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A Sliding Scale

Nuclear Proliferation Among States

by **Jessica Liu**

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Why do states engage in nuclear proliferation? Nuclear proliferation is a major security issue affecting the international arena. Existing studies debate both the strength and direction of determinants of nuclear proliferation and the effect of domestic and international circumstances on proliferation. A clear understanding of why states choose to pursue nuclear arms is critical to promoting and maintaining international security. By analyzing what factors may make a state less prone to proliferation, the international community may incentivize disarmament. My research question considers membership in the United Nations Security Council (UNSC) as a potential correlate of nuclear proliferation. Are countries that are members of the UNSC more likely to engage in nuclear proliferation compared to countries that are not elected to the UNSC?

Current scholarly research suggests many factors for proliferation. Existing literature cites three types of determinants: technological determinants, external determinants, and domestic determinants (Singh & Way, 2004, p. 862). States that are more technologically advanced are more likely to develop nuclear weapons due to a universal appeal of nuclear arms and the reduced costs of acquiring nuclear weapons compared to less advanced states (Singh & Way, 2004, p. 862; Jo & Gartzke, 2007, p. 167). External determinants, such as perceived security threats, cause a state to develop nuclear weapons in order to balance against a rival state's nuclear capabilities or a conventional threat. An alliance with a major power, on the other hand, diminishes the probability of proliferation (Bleek & Lorber, 2013, p. 1; Jo & Gartzke, 2007, p. 185; Singh & Way, 2004, p. 863). Some argue that in relation to the democratic peace theory, the pacifying effects of democracy and interdependence among democratic states reduce the ambition to pursue nuclear weapons. Quantitative tests have found that economic integration deters nuclear proliferation, because states do not wish to threaten economic partners (Singh & Way, 2004, p. 864).

Scholars have also tested the effects of signing the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) on nuclear proliferation, though they have reached different conclusions. Jo and Gartzke found that while states that have ratified the NPT ratification are less likely to initiate nuclear programs, NPT ratification has not deterred proliferation at the system level (Jo & Gartzke, 2007, p. 167). However, Bleek and Lorber found that NPT ratification is significantly and negatively linked to

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all stages of proliferation (Bleek & Lorber, 2013, p. 12).

To continue the discussion of how different factors affect nuclear proliferation, I study how being a member of the United Nations Security Council (UNSC) affects a state's status on nuclear proliferation. I also control for NPT ratification and enduring rivalry. The first section of this paper states my hypotheses and the rationale behind my predictions. The next section explains the construction of the dataset and coding for the variables. I then analyze the data using ordered logistic regression and discuss my findings. The last section contains a brief overview of considerations for future research.

THEORY

As Singh and Way (2004), among other scholars cited above, theorize, both external and internal factors affect a state's decision to proliferate. I further examine this by introducing a new independent variable, membership in the U.N. Security Council, in a model in conjunction with variables studied by other scholars. I adopt Singh and Way's use of a continuum as the dependent variable to separate the various stages a state may reach towards proliferation. The different stages are: no significant interest in nuclear weapons, serious exploration of nuclear weapons, pursuit of a nuclear weapons program, and acquisition of nuclear weapons (Singh & Way, 2004, p. 861).

United Nations Security Council

I analyze the effect of membership in the United Nations Security Council on nuclear proliferation. The UNSC is charged with maintaining international peace and security and handles many issues relating to deterrence (United Nations, 1945). In order to maintain international security, members of the council must protect themselves against potential aggressors. Thus, I expect elected states to be more likely to have at least explored nuclear weapons. In addition, after a state has been elected to the UNSC, it is more likely to want to increase its own security in order to legitimize its authority as part of the council. It may also do so to deter retaliation from other states as a result of the policies it helps create and impose.

Hypothesis 1

States that are members of the United Nations Security Council are more likely to engage in nuclear proliferation.

NPT Ratification

I also measure the effect of ratifying the Treaty on the Nonproliferation of Nuclear Weapons on proliferation. The NPT is currently the only multilateral binding agreement dedicated to

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disarmament. More countries have ratified the NPT than any other arms limitation and disarmament agreement (United Nations Office for Disarmament Affairs, n.d.). Although it explicitly prohibits the acquisition of nuclear weapons, the goal of the NPT to prevent the spread of nuclear weapons may implicitly discourage the exploration and pursuit of nuclear weapons as well. I do not consider the relationship between being a signatory of the NPT and acquisition of nuclear weapons in my model because of perfect prediction, save for a few violations of the NPT.

Hypothesis 2

States that have ratified the Treaty on the Non-Proliferation of Nuclear Weapons are less likely to explore or pursue nuclear weapons.

