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Nuclear Weapon Influence

Conflict and Resolution

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This research explores the argument that even when nuclear weapons are not used as a weapon in conflict or resolution, they remain an unseen element of the interaction in both conflict and resolution that influences the outcome. Using OLS regression and Binomial logistic regression, the effect of nuclear weapons on conflict and resolution is tested using COW data from 1945 to 2001 and from 1989 to 2001 to control for the effects of the Cold War. This research finds that the presence of nuclear weapons would influence conflict such that fatalities would and intensity level would increase. Furthermore, nuclear weapons presence would decrease peaceful attempts and cause a decreased probability of a defense pact. Future research is needed to study the relationship between nuclear weapons and major power status as well as explore the nature of the Cold War effect. By determining more fully the relationship between conflict, nuclear weapons, and the fungibility of nuclear weapons, the United States can more effectively seek to decrease conflict and proliferation.

Introduction

The atomic bomb, first used against another country at Hiroshima and Hagasaki, ultimately ended World War II and killed between 150,000 to 246,000 people changing history and warfare forever. Today, there are approximately 23,000 nuclear weapons—strategic, non strategic, and operational—worldwide claimed by nine different nuclear countries: Russia, United States, France, China, United Kingdom, Israel, Pakistan, India, and North Korea (FAS 2010). However, despite their spread, the utility of nuclear weapons is debatable.

Robert McNamara explains the military role of nuclear weapons and believes that "nuclear weapons serve no military purpose whatsoever. They are totally useless—except only to deter one's opponent from using them" (McNamara 1983, 76). Furthermore, nuclear weapons are "special" munitions in that they require "special command, control and communications arrangements… special security precaution", all of which limit the flexibility of when the units can be deployed and military plans altered (McNamara 1983, 76). Their inflexibility provides a lack of relevance on the battlefield. Robert Art disagrees and describes force as a "blunt instrument [in war], but it can achieve decisive results if wielded properly", however when used in times of peace, "military power is held at the ready, and its exact influence on political outcomes becomes more difficult to trace" and thus, force achieves fungibility (Art and Waltz 2009, 3). Such fungibility can also be understood through classic Clausewitz theory that "war is a mere continuation of politics [or policy] by other means" (Clausewitz 1976). Clausewitz synthesizes war and politics through the trinity of violent emotion, chance, and rational calculation (Bassford 2008). With the advent of nuclear weapons, some strategists believe that war has lost its position as a tool of politics. However Sokolovsky argues that "it is well known that the essence of war as a continuation of politics does not change with changing technology and armaments" (qtd in Mason 1977, 82).

The United States is not only a nuclear country, but is also responsible for underwriting the security guarantees across the international system. By determining more fully the relationship between conflict, nuclear weapons, and the fungibility of nuclear weapons, the United States can more effectively seek to decrease conflict and proliferation. This policy memo explores and explains the relationship between conflict and resolution and a countries' nuclear status to argue that even when nuclear weapons are not used as a weapon in conflict or resolution, they remain an unseen element of the interaction in both conflict and resolution that influences the outcome.

In presenting this research, I will first provide a review of relevant literature. Second, I will discuss my four hypotheses that will be tested. Third, there will be a description of the data set followed by information about the variables within the model. This memo will then describe the methods used to test the hypotheses and the results. Finally, this memo will discuss conclusions and policy implications.

Literature Review

The majority of the literature devoted toward nuclear weapons and their impact focuses either on their impact in conflict or outside conflict. Within the confines of conflict, nuclear weapons are seen pessimistically as a danger in light of the consequences of nuclear war and accidents and the dangers of limited war. Optimistically, nuclear weapons are viewed as a deterrent from truly savage conflict. The other area of literature considers the fungibility of nuclear weapons as a tool of state power—not necessarily used for war. As this research explores the impact of nuclear weapons in both stages of conflict and resolution, both literatures are discussed for their theoretical frameworks and past research in explaining the impact of nuclear weapons.

