Spreading Temptation: Proliferation and Peaceful Nuclear Cooperation Agreements (Fuhrmann, 2009)

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Winter, 2018

What is peaceful cooperation?

And why is it so important?

Previous Scholarship

- Nuclear demand (Sagan)
  - Regime type
  - Economics
  - Security
  - Alliances
- Neglect peaceful cooperation as a means of proliferation
  - Nuclear supply
  - Capacity
  - Civilian → Military

Peaceful Cooperation

- “Transfer of nuclear technology, materials, or knowledge from one state to another for peaceful purposes” (7)
  - Eisenhower begins process after speech to UN assembly
  - Over 2,000 bilateral agreements have been signed since
  - France, 2007
- Nuclear proliferation is correlated with such cooperation
  - All forms of aid increase the chances that a country will both pursue and construct a weapon (12)

Peaceful Cooperation

- Weapons programs and civilian programs require similar processes
  - Enrichment and reprocessing for example
- Civilians gain necessary experience and expertise
- Reduction in the expected costs of exploration and production, similar to strong economies or a lack of credible security agreements (13)
- Scientists often lobby the government when they feel there is a good chance of rapid development
  - Politicians' calculus: quicker development = fewer diverted resources

How compelling?

Initial Reactions

Hypotheses

- H1: Countries receiving peaceful nuclear assistance are more likely to begin nuclear weapons programs
- H2: Countries receiving peaceful nuclear assistance are more likely to begin nuclear weapons programs when a security threat arises
- H3: Countries receiving peaceful nuclear assistance are more likely to acquire nuclear weapons
- H4: Countries facing security threats and receiving peaceful nuclear assistance are more likely to acquire weapons

Case Studies

What were some of them?

South Africa, Israel, and North Korea

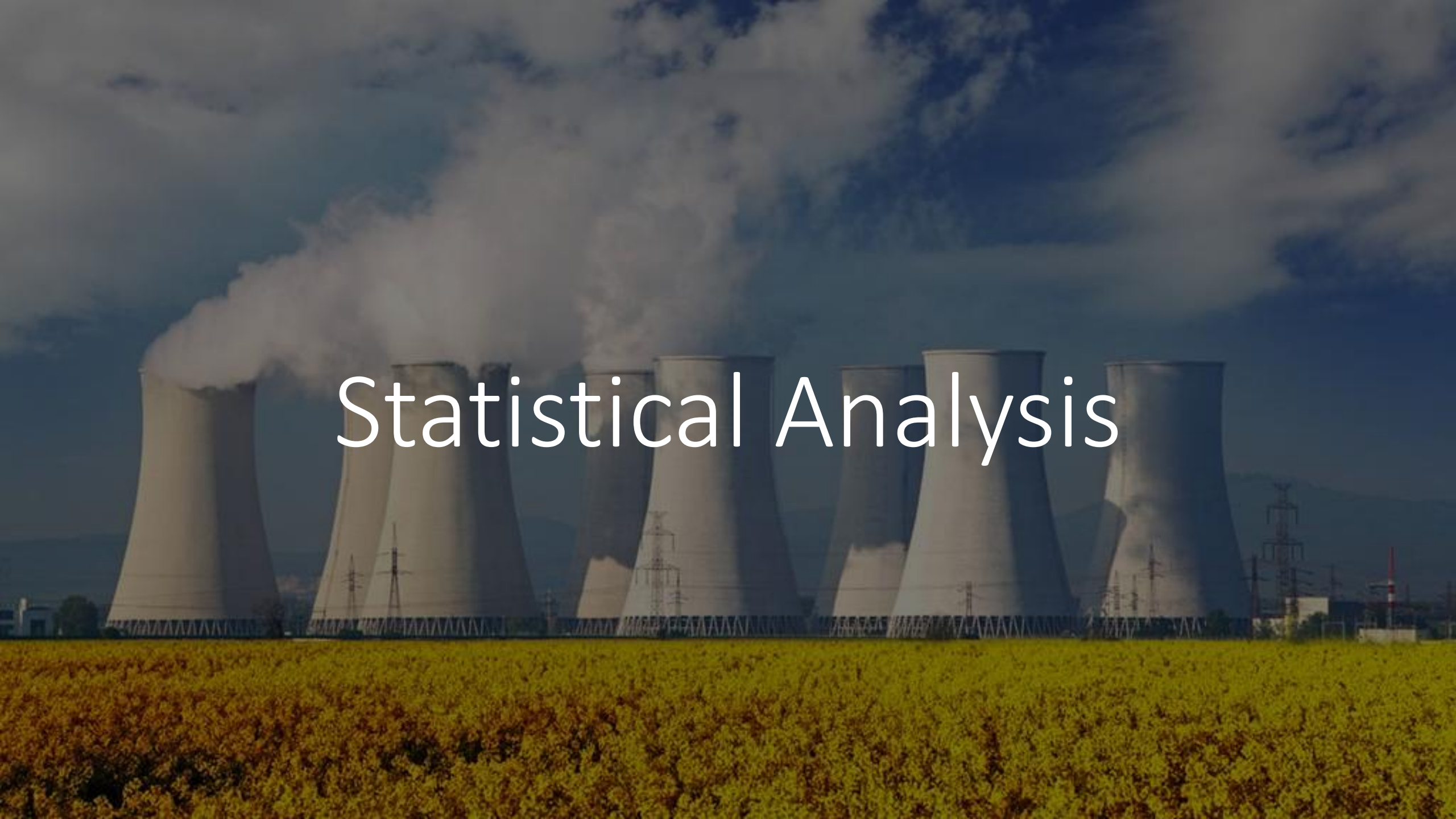
- South Africa begins in 1957 with US assistance (15)
  - Supply of enriched uranium and technical training
  - Atomic Energy Corporation pressure prime minister to produce weapons
  - Security motivations came after (Mozambique and Angola)
- Israel
  - Heavy water supplied by US, Britain, and Norway
    - Laboratory quantities (16)
- North Korea
  - Training provided by the Soviet Union in late 1950s
    - Construction of facilities in 80s which provided plutonium for detonations in 2006 (17)

