# Why Nuclear Energy Programs Rarely Lead to Proliferation

Nicholas L. Miller

- Miller paper claims that the relationship between nuclear energy and proliferation programs is overstated
- Two main reasons why pursuing energy programs would actually limit the odds of proliferation

1. By engaging in any nuclear program you increase interest and visibility of you country. Making it more likely that weapons programs will be discovered.
2. This attracts sanctions to be emplaced increasing the costliness of your program.

# Arguments for Energy Programs Help Proliferation

1. Nuclear energy programs lower the cost of proliferation via gaining the ability to produce materials such as enriched uranium.
2. The actual infrastructure created for nuclear energy can subsequently create a desire to proliferate regardless of original intent.
3. Countries can use these programs to cover for gaining over necessary materials for weapons programs.

# How Energy Programs Restrain Proliferation

- Two arguments against conventional wisdom

1. It increases visibility of the country

➔ The process of acquiring more materials and technology increases ability for outside agencies to collect data.

➔ Offers visibility on sites such as reactors, research centers, and nuclear staff.

➔ If within NPT or by supplier requirements the sites will be under scrutiny of these organizations.

➔ Nuclear programs are not necessary for starting weapons programs. Ex: Israel, Iraq Post-Osirak, and North Korea.

# Cont.

2. Heightened Costs From Nonproliferation Sanctions

➔ Nuclear fuel and other material is heavily controlled

➔ Ex: Soviet Union

# Empirical Assessment

- Designed to prove the relationship of increased “pursuit” and energy programs is unlikely
- Table 1 lists countries which did have nuclear energy programs that did not pursue nuclear weapons from 1945-2009
- Energy programs defined as building or having a functioning reactor
- “Pursuit” is defined as taking serious steps such as upper level officials moving politically in that direction, or development of specific technology
- Table 2 summarizes the level and timing of nuclear energy activity among countries that pursued them from 1954-2009.

Table 1. States with Nuclear Energy Programs That Did Not Pursue Nuclear Weapons, 1945–2009

| | | | |
|---|---|---|---|
| Belgium (1957) | Japan (1960) | Hungary (1974) | Armenia (1991)* |
| Sweden (1957) | Spain (1964) | Yugoslavia (1975) | Kazakhstan (1991)* |
| Canada (1958) | Netherlands (1965) | Mexico (1976) | Lithuania (1991)* |
| Czechoslovakia (1958) | Switzerland (1965) | Philippines (1976)** | Slovenia (1991)* |
| Italy (1958) | Bulgaria (1970) | Poland (1982)** | Ukraine (1991)* |
| West Germany (1958) | Finland (1971) | Romania (1982) | Czech Republic (1993)* |
| East Germany (1960) | Austria (1972)** | Cuba (1983)** | Slovakia (1993)* |

NOTE: Year when construction on first power reactor begun (or when reactor inherited at independence) appears in parentheses.

*Inherited power reactors at independence rather than constructing them.

**Construction on power reactors never completed/reactors never became operational.

Table 2. Nuclear Energy Programs and Pursuit, 1954–2009

| No Energy Program during Pursuit | Energy Program during Pursuit | Energy Program Predated Pursuit | Power Reactor Operating before Pursuit |
|---|---|---|---|
| Australia | Argentina | Argentina | Argentina |
| China | Brazil | Brazil | |
| Egypt | France | India | |
| Iraq | India | Iran | |
| Israel | Iran | Pakistan | |
| Libya | North Korea* | | |
| Syria | Pakistan | | |
| | South Africa | | |
| | South Korea | | |
| | Taiwan | | |

*North Korea briefly had light water power reactors under construction in the early 2000s as part of the Agreed Framework.

Table 3. Nuclear Energy Programs and the Probability of Pursuit, 1954–2000

| | Annual Probability of Pursuit | Number of Observations |
|---|---|---|
| No power reactor operating | 0.25% | 5,606 |
| Power reactor operating | 0.17% | 592 |

*P*-value from a chi-square test assessing the difference across the two groups: 0.70.

Table 4. Nuclear Energy Programs and the Probability of Pursuit, 1954–2000

| | Annual Probability of Pursuit | Number of Observations |
|---|---|---|
| No power reactor operating or under construction | 0.20% | 5,418 |
| Power reactor operating or under construction | 0.51% | 780 |

*P*-value from a chi-square test assessing the difference across the two groups: 0.10.