Nuclear Weapons within Conflict: A Weapon of Limited War

Within conflict, Geller's (1990) empirical analysis results indicate that possession of nuclear weapons appears to have no deterrent effect in disputes with nonnuclear states. Furthermore, disputes between nuclear states are more likely to escalate than disputes by nonnuclear states. However, disputes between nuclear and nonnuclear states can also escalate, but nuclear targets are less likely to respond to provocation than nonnuclear targets(Geller 1990, 302-303).

Rauchhaus (2009) agrees with and goes further in his empirical analysis finding that states with nuclear weapons are more likely to engage in militarized disputes, use force, and be involved in uses of force resulting in fatalities. These correlations remain when the opposition state is nuclear or nonnuclear, though the results are more prominent when the opposition state holds nuclear weapons. At the same time, when both states hold nuclear weapons, the probability of nuclear war is decreased and the probability of crisis initiation and limited uses of force are increased (Rachhous 2009, 269-272).

Gartzke and Jo (2009) also agree that nuclear weapon states are significantly more likely to initiate militarized dispute. However, they find that when the instruments for nuclear proliferation are added to the model, little of this effect is due to the nuclear weapons themselves (Gartzke and Jo 2009, 220-221).

Beardsley and Asal (2009) find that opponents of nuclear states are more eager for crises to end and face significantly shorter crises as the expected costs are higher on average. They find that nuclear-nonnuclear state high-intensity conflict is expected to last only 116 days while nonnuclear-nonnuclear state high-intensity conflict is expected to last 246 days. Furthermore, in salient cases, nuclear weapons have a significant dampening effect on crisis length; alternatively, nuclear weapons are less relevant in crises with little salience(Bearsley and Asal 2009, 293).

Nuclear Weapons outside Conflict: the Fungibility of Power

For the purposes of this research, I will consider nuclear weapons as a possible fungible tool of state for the purpose of negotiation or diplomacy. While little research has explored how nuclear weapons affect an actor's ability to achieve better bargains, coercive diplomacy, or "forceful persuasion" (qtd Alexander George in Art and Cronin 2003, 57), is a form of compellance where a state attempts to utilize the threat of military power as a lever against a target. While Ikle and Leites (1962) believe that the "sham bargaining position" can lead to the opposition modifying

their original position (Ikle and Leites 1962, 25), Art points out that the failure of coercive diplomacy leads to two choices in which the state must either risk loss of face and future bargaining power or loss of life as they follow through on the threat (Art and Cronin 2003, 58).

The impact of nuclear weapons in such a case becomes problematic as, following coercive diplomacy theory, should a state wish to use it as a tool of negotiation, the threat would have to be credible and there would need to be the plausible threat of nuclear use (Jervis 1989, 3). Kroenig (2009) uses case study analysis to argue that conflict and proliferation is better understood by examining states as either power-projecting states or non-power projecting states (Kroenig 2009, 2-3). For power-projecting states, Kroenig argues that nuclear proliferation reduces the effectiveness of coercive diplomacy as it deters power-projecting states from using military force and it undermines the credibility of the associated threats (Kroenig 2009, 10). Similarly, nuclear proliferation also undermines the alliance structures of power-projecting states as nuclear weapons reduce the value of the security guarantees to the allies (Kroenig 2009, 17).

This coercive diplomacy theory is contrasted with research by Gartzke and Jo (2009) as well as Beardsley and Asal (2009). Gartzke and Jo (2009) find in their empirical study that nuclear weapons increase diplomatic status without affecting whether states fight in conflict. They find that nuclear target states are more likely to be the recipients of propositions (224). Furthermore, other states will seek to resolve differences with nuclear powers over oncoming conflict issues, even when "nuclear powers are no more prone to seek settlements with other states" (Gartzke and Jo 2009, 224). Gartzke and Jo also found that nonnuclear opponents are "more willing to accommodate nuclear states, while nuclear states are not more willing to pursue peaceful accommodation" (225). Beardsley and Asal (2009) observe that nuclear-weapons states prevail in coercive diplomacy when it is defined as either gaining concessions or having their opponent back down from demands. Their empirical study found that nuclear actors are more like to be victorious against nonnuclear actors in gaining concessions. However, new nuclear states and crisis success were only statistically significant in one model as new nuclear states, as opposed to mature nuclear states who tended to win more often, were less adapted to their new bargaining position (Beardsley and Asal 2009, 295).