India

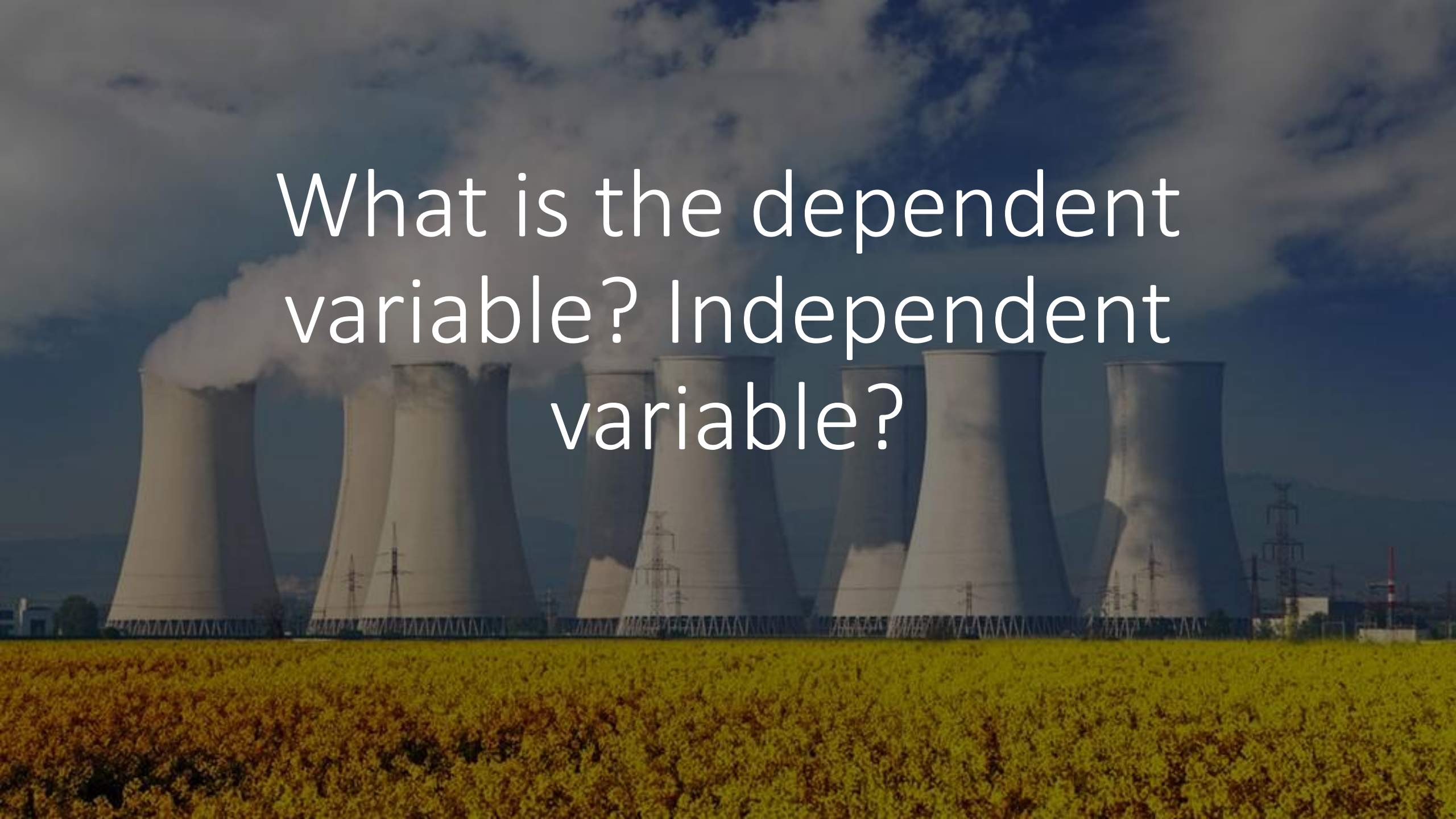
- Indian nuclear weapons program (1964)
  - British supplied designs (1955)
  - Canadian supplied reactors (1956)
  - US heavy water, designs, materials, and expertise (1960, 1961)
    - Colombo Plan
  - Homi Bhabhi urges prime minister to pursue weapons and in 1964, the program was announced
    - Food shortages and economic hardships
    - Chinese rivalry

Pakistan

- Nuclear cooperation agreement signed between US and Pakistan (1955)
  - Research reactor and highly enriched uranium
- Training of technicians to produce isotopes and conduct neutron physics experiments (1963)
- Canadian heavy water, British hot cells, French reprocessing centers and American technical expertise (Argonne National Laboratory)
- Weapons program started in 1971 in response to loss in Indo-Pakistani war
  - Increased efforts after India’s tests in 1974
- A.Q. Khan stole technology from his workplace in the Netherlands



