Week 6 Presentation

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The Correlates of Nuclear Proliferation: A Quantitative Test

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Background

- Most scholarship focuses on qualitative case studies
  - Search for a deterministic, univariate explanation
- Authors developed a data set on nuclear proliferation that identifies four stages to weaponization
  - No noticeable interest
  - Serious exploration of the weapons option
  - Launch of a weapons program
  - Acquisition of nuclear weapons

Background cont.

- Authors conduct survival models and multinomial logistic regressions to test three hypotheses
  - Technological determinants: role of economic development and declining cost of weapons
  - External determinants: role of the security environment created by the great powers
  - Internal determinants: role of domestic factors such as regime type and economic policies

Technological Determinants

- Once a country has the latent capacity, proliferation becomes inevitable.
  - Economic prosperity, literacy levels, scientific development
  - Can be achieved through an intentional effort or as a result of natural growth
- Not sufficient in itself
  - Plenty of states who have the latent capacity to proliferate have chosen not to

External Determinants

- Emphasizes the willingness, rather than the ability of states to proliferate
- Focuses on two factors:
  - Presence (or absence) of a security threat
  - Security guarantee from a powerful alliance power
- Insufficient as well
  - Many states with security threats do not pursue proliferation

Domestic Determinants

- Four main determinants:
  - Democracy
  - Liberalizing governments
  - Autonomous elites
  - Symbolic/status motivations

Proliferation Data

- Dependent variable
  - First explosion/assembly of weapons
  - Pursuit of weapons
  - Exploration of weapons

Explanatory Variables

TABLE 1
Theoretical Expectations and Measures

Explanatory Variable	*Anticipated Direction of Effect*	*Operationalizations*
Technological determinism		
Level of development	Positive	Gross domestic product (GDP) per capita; energy consumption per capita
Industrial capacity	Positive	Index based on steel production and electrical-generating capacity; aggregate and per capita electricity and steel production
External determinants		
Security threat	Positive	Participation in enduring rivalry; frequency of militarized interstate dispute (MID) involvement
Security guarantee	Negative	Alliance with great power
Internal determinants		
Democracy	Negative	Polity IV democracy scale
Democratization	Uncertain	Change in Polity IV democracy scale (3-, 5-, and 10-year periods)
Global democracy	Negative	Percentage of democracies among states in system
Exposure to global economy	Negative	(Exports and imports)/GDP
Economic liberalization	Negative	Change in trade ratio (3-, 5-, and 10-year periods)
Dissatisfaction/symbolic motivations	Positive	S score or Tau-b with either global or regional hegemon

Hazard Model Results

TABLE 2
The Correlates of Nuclear Weapons Proliferation

Independent Variable	*Dependent Variable*		
	Explore	*Pursue*	*Acquire*
Technological determinants			
GDP per capita	0.00052[.119]	**0.001**[.017]	0.0002[.378]
	(0.0003)	(0.0004)	(0.0003)
GDP squared	**–3.66e-08**[.094]	**–7.92e-08**[.017]	**–2.36-08**[.100]
	(2.19e-08)	(3.11e-08)	(1.43e-08)
Industrial capacity index	**1.89**[.016]	**1.46**[.046]	**3.19**[< .001]
	(0.78)	(0.73)	(0.91)
External determinants			
Enduring rivalry	**1.57**[.002]	**1.83**[.024]	**2.13**[.076]
	(0.50)	(0.81)	(1.77)
Dispute involvement	**0.17**[.010]	**0.38**[< .001]	**0.23**[.070]
	(0.07)	(0.09)	(0.13)
Alliance	–0.67[.260]	–0.83[.194]	–1.01[.225]
	(0.59)	(0.64)	(0.83)
Internal determinants			
Democracy	0.02[.525]	**0.070**[.084]	0.092[.123]
	(0.038)	(0.038)	(0.059)
Democratization	–0.03[.578]	–0.080[.323]	0.016[.895]
	(0.056)	(0.081)	(0.120)
Percentage of democracies	–0.05[.204]	**–0.186**[.007]	–0.094[.351]
	(0.04)	(0.069)	(0.101)
Economic openness	–0.01[.235]	–0.018[.112]	0.0002[.989]
	(0.01)	(0.012)	(0.015)
Economic liberalization	**–0.037**[.030]	**0.35**[.010]	–0.001[.963]
	(0.017)	(0.014)	(0.018)
Constant	**–4.66**[< .001]	**–6.34**[.016]	–7.52[.022]
	(1.32)	(2.63)	(3.29)
Ancillary parameter (p)	0.55	1.42	1.04
Standard error (p)	0.113	0.48	0.36
Log likelihood	–56.12	–28.57	–19.61
Number of countries	149	149	149
Total observations	5,215	5,578	5,784

NOTE: Coefficients are estimates for parametric survival models with a Weibull distribution; robust standard errors, adjusted for clustering by country, are in parentheses. p values are superscripted and are for two-sided tests. Coefficients that are significant at better than the 10% level are bold. GDP = gross domestic product.