Hypotheses

The following are the hypotheses about based on the literature review. Following the theories of the literature review in which nuclear countries are more likely to escalate conflict, more likely to engage in militarized disputes, and more likely to initiate militarized disputes, the explanatory variables to test nuclear weapon affect on conflict include intensity of conflict and the number of fatalities (Geller 1990; Rachhaus 2009; Gartzke and Jo 2009). The literature review of nuclear weapons outside conflict indicated mixed affects. In power projecting states, nuclear proliferation reduces effectiveness of coercive diplomacy and undermines the alliance structure (Kroenig 2009). Other theories found that nuclear weapons increase diplomatic status, make countries more prone to seeking settlement, and become more likely to gain concessions out of a nonnuclear state (Gartzke and Jo 2009; Bearsley and Asal 2009). Following these theories, the explanatory variables to test nuclear weapon affect outside conflict (conflict resolution) include the number of peaceful attempts bilaterally and third parties and whether or not the state reached a defensive pact.

Hypothesis 1: Nuclear weapon possession, though not necessary use, in conflict causes limited conflicts which will be significantly different in intensity than those conflicts where nuclear weapons are not present.

H_0: There is no relationship between nuclear possession and level of intensity of a conflict.
H_1: There is a relationship between nuclear possession and the level of intensity of a conflict.

Hypothesis 2: As nuclear states choose to limit their use of force in conflict by not utilizing nuclear weapons, conflicts will either have lower amounts of violence and lower number of deaths or increase levels of violence and increase the number of deaths.

H_0: There is no relationship between nuclear possession and number of casualties.
H_2: There is a relationship between nuclear possession and the number of casualties.

Hypothesis 3: A states' possession of nuclear weapons will influence the number of peaceful attempts-- bilateral negotiations, third party binding attempts, and third party nonbinding attempts—following a conflict.

H_0: There is no relationship between nuclear possession and number of peaceful attempts.
H_3: There is a relationship between nuclear possession and peaceful attempts.

Hypothesis 4: Nuclear weapon possession is a tool for bargaining in negotiation. Nuclear weapon possession will influence the probability of two states reaching a defense pact.

H_0: There is no relationship between nuclear possession and reaching a defense pact.
H_4: There is a relationship between nuclear weapons and the probability of a defense pact.

Data

The dataset used is a replication with alterations of the Gartzke and Jo dataset from the article "Bargaining, Nuclear Proliferation, and Interstate Disputes". The dataset references data from EUGene, ICOW (Issue Correlates of War), Correlates of War (COW), as well as specific studies that have used this same data to find new variables to examine militarized interstate disputes (MID) data from the years 1816-2001. This dataset defines a MID such that:

> Militarized interstate disputes are united historical cases of conflict in which the threat, display or use of military force short of war by one member state is explicitly directed towards the government, official representatives, official forces, property, or territory of another state. Disputes are composed of incidents that range in intensity from threats to use force to actual combat short of war (Jones and Bremer and Singer 1996, 163).

The dataset in its entirety includes 10041 observations; however, I will be limiting my observations to only those from 1945 to 2001 and from 1989 to 2001 to include a total of 4,576 or 1,249 observations respectively. These subsets of the data were chosen to account for when nuclear weapons have been present in conflict and also for the Cold War effect.

In the data on militarized disputes, the U.S. was most often one of the states both in 1945-2001 and 1989-2001. Moreover, the study sample is not a representative mix from all regions of the world. From 1945-2001, 55.46% of the MIDs occurred between two states in the Americas, 19.69% occurred between two states in Europe, and 15.69% occurred when one state was from the Americas and the other was from Europe. From 1989-2001, 53.80% of the MIDs occurred between two states in the Americas, 18.90% occurred between two states in Europe, 11.93% occurred when one state was from the Americas and the other was from Europe, and 8.57% occurred between two states in the Middle East. In both time periods, this research does not consider any data where either country came from Africa.