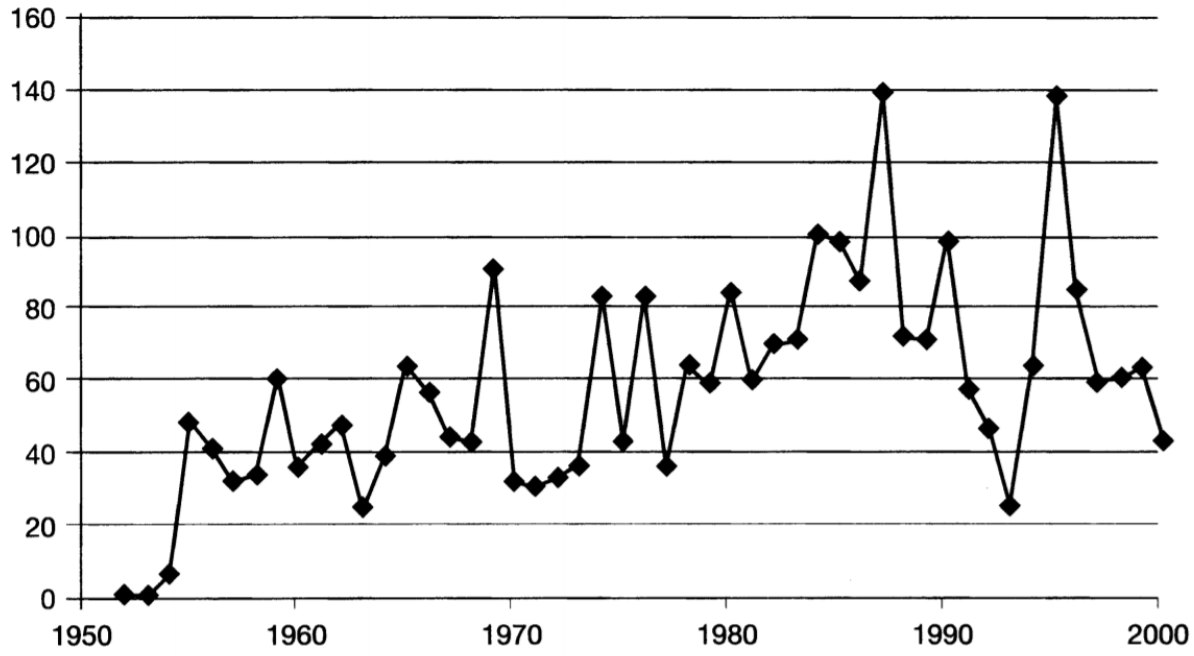
Statistical Analysis



What is the dependent variable? Independent variable?

NCA Agreements

Figure 1. Total Number of Nuclear Cooperation Agreements Signed, 1950–2000



SOURCES: Matthew Fuhrmann, "Taking a Walk on the Supply Side: The Determinants of Civilian Nuclear Cooperation," *Journal of Conflict Resolution,* Vol. 53, No. 2 (April 2009), pp. 181–208; and James F. Keeley, "A List of Bilateral Civilian Nuclear Cooperation Agreements," University of Calgary, 2003.

NCA Agreements

Table 1. Top Recipients of Nuclear Cooperation Agreements, 1945–2000

Country	Total Number of Agreements
United States	396
France	221
Germany	171
Russia	136
United Kingdom	133
Japan	122
Italy	112
Belgium	93
Argentina	92
Netherlands	80
Canada	77
Brazil	70
Spain	70
Switzerland	68
Luxembourg	63
Sweden	56
Denmark	55
China	53
South Korea	49
India	39
Ireland	36
Romania	35
Portugal	33
Czechoslovakia (1945–91)	30
Greece	30
Egypt	29
Finland	29
Poland	28
Australia	25
Indonesia	22

NOTE: summary statistics: $N = 186$; mean = 15.34; minimum = 0; maximum = 396

Findings

Table 2. Nuclear Cooperation, Militarized Disputes, and Nuclear Weapons Program Onset, 1945–2000

		Civilian Nuclear Cooperation			Civilian Nuclear Cooperation and Militarized Disputes		
		No	Yes	Total	No	Yes	Total
Nuclear weapons program onset	No	4,066 (99.93%)	2,865 (99.58%)	6,931 (99.78%)	5,080 (99.92%)	1,851 (99.41%)	6,931 (99.78%)
	Yes	3 (0.07%)	12 (0.42%)	15 (0.22%)	4 (0.08%)	11 (0.59%)	15 (0.22%)
	Total	4,069 (100%)	2,877 (100%)	6,946 (100%)	5,084 (100%)	1,862 (100%)	6,946 (100%)
		Pearson Chi2(1) = 9.22, Pr = 0.002			Pearson Chi2(1) = 16.59, Pr < 0.0001		

Table 3. Nuclear Cooperation, Militarized Disputes, and Nuclear Weapons Acquisition, 1945–2000