Effect of Explanatory Variables

TABLE 3
Substantive Effects of the Explanatory Variables on the Likelihood of Exploring Nuclear Weapons

Variable	*Percentage Change from Baseline Hazard Rate*	
	Explore	*Acquire*
Great-power military alliance	–49	–64
Participation in ongoing enduring rivalry	+382	+743
Increase in frequency of MIDs (two more/year)	+38	+52
Industrial capacity threshold	+563	+2,340
Increase in trade openness	–72	–2
Increase in per capita GDP—$500 at very low level	+26	+12
Increase in per capita GDP—$500 at high level	–20	–17
Satisfaction	+40	–82
Increase in democracy	+25	+94

NOTE: MID = militarized interstate dispute; GDP = gross domestic product.

Multinomial Logit Model Results

TABLE 4
Pathways to Proliferation: Multinomial Logit Models

Independent Variable	*Level*		
	1 (Explore)	*2 (Pursue)*	*3 (Acquire)*
Technological determinism			
GDP per capita	**0.0003**$^{<.001}$	**0.0005**$^{<.001}$	**0.0004**$^{<.001}$
	(0.00005)	(0.0001)	(0.0001)
GDP squared	**−1.55e-08**$^{<.001}$	**−4.36e-08**$^{<.001}$	**−1.00e-08**$^{<.001}$
	(2.73e-09)	(7.86e-09)	(1.80e-09)
Industrial capacity index	**2.88**$^{<.001}$	**2.41**$^{<.001}$	**22.59**$^{<.001}$
	(0.270)	(0.280)	(0.664)
External determinants			
Enduring rivalry	**0.43**$^{.017}$	**0.67**$^{.003}$	**1.61**$^{<.001}$
	(0.179)	(0.221)	(0.240)
Dispute involvement	**0.31**$^{.002}$	**0.77**$^{<.001}$	**0.86**$^{<.001}$
	(0.099)	(0.105)	(0.119)
Alliance	**−1.24**$^{<.001}$	−0.22$^{.205}$	**−1.25**$^{<.001}$
	(0.19)	(0.18)	(0.18)
Internal determinants			
Democracy	**0.020**$^{.073}$	**−0.027**$^{.055}$	**0.029**$^{.018}$
	(0.011)	(0.014)	(0.012)
Democratization	−0.005$^{.790}$	0.003$^{.937}$	−0.023$^{.334}$
	(0.020)	(0.032)	(0.024)
Percentage of democracies	**−0.122**$^{<.001}$	0.017$^{.390}$	**0.036**$^{.066}$
	(0.017)	(0.019)	(0.019)
Economic openness	**−0.028**$^{<.001}$	**−0.012**$^{.001}$	**−0.027**$^{<.001}$
	(0.003)	(0.003)	(0.003)
Economic liberalization	0.002$^{.917}$	−0.007$^{.299}$	0.003$^{.675}$
	(0.009)	(0.007)	(0.007)
Constant	**−1.47**$^{.006}$	**−6.95**$^{<.001}$	**−28.31**$^{<.001}$
	(0.538)	(0.745)	(0.339)

NOTE: Log pseudo-likelihood = −1874; pseudo-R^2 = 0.39; total observations = 6,125. The reference category is no steps to pursue nuclear weapons. Coefficients are estimates for multinomial logit regression models, with robust standard errors in parentheses. *p* values are superscripted and are for two-sided tests. Coefficients that are significant at better than the 10% level are in bold. GDP = gross domestic product.

Countries That Could Have Proliferated

TABLE 5

Dogs That Didn't Bark? Countries That Did Not Seriously Explore the Nuclear Option . . . but Should Have

Country	*Years of Maximum Predicted Hazard*
Saudi Arabia	Mid-1980s to mid-1990s
West Germany	Mid-1950s to early 1960s
Japan	Mid-1950s to 1960s
Turkey	Late 1960s to 2000
Bulgaria	1950s
Spain	1960s to early 1970s
Greece	1960s and 1980s
Italy	1950s to early 1960s
Syria	Various

Conclusion

- Nuclear weapon proliferation is well accounted for by existing theories
  - External security threat
  - Role of great power alliances
  - Economic/technological advancements
- Reducing the external security threat and promoting economic interdependence may reduce the desire to proliferate

Making It Personal: Regime Type and Nuclear Proliferation

CHRISTOPHER WAY AND JESSICA WEEKS

Background

- Most studies assert regime type has little if any affect on nuclear proliferation
  - These studies generally code all states as being democratic or non-democracies
  - Way and Weeks believe that personalistic dictatorships need to be examined individually
    - E.g. Kim Jung Un, Muammar Gaddafi
- Way and Weeks' argument: Personalistic democracies have greater incentives and less constraints to proliferate than leaders of other regimes.

