Economics of Conflict, War, and Peace

Prof. Dr. Jurgen Brauer; Summer 2009
Chulalongkorn University; Bangkok, Thailand

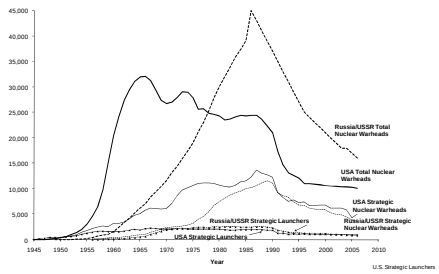
Session 4.1
Capital: ABC weapons/WMD

ABC/WMD

- ABC: atomic, biological, chemical weapons
  - Atomic or radiological
  - Biological or bacteriological
  - Chemical: not including explosives
- WMD: weapons of mass destruction

ABC/WMD: atomic weapons

USA and Russia/USSR nuclear weapons, 1945-2006



Source: Anderton/Carter – Fig. 10.3; draft manuscript (2008)

ABC/WMD: atomic weapons

- Information very scant
  - Some count data
    - Obviously not wholly reliable, credible
  - Virtually nothing on economic costs, or even production (technical) cost
    - Pakistan: started in 1972; cost estimate of $500-$700 million annually, not counting delivery system (based on UNSCOM study for Iraq)
    - Pakistan economic/social indicators: GDP, HDI
  - Basically we have a binary (0, 1) variable, not a continuous one
    - Even then, there are some states (e.g., Israel) for which we don't know

ABC/WMD: atomic weapons

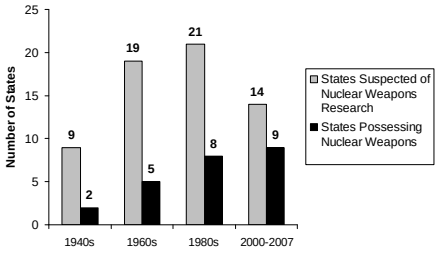
- Past or current weapons-related atomic programs:
  - Argentina, Belarus, Brazil, China, Egypt, India, Iran, Iraq, Israel, Kazakhstan, Libya, North Korea, Pakistan, Russia, South Africa, South Korea, Taiwan, Ukraine, Uzbekistan, and Yugoslavia
  - + US, UK, France
  - In all, that's 23 states
  - *Source*: Nuclear Threat Initiative (www.nti.org)

ABC/WMD: atomic weapons

- Withdrawn: Argentina, Brazil, Iraq, Libya, South Africa, South Korea, Taiwan
- Not acknowledged: Israel
- Suspected: Iran [now maybe also Syria]
- Tested: China, India, Pakistan, North Korea, and known to possess some delivery and targeting technology

ABC/WMD: atomic weapons

Number of states suspected of nuclear weapons research and possession



Source: Anderton/Carter (2009) – Fig. 10.3

ABC/WMD: atomic weapons

- Main stimulus: perception of threat
  - Same as for domestic production of major conventional arms [Brauer 1991, 2000]
- Important observation: even poor states can tackle a major scientific and industrial undertaking, often with assistance from others (willingly or unwittingly) [see, e.g., Pakistan, South Africa, South Korea stories]
- Cost is apparently high, possibly explaining industry exit (Brazil, Libya, South Africa) or sell-off (Belarus, Kazakhstan, Ukraine) as threat-perceptions change

ABC/WMD: biological weapons

- BTWC [Biological and Toxin Weapons Convention]
  - 1972
  - 147 states are members
  - Nonmembers include Syria
  - 1975: entered into force
  - Prohibits development, production, stockpiling
  - No verification protocol
    - Independent confidence-building measures
      - Annual declarations, etc. but since 1986, <40 states report regularly (and almost no LDCs report)
    - Biodefense/biosecurity work

ABC/WMD: biological weapons

- Known bioweapons work
  - Offensive: Iran, Iraq, Libya, South Africa, former USSR
  - Defensive: India
  - Alleged: China, Cuba, Egypt, North Korea
  - Eliminated: Belarus, Ukraine, Uzbekistan
  - Potential: Brazil, Pakistan, Russia (but no evidence of current work)
  - Conflicting reports: Israel, Syria

ABC/WMD: biological weapons

- Application
  - Only known effective mass-dispersal method for bacteria, viruses, and toxins is through infectious aerosols
  - Requires industrial processing of biological agents to 1-10 microns while maintaining viability in storage and dispersal, thought to be "technologically demanding"

ABC/WMD: biological weapons

- Assessment
  - Small-scale production probably possible
  - Mainly for state-terror, shock and uncertainty value, etc.
  - Practical military field application questionable
  - Questionable diplomatic (threat, negotiation, bargaining) value …
  - … as compared to other uses of scarce resource for military purposes