		Civilian Nuclear Cooperation			Civilian Nuclear Cooperation and Militarized Disputes		
		No	Yes	Total	No	Yes	Total
Nuclear weapons program onset	No	4,077 (99.95%)	3,050 (99.77%)	7,127 (99.87%)	5,099 (99.96%)	2,028 (99.66%)	7,127 (99.78%)
	Yes	2 (0.05%)	7 (0.23%)	9 (0.13%)	2 (0.04%)	7 (0.34%)	9 (0.13%)
	Total	4,079 (100%)	3,057 (100%)	7,136 (100%)	5,101 (100%)	2,035 (100%)	7,136 (100%)
		Pearson Chi2(1) = 4.49, Pr = 0.034			Pearson Chi2(1) = 10.73, Pr = 0.0001		

Findings

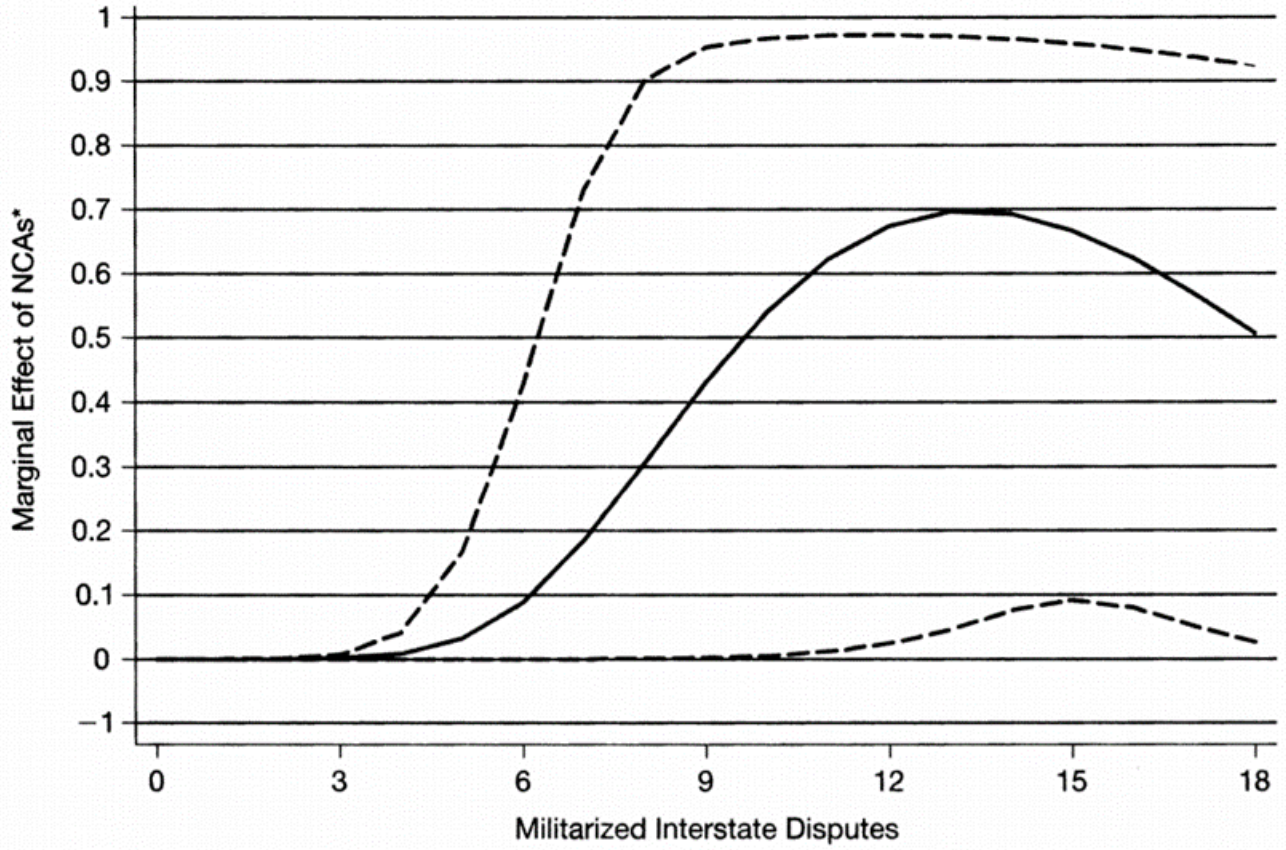
Table 4. Determinants of Nuclear Weapons Proliferation, 1945–2000