The State of the Literature

- Most studies focus on the autocracies vs. democracies
  - Chafetz (1993): Democracy spreads the zone of peace, reducing security dilemmas
  - Sasikumar and Way (2009): Democracies are more transparent, reducing the effect of elites
  - Montgomery (2005): Factors that push proliferation do not vary much between autocracies and democracies
  - Perkovich (1999): Democracies have an incentive to proliferate as a way of pandering to nationalist populations
  - Kroenig (2009): Democratic regimes face pressure to proliferate from constituencies which favor nuclear development

Domestic Institutions and Proliferation

- Motives:
  - Nuclear weapons may deter attacks and prevent possible coercion
  - Benefits important domestic interests groups
  - International prestige
  - Protection of external interference
- Cost and Constraints:
  - Extensive economic costs
  - International backlash
  - Domestic actors who oppose proliferation

Politics of Personalistic Dictatorships

- Personalistic dictators enjoy a tremendous amount of discretion
  - Military or political parties have little independent power
- Have to root out internal opposition
  - Create a cult of personality or a "sink or swim" situation for insiders
  - Keep the military relatively weak to prevent coups
    - Makes nuclear weapons more important
- Personalist dictators face fewer internal constraints

Empirical Analysis

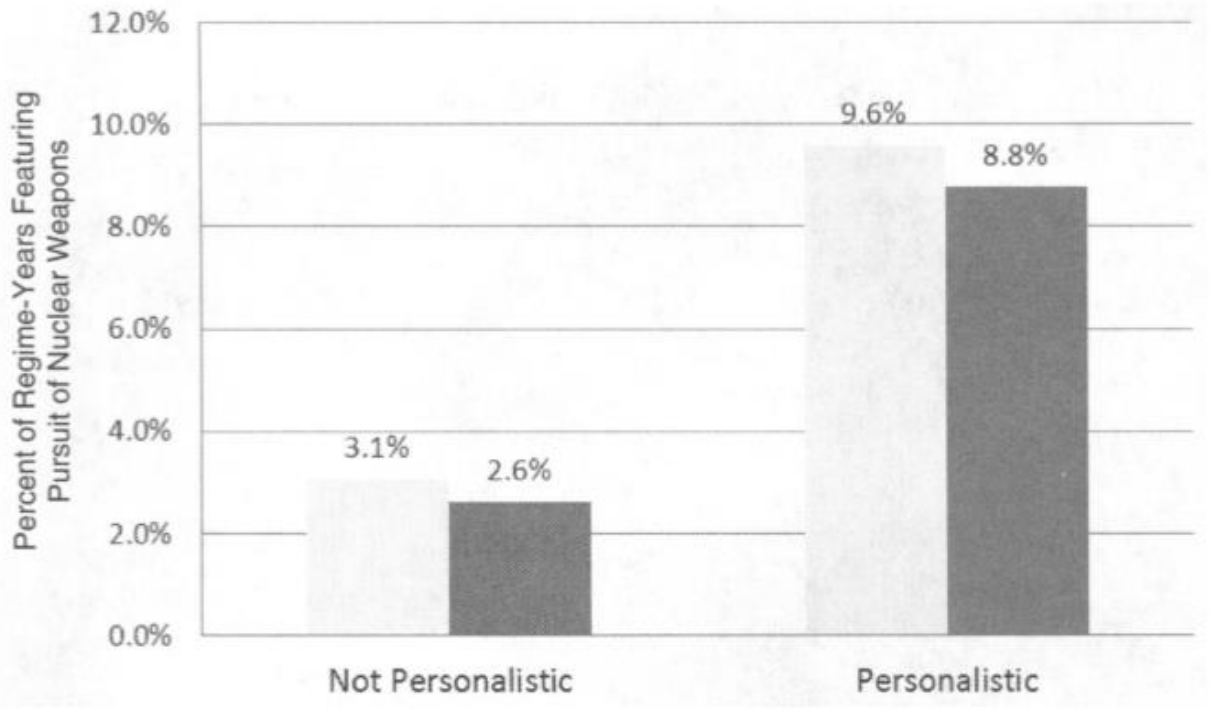
- Effects of cause approach instead of cause of effects
- Omits variables which are caused by personalism
  - E.g. Alliances or economic integration
  - Done to avoid post-treatment bias
- Dependent variable: pursuit of nuclear weapons (Singh and Way 2004) and (Jo and Gartzke 2004)

Empirical Analysis

- Personalization is measured by 8 indicators
  - Does access to high government offices depend on personal favor from the leader?
  - Is the politburo or equivalent a rubber stamp?
  - Does the leader control the security forces?
  - Does the leader choose party leaders?
  - Was the successor or heir-apparent a family member or close compatriot?
  - Is the military hierarchy disorganized or did the leader create a new military force?
  - Have dissenting officers or officials been murdered, purged, or exiled?
  - Have military officers been marginalized from decision making?