Enduring rivalry

Lastly, I analyze whether a state participates in an enduring rivalry in any given year. A vast majority of wars and militarized disputes occur within enduring rivalries, supporting the argument that the presence of an enduring rivalry is a significant security threat (Singh & Way, 2004, p. 869). A state that has a history of rivalry with another state is more likely to sense an urgency to develop nuclear weapons to protect itself. States whose rivals possess nuclear weapons are also more likely to develop nuclear weapons to defend against a potential preemptive strike.

Hypothesis 3

States that are involved in enduring rivalries are more likely to engage in nuclear proliferation.

METHODOLOGY

Dependent Variable

The dataset is based on that from Singh and Way's article (2004). The unit of analysis, country-year, analyzes 154 countries from 1945-2000 (Singh & Way, 2004, 861). The dependent variable is the level of nuclear proliferation that a state reaches. Because some states may express interest in nuclear weapons or start to build nuclear weapons but never progress to detonating them, I use Singh and Way's coding of placing proliferation on a continuum from 0 to 3. This accounts for states having many possible stopping points while on the path to proliferation. 0 demonstrates that a state has expressed no interest in nuclear weapons, 1 serious exploration of the possibility of developing weapons, 2 substantial efforts to develop weapons, and 3 acquisition of nuclear weapons capability. Exploration is coded for the year a country first considers building nuclear weapons, as shown by political authorization or research by defense agencies that may oversee potential weapons development. Pursuit is defined as when states make an active effort to

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gain nuclear weapons, such as through a cabinet-level political decision or movement toward weaponization. Acquisition is coded from the year a country has its first explosion or possession of a nuclear weapon (Singh & Way, 2004, p. 866-867). If a country renounces its nuclear weapons, subsequent years are coded as 0 to indicate no further interest in nuclear weapons.

Singh and Way break down the *level* of nuclear proliferation variable into separate dichotomous variables for the stages of *exploration*, *pursuit*, and *acquisition*. I utilize these to analyze how the independent variables affect whether a state achieves each stage of the nuclear continuum. Once a country achieves a value of 1 for a stage during a specific year, observations for future years under that stage are dropped and coded as missing. I employ ordered logistic regression because the dependent variable is ordinal. I cluster using country codes established by the Correlates of War project, so that observations for various years are grouped by country (Correlates of War Project, 2006). This accounts for the inherent correlation of observations made within the same country.

Independent Variables

I create a dichotomous variable for the years that a state is elected into the UNSC. The dichotomous variable utilizes 0 for non-membership during a country-year and 1 for membership. The coding for membership in the *United Nations Security Council* is taken from the United Nations website (United States Security Council, 2013). Countries are elected for two-year terms, although a few countries served on the council for just one year in a given period.

Several countries posed coding challenges. Taiwan, officially known as the Republic of China, was originally a permanent member of the UNSC until its seat was replaced by the People's Republic of China in October 1971 (United Nations General Assembly, 1971). I code Taiwan as a member of the UNSC until 1971 and China as a member from 1971 onwards. Both are coded as 1 in 1971 because each was a member for a portion of the year. The United Arab Republic, consisting of Egypt and Syria, was a member of the UNSC from 1961-1962 (United Nations, n.d.). However, it split in October 1961, after which Egypt adopted the original name. Syria and Egypt are both coded as members separately in 1961, but only Egypt is coded as a member in 1962.

The data on whether a state is an NPT signatory is merged from a dataset created by Jo and Gartzke (2007). The variable is dichotomous, with a 0 representing a state that did not ratify the treaty during that year and a 1 representing a state that ratified it. The dataset's observations span from 1939 to 1992, while Singh and Way's observations span from 1945-2000. When I merge Jo and Gartzke's data into Singh and Way's dataset, observations prior to 1945 are dropped, and the values for

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the *NPT ratification* after 1992 are coded as missing.

The variable for *enduring rivalry* is from Singh and Way's original dataset (2004). The presence of an enduring rivalry accounts for a significant portion of the security threat facing a state. The authors adopt coding from another article by Bennet (1998) and utilize a dichotomous variable whose value is 1 if the state is involved in one or more enduring rivalries in a given year, and is 0 if not. There are no issues of multicollinearity, or correlations of ± 0.6 or greater, among the variables in my models. Because the variables for exploration, pursuit, and acquisition of nuclear weapons are combined into the variable for level of nuclear proliferation, there is logically a high correlation of the three with the level of nuclear proliferation. To avoid multicollinearity, I perform regressions for exploration, pursuit, and acquisition separately from the regression on level of nuclear proliferation. The correlation table is below:

	level	explore	pursue	acquire	rivalry	npt_rati	UNSC
level	1.0000						
explore	0.9240	1.0000					
pursue	0.4858	0.4466	1.0000				
acquire	0.2813	0.1996	0.2423	1.0000			
rivalry	0.3062	0.0688	0.0724	0.0542	1.0000		
npt_rati	-0.0775	-0.0324	-0.0279	-0.0358	-0.0936	1.0000	
UNSC	0.4056	0.0397	0.0303	0.0451	0.1256	-0.0322	1.0000