Data on militarized disputes have been collected and documented from a variety of sources including searching global, regional, and national sources for indication of threat or use of force by one state against another (Correlates of War). Some of the variables have also been taken from comparisons of countries by the Center for International Comparison's Penn World Tables (Center for International Comparisons).

The dataset corrects for any bias inherent in information gathering by relying mainly on the EUGene, ICOW, and COW data. However, some direct dyadic interaction variables are used. Dyadic MID data is only available from the COW project from 1993-2001 because incident data had only been systematically coded since 1993. Pre-1993 period dyadic interactions are based on assumptions and additional research. Acknowledgment of potential bias has allowed the dataset to be understood in context.

Variables

Table 1 and Table 2 reference the descriptive statistics of the variables used in the models. The following discussion explains the dependent and independent variables used in the analysis.

DEPENDENT VARIABLES

Overall hostility level

This ordinal dependent variable is measured with a sliding scale from 0 to 5. A "0" hostility level means that there was no hostility. A "1" hostility level means that there was no militarized action in the dispute. A "2" hostility level corresponds to a threat to use force. A "3" hostility level corresponds to a display of force. A "4" hostility level corresponds to the use of force. A "5" hostility level corresponds to war.

This variable is used to examine the intensity of the conflict. This is a good proxy for the dependent variable that is desired—the Highest Act variable of levels of violence reached in the conflict—when data for the Highest Act variable were not available. The Highest Act variable is included in many COW datasets, but not this one, and measures the intensity of violence by the highest act of force committed on by State A on both A and B ranging. This data ranges from no militarized action to the threat of various action (force, blockade, territory, war, weapons), to a show of force, to an alert, to a nuclear alert, to border violation, to seizure, to attack, to clash, to a declaration of war, etc. The dependent variable used is a viable proxy for the as it does differentiate between different hostility levels. However, as it is a proxy for the desired variable, there is a level of measurement error inherent in the variable as the ordinal levels are broad and provide less accuracy than desired in examining the hostility levels with different displays of force.

Overall fatality level

This ordinal dependent variable is measured with a sliding scale from 0 to 6. A "0" corresponds with zero deaths. A "1" corresponds with 1 to 25 deaths. A "2" corresponds with 26-100 deaths. A "3" corresponds with 101-250 deaths. A "4" corresponds with 251 to 500 deaths. A "5" corresponds to 501-999 deaths. A "6" corresponds to more than 999 deaths. This dependent variable acts as a proxy to determine the levels of violence in conflicts.

Number of Peaceful Attempts

This continuous variable considers the number of peaceful settlement attempts that occurred during any MID. This includes bilateral negotiations, non-binding third party attempts, and binding third-party attempts. Bilateral negotiations are negotiations between official representatives of State A and State B, without third party assistance. A binding third party attempt—either a arbitration or adjudication—is where a third party actor makes a binding decision to help resolve the conflict of interests. An adjudication involves a legal tribunal such as the International Court of Justice. An arbitration involves an ad hoc submission of the dispute to a third party both actors consider to be acceptable. Non binding third party attempts include inquiry and conciliation and mediation. Inquiry and Conciliation represent non-binding activities where a third party will perform a fact-finding mission to study the claim, clarify facts, or establish the disputed question in an unbiased approach. Mediation involves the third party

discussing the disputed question and contributing suggestions towards a settlement (Hensel 2008, 8-10).

Defense Pact

This is a nominal dependent variable categorizing whether the conflict ended with a defense pact, coded with a "1", or otherwise, coded with a "0". This is a proxy for a measurement of concluded peace after the conflict. A defense pact is defined as "the highest level of military commitment, requiring alliance members to come to each other's aid militarily if attacked by a third party" (COW).