Atomic Assistance	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Peaceful nuclear cooperation	0.023***	0.062***	0.016**	0.049***	0.019***	0.055***	0.004	0.014
	(0.009)	(0.023)	(0.007)	(0.018)	(0.006)	(0.020)	(0.011)	(0.033)
Militarized disputes	0.152***	0.286***	0.132***	0.265***	0.107**	0.206	0.069*	0.155
	(0.040)	(0.095)	(0.030)	(0.066)	(0.047)	(0.126)	(0.041)	(0.121)
Peaceful nuclear cooperation × militarized disputes			0.025**	0.057***			0.013**	0.024**
			(0.010)	(0.022)			(0.006)	(0.011)
Control Variables								
Nuclear protection	0.085	0.105	0.043	0.005	−0.297	−0.544	−0.340	−0.693
	(0.264)	(0.742)	(0.274)	(0.775)	(0.348)	(1.042)	(0.360)	(1.121)
Nuclear Nonproliferation Treaty	−1.040**	−2.375*	−1.168**	−2.642*				
	(0.463)	(1.286)	(0.536)	(1.435)				
Democracy	−0.000	0.007	−0.006	−0.008	0.016	0.025	0.010	0.011
	(0.016)	(0.045)	(0.016)	(0.042)	(0.016)	(0.053)	(0.017)	(0.055)
Democratization	−0.014	−0.034	−0.015	−0.036	−0.036	−0.079	−0.036	−0.099
	(0.022)	(0.065)	(0.024)	(0.075)	(0.035)	(0.103)	(0.040)	(0.127)
Economic openness	0.002	0.008	0.001	0.008	0.003	0.014	0.003	0.015
	(0.005)	(0.013)	(0.005)	(0.015)	(0.003)	(0.012)	(0.003)	(0.009)
Liberalization	−0.001	−0.004	0.003	0.019	0.005	0.040***	0.005	0.036***
	(0.006)	(0.017)	(0.006)	(0.017)	(0.004)	(0.012)	(0.003)	(0.011)
GDP per capita	0.000*	0.000	0.000**	0.001	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP per capita squared	−0.000***	−0.000*	−0.000***	−0.000**	−0.000***	−0.000	−0.000**	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Industrial capacity threshold	0.874***	2.150**	0.878***	2.219***	1.259***	2.666**	1.268***	2.867***
	(0.334)	(0.875)	(0.340)	(0.861)	(0.233)	(1.056)	(0.248)	(1.099)
Rivalry	0.909***	2.385**	0.758***	1.863**	0.884**	1.977	0.769*	1.688
	(0.317)	(0.975)	(0.286)	(0.816)	(0.394)	(1.286)	(0.404)	(1.323)
No proliferation years	0.012	0.031	0.007	0.015	−0.017**	−0.038	−0.021**	−0.049*
	(0.009)	(0.026)	(0.009)	(0.026)	(0.008)	(0.024)	(0.009)	(0.026)
Constant	−4.510***	−9.280***	−4.417***	−9.097***	−4.431***	−8.787***	−4.232***	−8.155***
	(0.459)	(1.195)	(0.430)	(1.067)	(0.481)	(1.433)	(0.461)	(1.264)
Observations	5,511	5,511	5,511	5,511	5,702	5,702	5,702	5,702

NOTE: Robust standard errors in parentheses; *significant at 0.10; **significant at 0.05; ***significant at 0.01. GDP = gross domestic product.

