of US program (1945-1998): $7 trillion (2012 dollars)
  – Still spend around $16 billion per year
Risky Business

• Unlike conventional weapons, it is easy to accidentally destroy the world with nuclear weapons
  – Dr. Strangelove and fluoride
  – Stanislav Petrov and the 1983 Soviet false alarm
Missing Weapons?

- During the height of the Cold War, 68,000 nuclear weapons were active in the world.
- Now down to 4,100
  - Less concern about having massive retaliation capability
  - More concern about losing a weapon
Nuclear Realities

• No one in Washington is seriously interested in dismantling all American warheads
• The talk about doing so is just that—talk
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Why Not Proliferate?

1. Threat of preventive war
2. Costs of proliferation
3. Bribes
Preventive War

- Previously: *exogenous* power shifts cause preventive war if the shift is too large relative to the costs of conflict.
- If shift is *endogenous* and visible, proliferator internalizes the credible preventive war threat and does not build.
- No concessions necessary.
Preventive War

• Previously: *exogenous* power shifts cause preventive war if the shift is too large relative to the costs of conflict
• If shift is *endogenous* and visible, proliferator internalizes the credible preventive war threat and does not build
• No concessions necessary

How big is the power shift?
Costs

- Nuclear weapons are not free
- Proliferation is an investment in the future
- If additional coercive power is not worth cost, proliferator does not build
- No concessions necessary
Bribes

• Previously: more power => more concessions
• Why not just offer concessions as if proliferator already had nuclear weapons?
  – Proliferator has no incentive to build
  – Opponent doesn’t have to deal with another nuclear country

Too Cold

Just Right?

Too Hot

How big is the power shift?
Preventive War

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How big is the power shift?
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Movie is so old Bears were actually good back then
Movie is so old Bears were actually good back then
Simple Soccer Penalty Kicks

• The striker aims left or aims right
• The goalie dives left or dives right
• Assume the striker and goalie are superhuman. How should they play?
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**Penalty Kicks**

- **Striker**
- **Goalie**
Penalty Kicks

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 Goalie

Striker

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The diagram illustrates a 2x2 matrix game, often referred to as a Prisoner's Dilemma, where the players are the Striker and the Goalie. The outcomes are as follows:

- If the Striker chooses to kick right and the Goalie dives right, the Striker gets 1 point and the Goalie gets -1 point.
- If the Striker chooses to kick right and the Goalie dives left, the Goalie gets -1 point and the Striker gets 0 point.
- If the Striker chooses to kick left and the Goalie dives left, both players get 0 points.
- If the Striker chooses to kick left and the Goalie dives right, the Striker gets 0 points and the Goalie gets -1 point.
Penalty Kicks

Striker

Goalie

Dive Left  Dive Right

Kick Left  0, 0  1, -1

Kick Right  1, -1  0, 0
Penalty Kicks

Striker

Kick Right  Kick Left

0, 0  .5, -.5

1, -1  0, 0
Guessing Games!

• Penalty kicks are a guessing game
  – Makes players act randomly (but intelligently)
• Is preventive war also?
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Trivia Time!

• What was the original official military name for the Iraq War?
Trivia Time!

• What was the original official military name for the Iraq War?

  Operation
  Iraqi
  Liberation
Trivia Time!

• What was the original official military name for the Iraq War?

  Operation
  Iraqi
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Covert Proliferation

Rising State

Build

Don’t Build

Declining State

Prevent

Peace

Status Quo
Covert Proliferation

Declining State

Rising State

Build

Don’t Build

Prevent

Peace

War Payoffs

Status Quo
Covert Proliferation

Declining State

Rising State

Build

Don’t Build

War Payoffs & Wasted Costs

War Payoffs

Status Quo

Peace

Prevent
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Some Payoffs...
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### Covert Proliferation vs. Rising State

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- **War Payoffs & Wasted Costs**
- **War Payoffs**
- **Successful Power Shift**
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Covert Proliferation

Rising State

Declining State

Build

War Payoffs & Wasted Costs

Don’t Build

War Payoffs

Prevent

Successful Power Shift

Peace

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Covert Proliferation Rising State
Covert Proliferation

Rising State

Declining State

Build

War Payoffs & Wasted Costs

Don't Build

War Payoffs

Successful Power Shift

Status Quo

Prevent

Peace
Covert Proliferation

Rising State

Don’t Build

War Payoffs

Prevent

Declining State
Covert Proliferation

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Don’t Build

Prevent

Mistaken Preventive War

Declining State
What Are You Buying?

• Do you accept that the U.S. should have invaded Iraq if Iraq had a WMD program?
• Do you accept that the U.S. could not adequately monitor Iraqi activity?
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  – It just looks silly after the fact!
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