INDEPENDENT VARIABLES

Major Power

Major Power status is coded "1" for countries considered to be a major power and "0" for countries not considered to be a major power. The COW project's classification of major power status is used for this variable. Major Powers in the period of this study include the United States (1945-2001), United Kingdom (1945-2001), Soviet Union/Russia (1945-2001), France (1945-2001), Germany (1990-2001), Japan (1991-2001), and China (1950-2001). Singer and Diehl (1990) describe that a major power is a state that is recognizes by other states as a major state (58). The criterion for major power designation is largely non-qualitative as it relies on the aggregated collective judgment of the system membership—major power designation through the COW project is decided by an academic survey of experts identifying great powers based on both material capabilities and treated as an important and dominant actor in the international system. Inidividual opinion of various experts could provide error and bias in measurement. This criteria proves difficult as Small and Singer acknowledge as the "differentiation between major powers and others are not as operational as we might wish" at the same time, while Garoke and Jo (2009) do not utilize the major power variable as they believe it to be influenced by nuclear weapons status (220-221), Singer and Diehl (1990) note that state importance is still a major indicator and deciding factor when considered that the U.S., Soviet Union, United Kingdom, France, and China, all of whom hold permanent seats at the UN Security Council and are considered major powers in the COW list (59). Similarly, I have chosen to include the two as separate variables as not every state that has major power status has nuclear weapons and vice versa.

National Capacity

National Capacity is based on the COW Composite National Capacity Index (CINC) in which demographic, industrial, and military indicators are used to measure national capabilities (Singer and Diehl 1990, 54-55). The CINC only measures hard powers and may not represent total national power. This measure is computed by summing all observations of the 6 capability components of the given year, converting each state's absolute components to a proportion of the international system total and averaging across the 6 components (Correlates of War).

Political Relevancy

This variable measures "1" if the dyad is politically relevant and "0" if it is not. COW considers only those dyads to be politically relevant when the dyad includes two states that are contiguous,

touching along a border, or where at least one member of the dyad is a major power (Bennett 2006, 246).

Military Expenditures
This continuous variable measures the amount of military expenditures for the year of the conflict in year of conflict US Dollars.

Rivalry
This variable coded "1" if the state is considered to be a rival with the other and "0" if otherwise. This data is taken from Diehl-Goertz data recommendations on the basis that rivalry is not a random process but a influenced by duration, hazard rate, randomness, and cumultative hazard rate. While it seems obvious that rivals would be more prone to conflict, states that are not rivals may still experience greater hostility because of diffusion. Furthermore nuclear status can also influence rivalry and security concerns as the weapons can cause a nation to act more aggressively toward another state (Garkoke and Jo 2009, 12).

Index of Claim salience
This variable is an ICOW index of the salience or importance of the claimed territory, river, or maritime zone to the two participants. This variable is measured at the highest salience value while the case is ongoing. The index ranges from 0 to 12 where higher values indicate greater salience. See Appendix A for a breakdown of the index.

Proportion of World GDP
This economic indicator measures the proportion of the state's national GDP to the world GDP. Economic integration into the world economy conditions a state's motivation and ability to proliferate. Furthermore, while poorer countries may hold more grievances, wealthy nations can more easily fund militaries with the tools of warfare (Garkoke and Jo 2009, 12).

Nuclear Status
This variable is coded "1" if the state has nuclear weapons in the conflict and "0" if it does not. This does not necessitate that the country uses the nuclear weapons—only that they are present within that countries arsenal of weapons.

Initiates conflict
This nominal variable considers whether state A initiated a MID against State B. It is coded such that "1" is yes, and "0" is no.

Resolved
This nominal variable, for which dummy variables are created and used, considers how the conflict was resolved. In these cases the variable is coded "1" if the statement is true for the MID, and "0" if false. Please note the explanations of the four dummy variables which are mutually exclusive:

- Resolved when claim was dropped by Challenger.
- Resolved with a Third Party
- Resolved bilaterally
- Resolved when claim was dropped by target.