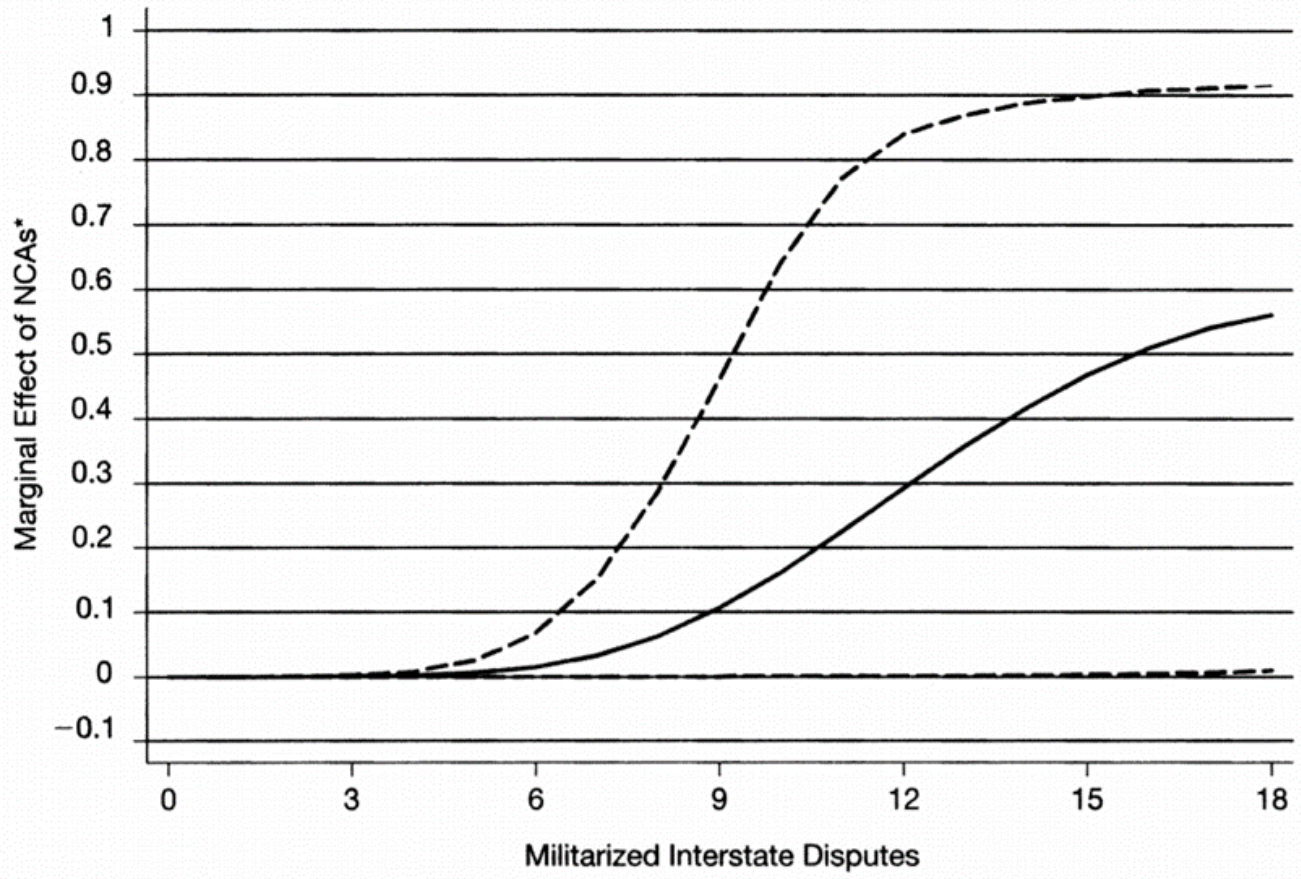
Findings

Figure 2. Marginal Effect of Nuclear Assistance on Weapons Program Onset as Number of Disputes Increases