DISCUSSION

Before testing my variables, I explore the distribution of states on the nuclear proliferation continuum (Graph 1). This information allows a more detailed understanding of the statuses of states on nuclear proliferation. Only countries that have at minimum shown interest in nuclear proliferation, or that have been coded as 1 or higher for the level variable, are analyzed. If a country has reached multiple stages of nuclear proliferation, the achievement of each stage is factored into the calculations in order to holistically gauge how far countries overall have progressed on the continuum. Almost half of the countries studied have explored weapons, but less than a third have seriously pursued nuclear weapons, and less than a quarter have acquired them. However, these observations are limited by their small sample size, as over 90% of 152 countries in the dataset have shown no interest in domestic nuclear programs.

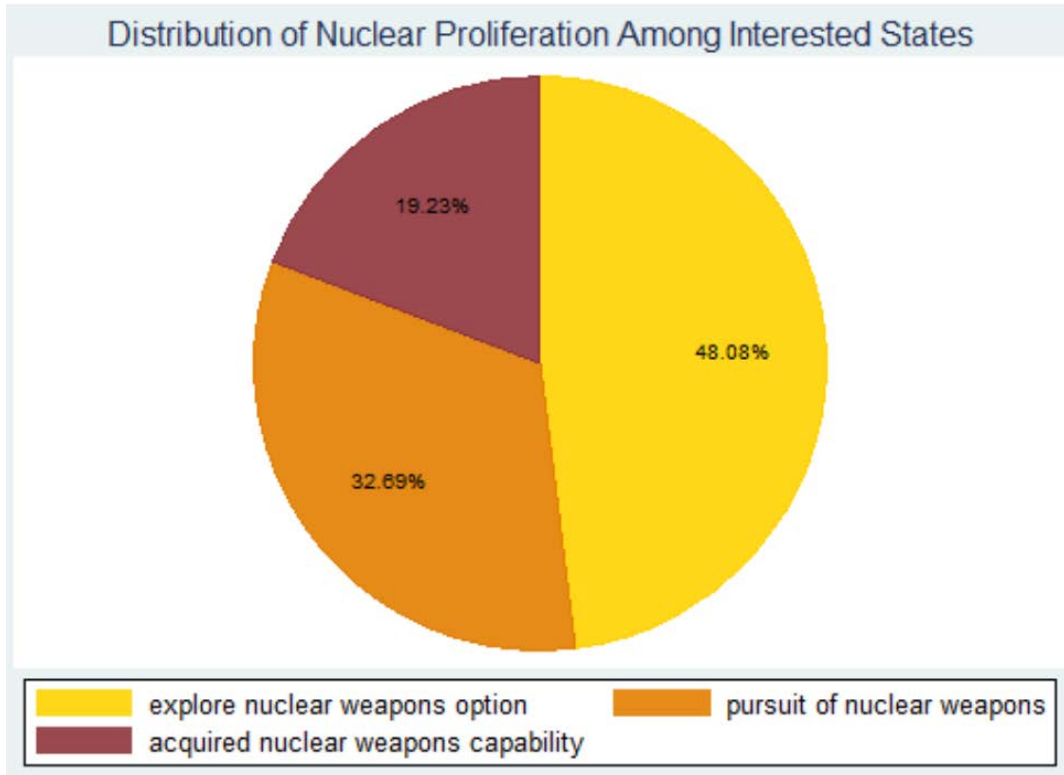


Figure 1

Table 1 shows that although hypotheses 1 and 3 hold true, hypothesis 2 is proven incorrect. Countries that are members of the United Nations Security Council are 2.25 times more likely to achieve a higher rating on the level of nuclear proliferation than countries that are not members. Countries that experience enduring rivalry are also significantly more likely to achieve a higher rating than countries that do not have enduring rivalry, although the coefficient is 1.78, which denotes a smaller effect than that of the UNSC variable. Both relationships are significant because they have a P-value of 0.00.