Results

FIGURE 1 Personalist Regimes and the Pursuit of Nuclear Weapons



Note: Light gray is program dates according to Jo and Gartzke (2007); dark gray is program dates according to the updated Singh and Way (2004) codings.

Results Using Singh and Way's Coding

TABLE 1 Personalist Regimes and the Pursuit of Nuclear Weapons (Dependent Variable: Singh and Way [2004] Codings)

	Basic Model	Plus Population	Plus Capabilities	*Plus Economic* Development
Personalist Regime	2.96$^{<.001}$	3.02$^{<.001}$	2.96$^{<.001}$	3.06$^{<.001}$
	(0.635)	(0.676)	(0.627)	(0.701)
Number of Land Borders (security environment)	0.859$^{<.001}$	0.551$^{<.001}$	0.750$^{<.001}$	0.772$^{<.001}$
	(0.201)	(0.204)	(0.189)	(0.192)
Population (ln)		1.97$^{<.001}$		
		(0.508)		
Capabilities			51.90$^{.027}$	
			(23.47)	
GDP per Capita (ln)				0.805$^{.030}$
				(0.371)
Years without Pursuit of Nuclear Weapons (t)	−1.16$^{<.001}$	−1.11$^{<.001}$	−1.14$^{<.001}$	−1.17$^{<.001}$
	(0.117)	(0.118)	(0.116)	(0.117)
t^2	0.0526$^{<.001}$	0.0504$^{<.001}$	0.0518$^{<.001}$	0.0522$^{<.001}$
	(0.00676)	(0.00685)	(0.00672)	(0.00671)
t^3	−.000625$^{<.001}$	−.000602$^{<.001}$	−.000617$^{<.001}$	−.000619$^{<.001}$
	(.000102)	(.000102)	(.000102)	(.000101)
Constant	−10.35$^{<.001}$	−28.50$^{<.001}$	−10.15$^{<.001}$	−16.36$^{<.001}$
	(1.50)	(6.04)	(1.41)	(3.54)
Log likelihood	−210.86	−198.67	−208.82	−194.50
Countries	173	173	173	173
Observations	5,338	5,338	5,338	5,221

Note: Two-tailed p-values in italicized superscripts, standard errors in parentheses. Shaded row highlights the main variable of interest.

Results Using Jo and Gartzke's Coding

TABLE 2 Personalist Regimes and the Pursuit of Nuclear Weapons (Dependent Variable: Jo and Gartzke [2004] Codings)

	Basic Model	Plus Population	Plus Capabilities	Plus Economic Development
Personalist Regime	3.30$^{<.001}$	3.21$^{<.001}$	3.35$^{<.001}$	3.22$^{<.001}$
	(0.654)	(0.691)	(0.670)	(0.697)
Number of Land Borders (security environment)	1.06$^{<.001}$	0.710$^{.012}$	1.01$^{.001}$	0.778$^{.012}$
	(0.233)	(0.284)	(0.221)	(0.210)
Population (ln)		1.81$^{.013}$		
		(0.730)		
Capabilities			104.31$^{.001}$	
			(28.35)	
GDP per Capita (ln)				0.587$^{.104}$
				(0.362)
Years without Pursuit of Nuclear Weapons (t)	−1.56$^{<.001}$	−1.48$^{<.001}$	−1.53$^{<.001}$	−1.55$^{<.001}$
	(0.169)	(0.169)	(0.168)	(0.166)
t^2	0.088$^{<.001}$	0.0844$^{<.001}$	0.0871$^{<.001}$	0.0874$^{<.001}$
	(0.0127)	(0.0126)	(0.0126)	(0.012)
t^3	−.00139$^{<.001}$	−.00132$^{<.001}$	−.00135$^{<.001}$	−.00136$^{<.001}$
	(.000251)	(.000248)	(.000240)	(.000245)
Constant	−10.25$^{<.001}$	−26.03$^{<.001}$	−11.57$^{<.001}$	−12.13$^{.015}$
	(1.59)	(9.39)	(1.60)	(3.44)
Log likelihood	−198.17	−189.42	−191.70	−186.00
Countries	173	173	173	173
Observations	5,337	5,335	5,335	5,220

Note: Two-tailed p-values in italicized superscripts, standard errors in parentheses. Shaded row highlights the main variable of interest.

Conclusion

- Policymakers should discourage leaders from amassing large amounts of personal power
- Personalistic dictatorships need to be watched closely
- External regime change may encourage nuclear proliferation
  - American policy is often counter-productive