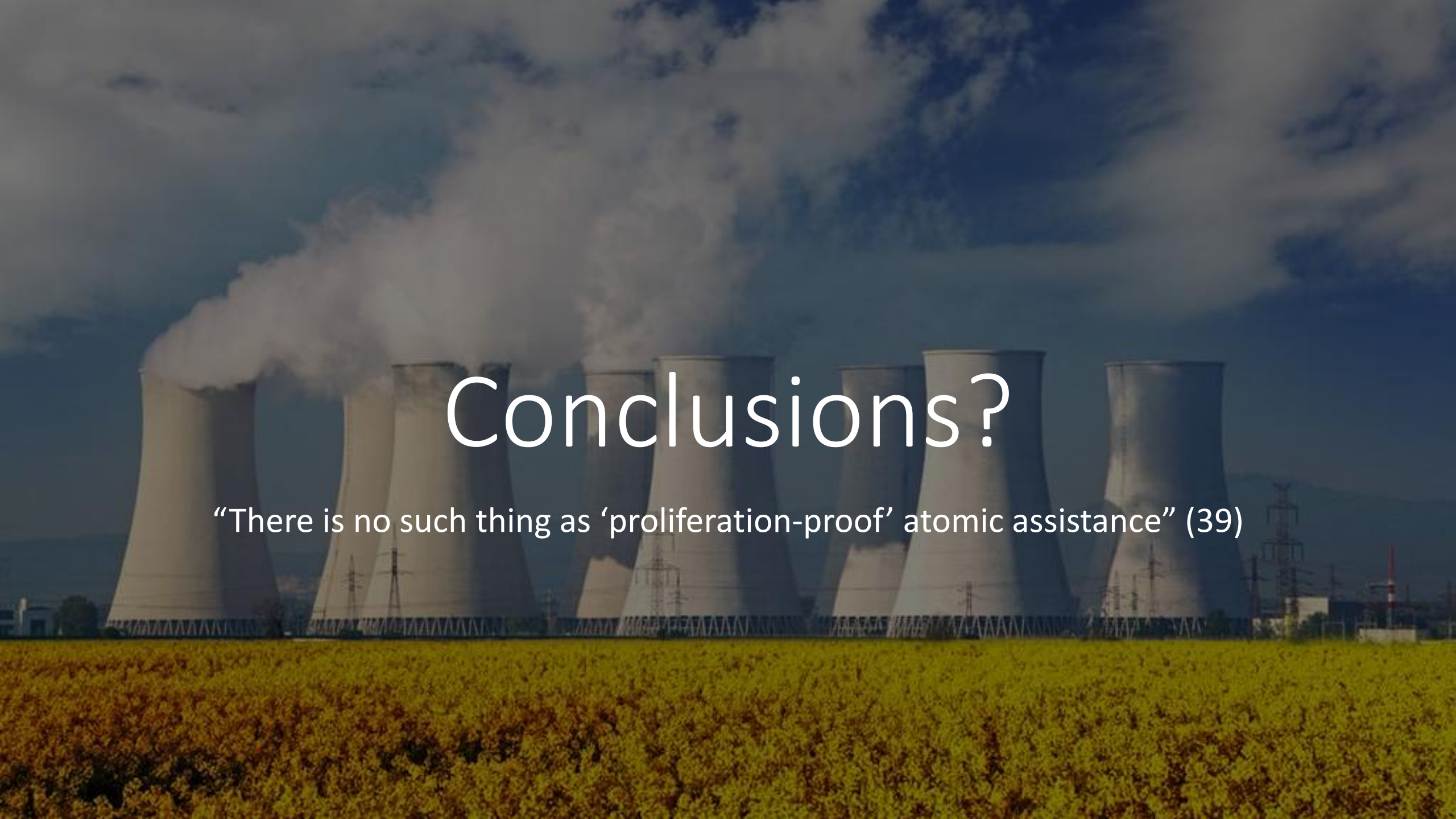
Findings

Figure 3. Marginal Effect of Nuclear Assistance on Weapons Acquisition as Number of Disputes Increases



Exogeneity

What is it and does it impact the results?



Conclusions?

"There is no such thing as 'proliferation-proof' atomic assistance" (39)

Implications, Solutions and Lingering Questions

- New nuclear renaissance dawns
- Recent agreements (Middle East, Latin America, Africa, Southeast Asia)
  - Need reconsideration
- IAEA needs more resources
- Questions that remain
  - Relationship between illicit trade and peaceful cooperation
  - More case studies on why countries receiving assistance proliferate
  - Why suppliers provide assistance

Any Questions?