ABC/WMD: chemical weapons

- CWC [Chemical Weapons Convention]
  - 1993
  - Has a secretariat [Organization for the Prohibition of Chemical Weapons (OPCW)]
  - 167 states have ratified (as of 31 Dec 2004)
  - Nonsignatories include: Egypt, Iraq, North Korea, Syria
  - Signed but not ratified: Israel

ABC/WMD: chemical weapons

- Known activity
  - Iraq, Syria (through Egypt), Libya (now renounced)
- Inspection
  - "anytime, anywhere"
- Declaration
  - By 2005, 5 states declared possession
  - 12 declared >60 former production sites
  - 10 declared pre-1946 stockpiles
  - 3 declared harboring "abandoned" munitions (e.g., over 1 million Japanese munitions in China)
  - Destruction of "declared" chemical munitions and dismantling of production facilities occur

ABC/WMD: chemical weapons

- Assessment
  - On the whole, the CWC supervision, advice, inspection regime is thought to work well
  - OPCW has staff of 500; budget of E75 million (in 2005)
  - The CWC received active support from the world's chemical industry (!)
  - Nonetheless, the chemical industry's knowledge improves, including in the area of miniaturization of production processes

ABC/WMD: bio/chemical weapons

- Cost, delivery, use
  - Little known about production cost
  - For long-distance application, same long-distance delivery method problems as for atomic weapons need to be solved
    - With the additional difficulty of keeping bio and chem agents alive in flight transit and during high-temperature atmospheric re-entry and final explosion

ABC/WMD: bio/chemical weapons

- Use
  - Highly dependent on meteorological and topological conditions
  - These weapons probably of minor genuine state-on-state warfare use
    - For strategic purposes
    - More likely for tactical purposes, esp. when overwhelmed in terms of major conventional forces
  - Perhaps more likely to be used by nonstate terror organizations
  - Binding constraint may be organizational and diplomatic:
    - new military doctrine and training
    - Withdrawal from BTWC, CWC

ABC/WMD: bio/chemical weapons

- Substitutes/complements
  - Missile technology is a complement to most ABC weapons
  - Brazil, China, India, North Korea, Pakistan, Russia, South Africa – indigenous progress
- [Brauer (1991, 2000) setup, findings]
- Cost data n/a
- Accuracy: not really important for atomic weapons
- The more accurate the targeting system, the more valuable conventional warheads become as compared to bio/chem weapons

ABC/WMD: bio/chemical weapons

- Missile delivery vehicle/technology prices likely to drop in future
  - Still, special fuels, engines, warheads, re-entry vehicles, guidance systems needed – all technologically complex
- Quite a surprising amount of outer-space activity by LDCs
  - 37 former/current LDCs involved in outer space activity
  - But only three with active military programs: China, Russia, U.S.
  - Only U.S. has capacity to weaponize satellites
- Economies of scale and scope likely so that in future the likelihood is of more capacity, not less

ABC/WMD: bio/chemical weapons

- ABC weapons theory
  - Limited amount of work
  - Singh and Way (2004) theory of entry
    - Motivation: threat perception & capacity; like Brauer (1991) for major conventional arms; the issue always comes back to demand: "willing and able" (i.e., threat perception/motivation and industrial production capacity)

ABC/WMD: bio/chemical weapons

- Jehiel, Moldavanu, and Stachetti (1996) theory of exit
  - Case of Ukraine: sell weapons in exchange for "aid" from the U.S./Russia; or sell weapons knowledge to other bidders like Iran, Iraq
  - Interesting part: include the avoidance of negative externality into the pricing request for U.S./Russia
  - One result: the seller can credibly commit not to sell; instead Ukraine can "sell" dismantlement

ABC/WMD: bio/chemical weapons

- Almost no work done on nuclear weapons theory of production
  - Koubi (1991) model based on commercial R&D and patent literature
  - Competitors monitor their *relative* position; if one gets a patent first, the others *switch* to alternative work
  - But in the nuclear case, if one gets a breakthrough first, the others *try harder* in order to catch up
  - With patents, the loser concedes; with nuclear arms, the loser never concedes

ABC/WMD: bio/chemical weapons

- So the race continues and there is no unilateral withdrawal from the race; such are the dynamics of the model
- This dynamic is heightened when the dynamics are multilateral
  - Instead of Indo-Pak …
  - Its U.S. <= Russia <= China <= India <= Pakistan
  - That is, so long as the U.S. races, so will Pakistan through this knock-on chain

ABC/WMD: bio/chemical weapons

- Four facts
  - Atomic weapons proliferation does take place
  - Some LDCs successfully have entered the market
  - Atomic weapons races do take place
  - Some LDCs exit
- Theory
  - A single theory that would tie together and explain all four of these fact we do not (yet) have