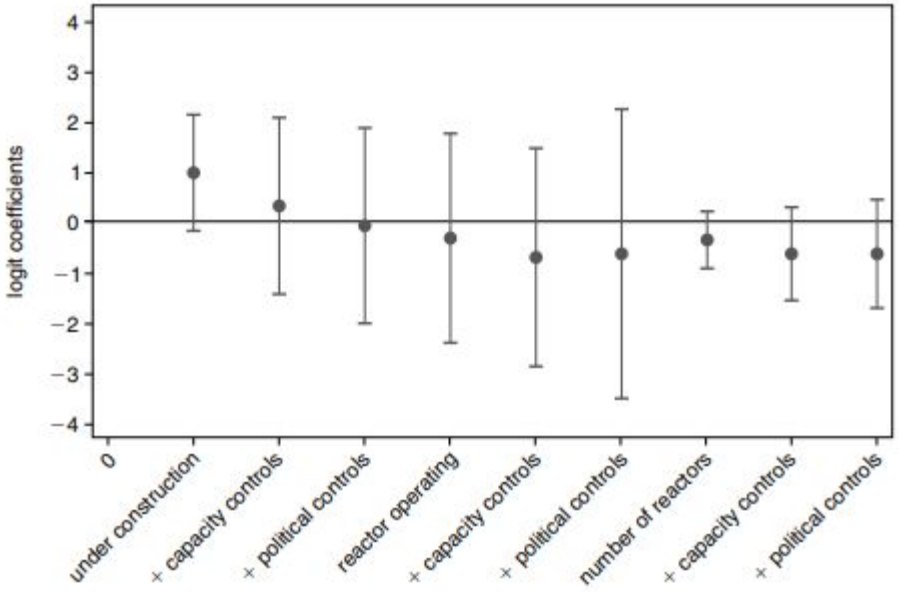
- Analyzes the probability of a country with a reactor pursuing versus one without

# Multivariate Models

- Three separate variables to measure nuclear programs

1. A binary variable of 1 if a state has a reactor or is building one.
2. A binary variable of 1 if a state has a reactor in operation
3. The total number of reactors

Figure 1. Nuclear Energy Programs and the Odds of Pursuit



# Energy Programs & Weapons Acquisition Assessment

- Assessment of whether or not energy programs lead to acquisition
- Only 17 case studies
- Codes with the presence of a energy program and the last year of the weapons program.

Table 5. Nuclear Energy Programs and Nuclear Weapons Acquisition, 1954–Present

| | Did Not Acquire Nuclear Weapons | Acquired Nuclear Weapons | % Acquired |
|---|---|---|---|
| No energy program | Australia, Egypt, Iraq, Libya, Syria | China, Israel, North Korea | 3/8 (37.5%) |
| Energy program | Argentina, Brazil, Iran, South Korea, Taiwan | France, India, Pakistan, South Africa | 4/9 (44%) |

# Political Restraints on Pursuit or Acquisition

1. Higher Likelihood of Detection and Pressure

- Tests to see whether or not nuclear energy programs increases likelihood of detection of parallel weapons program, and thereby increasing outside pressure
- Data from Montgomery and Mount, examines declassified assessments of 16 countries
- Binary variable equal to 1 if country's weapons programs project was underestimated, otherwise 0.
- Results: substantially less likely to underestimate programs with finished or building reactors (14.8% vs. 51.5%).

# Cont.

2. Whether or not countries with energy programs are more likely to experience nonproliferation pressure

- Analysis on data from 1945-2000 of countries pursuing nuclear weapons
- Result: countries who are building or have completed reactors are three times more likely to face U.S. sanctions in a given year.

# Heightened Costs From Nonproliferation Sanctions

- Countries may have higher costs associated with sanctions
- Ex: Japan
- Ex: Sweden
- Ex: Taiwan/South Korea

# Conclusion

- States with nuclear programs have not had a significantly higher likelihood of nuclear pursuit.
- States may have better access to nuclear knowledge/material but

1. Trying to use your energy program as cover will not be effective
2. Countries with energy programs face higher cost associated with sanctions

# Critiques

- Arguements focused on just American sanctions
- More pictures at the end