Ratification of the NPT has no significant relationship with a state's status on nuclear proliferation. This finding was unexpected because states that are resolved against acquiring nuclear weapons may be assumed to also be less likely to explore and pursue nuclear weapons. In addition, the result challenges the conclusions of Jo and Gartzke (2007) and Bleek and Lorber (2013). The disparity may be explained by my simplistic model, which has only a few independent variables and focuses on external determinants of nuclear proliferation. By adding variables such as technological development and economic factors into a future model, signatory status may become significant.

Other explanations for the lack of significance include the circumstances surrounding the treaty. Signing the NPT may not necessarily change state preferences for exploring or pursuing weapons (Jo & Gartzke, 2007, p. 179). Many treaties are signed as formalities

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because they represent actions states would have undertaken regardless of the presence of the treaty (Downs, Rocke and Barsoom 1996, p. 380). In this vein, the NPT may have been ineffective in deterring nuclear proliferation because states have agreed to avoid acquiring nuclear capability, but may continue to explore and pursue weapons.

<i>Independent Variables</i>	<i>Level of Nuclear Proliferation</i>	
	<i>Coefficient (R.S.E.)</i>	<i>P-Value</i>
<i>Rivalry</i>	1.782 (.476)	0.000
<i>NPT Ratification</i>	-.495 (.372)	0.183
<i>UNSC</i>	2.252 (.480)	0.000

Figure 2. Bolded coefficients are significant at the $p < 0.05$ level.

I disaggregate each stage of proliferation from the variable for level of proliferation in order to consider the effects of the independent variables on each stage. Before executing the regression, NPT ratification seems to reduce the likelihood that the state will explore and pursue nuclear weapons (Graph 2). This is in accordance with the belief that signing the treaty deters proliferation. However, a logistic regression demonstrates that NPT ratification still has an insignificant effect on proliferation (Table 2). A near-significant relationship is found between exploration of nuclear weapons and ratification of the NPT. States that have signed the NPT are -0.90 times less likely to explore nuclear weapons, but there is a 6.1% probability of the observed relationship being due to chance. I include the independent variables of rivalry and UNSC membership in this model in order to take into account their explanatory power. The UNSC and rivalry variables stay significant, except for the effect of UNSC membership on pursuit, which is just above the threshold of significance.

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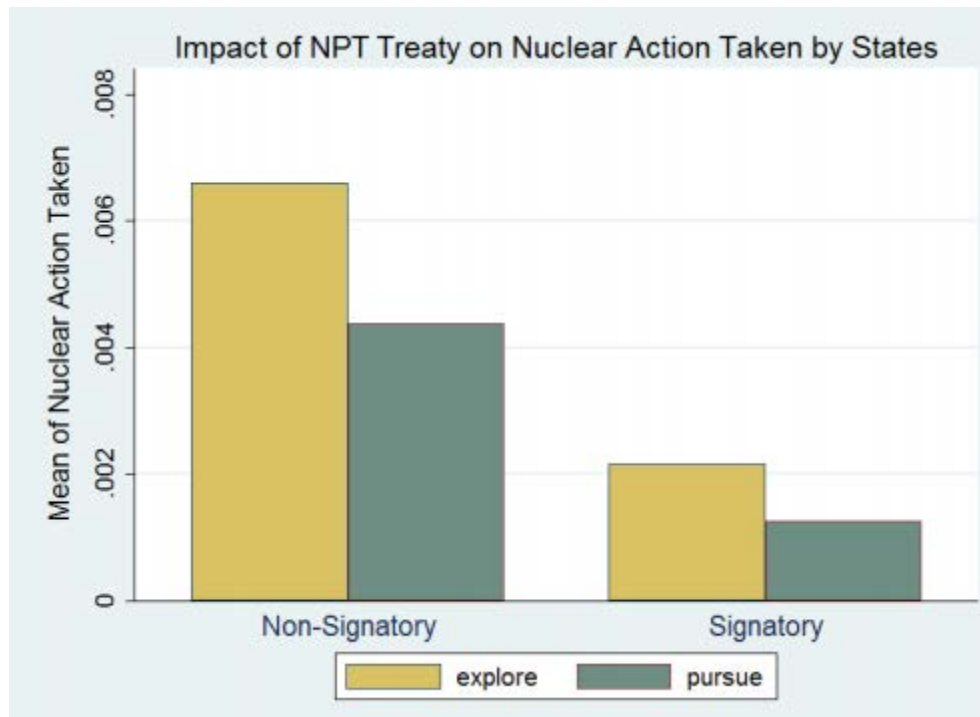


Figure 3.

Independent Variables	Exploration		Pursuit		Acquire	
	Coefficient (R.S.E.)	P-Value	Coefficient (R.S.E.)	P-Value	Coefficient (R.S.E.)	P-Value
Rivalry	1.878 (.430)	0.000	2.894 (.754)	0.000	2.821 (1.123)	0.012
NPT Ratification*	-.903 (.481)	0.061	-.935 (.658)	0.155	--*	--*
UNSC	1.172 (.451)	0.009	.988 (.577)	0.087	1.690 (.704)	0.023

Figure 4. *Npt_rati is omitted due to perfect prediction. The NPT prohibits signatories from acquiring nuclear weapons.

To further explore the effect of UNSC membership on state behavior, I analyze the differences between members of the UNSC and non-members and the average action they take regarding proliferation. I utilize the dichotomous variables of whether a state explored, pursued, or acquired nuclear weapons to separate the effects for each stage on the nuclear continuum. States that have been members of the UNSC show higher means of exploration, pursuit, and acquisition (Graph 3). This provides additional support for hypothesis 1, and predicts that members of the UNSC are more likely to exhibit higher levels of nuclear proliferation than states that are not members of the UNSC.

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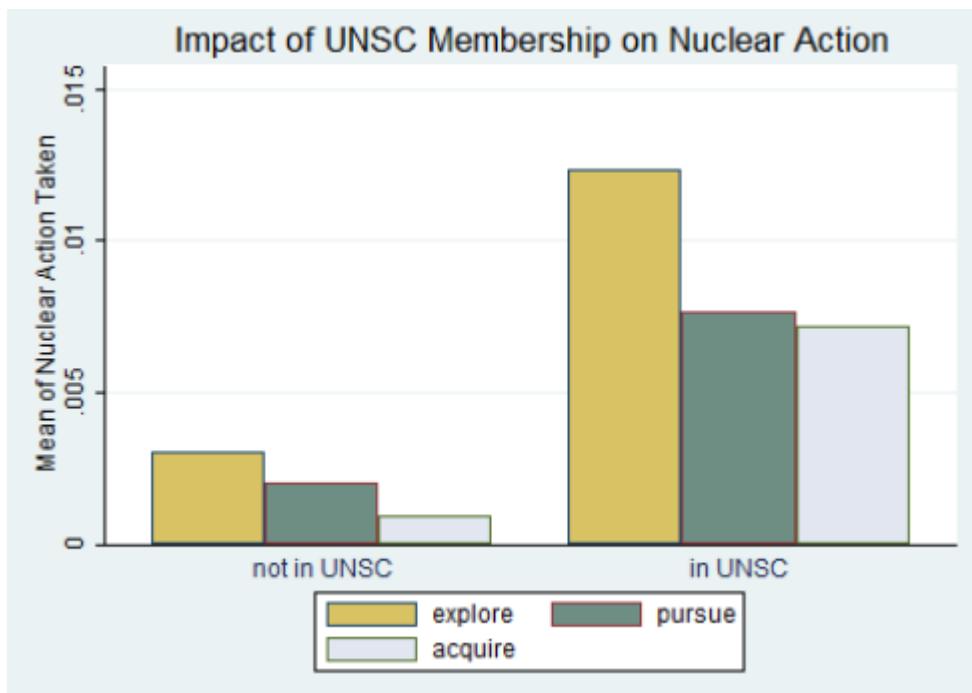


Figure 5.

CONCLUSION

Although nuclear proliferation is a growing concern, there are a limited number of nuclear states. Thus, the small sample size of states that have acquired nuclear weapons constrains the applicability of my findings. In order to limit observations to before the year 2000, I also did not code for countries that were elected to the United Nations Security Council after 2000.

Future studies on proliferation may include an updated dataset in order to analyze how states' attitudes towards nuclear proliferation have evolved. Controls, such as whether proliferation occurred during the Cold War and geographical region may be added. Motivations to proliferate during the Cold War may differ from motivations during other time periods due to the global political climate. Different regions may also share traits that affect states' decisions to proliferate. In addition, the coding of being a party to the NPT can be modified to include states that have acceded or succeeded to the NPT to analyze if a significant relationship exists.

Further research may also help explain why some states back down or reverse their decision to proliferate. Some states have voluntarily given up their nuclear arsenal or stopped their pursuit and exploration -- no longer exhibiting interest in nuclear weapons. A comparison of some of the traits of these countries may uncover findings about how to promote disarmament. The threat of nuclear warfare and immense consequences of unchecked nuclear proliferation demand immediate attention. As the

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international community works to establish peace and security among countries, it must better understand the basis for nuclear proliferation before it can successfully promote non-proliferation and global disarmament.

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