TABLE 1: DESCRIPTIVE STATISTICS OF VARIABLES 1945-2001

	1945-2001			
	Mean	Std. Dev.	Min	Max
Dependent Variables				
Hostility Level	0.523	1.316	0.000	5.000
Fatality Level	0.085	0.579	0.000	6.000
Number of Peaceful Attempts	0.205	0.577	0.000	7.000
Defensive Pact	0.601	0.490	0.000	1.000
Independent Variables				
Military expenditures State A	32800000.000	75800000.000	0.000	322000000.000
Capabilities State A	0.036	0.064	0.000	0.384
Major Power Status State A	0.250	0.433	0.000	1.000
Nuclear Possession State A	0.246	0.431	0.000	1.000
Rivalry State A	1.336	0.915	0.000	2.000
State GDP proportion of World GDP state A	0.044	0.076	0.000	0.299
Military expenditures State B	21100000.000	56100000.000	0.000	322000000.000
Capabilities State B	0.037	0.072	0.000	0.384
Major Power Status State B	0.286	0.452	0.000	1.000
Nuclear Possession State B	0.266	0.442	0.000	1.000
Rivalry State B	1.502	0.842	0.000	2.000
State GDP proportion of World GDP state B	0.043	0.078	0.000	0.299
Political Relevance	0.852	0.355	0.000	1.000
Saliance Index	6.577	2.264	0.000	12.000
Initator of Conflict	0.056	0.229	0.000	1.000
Claim Resolved by Challenger Dropping claim	0.010	0.097	0.000	1.000
Claim Resolved by Target Dropping claim	0.002	0.046	0.000	1.000
Claim Resolved through Third Party	0.012	0.108	0.000	1.000
Claim Resolved Bilaterally	0.017	0.130	0.000	1.000

TABLE 2: DESCRIPTIVE STATISTICS OF VARIABLES 1989-2001

	1989-2001			
	Mean	Std. Dev.	Min	Max
Dependent Variables				
Hostility Level	0.503	1.276	0.000	5.000
Fatality Level	0.060	0.488	0.000	6.000
Number of Peaceful Attempts	0.279	0.742	0.000	7.000
Defensive Pact	0.586	0.493	0.000	1.000
Independent Variables				
Military expenditures State A	54700000.000	104000000.000	0.000	322000000.000
Capabilities State A	0.032	0.053	0.000	0.157
Major Power Status State A	0.268	0.443	0.000	1.000
Nuclear Possession State A	0.286	0.452	0.000	1.000
Rivalry State A	1.485	0.851	0.000	2.000
State GDP proportion of World GDP state A	0.041	0.074	0.000	0.214
Military expenditures State B	30700000.000	79500000.000	0.000	322000000.000
Capabilities State B	0.019	0.040	0.000	0.157
Major Power Status State B	0.183	0.387	0.000	1.000
Nuclear Possession State B	0.193	0.395	0.000	1.000
Rivalry State B	1.501	0.848	0.000	2.000
State GDP proportion of World GDP state B	0.025	0.057	0.000	0.214
Political Relevance	0.801	0.400	0.000	1.000
Saliance Index	6.761	2.248	2.000	12.000
Initator of Conflict	0.043	0.203	0.000	1.000
Claim Resolved by Challenger Dropping claim	0.015	0.122	0.000	1.000
Claim Resolved by Target Dropping claim	0.002	0.049	0.000	1.000
Claim Resolved through Third Party	0.009	0.093	0.000	1.000
Claim Resolved Bilaterally	0.026	0.160	0.000	1.000

Method

The method used to test the three hypotheses in which the dependent variable is continuous and interval-ratio is a multivariate regression analysis using Ordinary Least Squares (OLS) regression while one of the hypotheses in which the dependent variable is a dichotomous nominal variable uses the Maximum Likelihood estimation of Binomial Logistic regression.

The assumptions of OLS regression which must be met are as follows:

- The regression model is linear, correctly specified and has an additive error term.
- The error term has population mean of 0.
- The independent variables are not correlated with the error term.
- The observations of the error term are not correlated with each other.
- The variance of the error term is constant
- No independent variable is a perfect linear function of any other independent variable.
- The error term is normally distributed.

Binary Logistic regression overcomes some of the restrictive assumptions of OLS regression as logistic regression does not assume the dependent variable is homoscedastic for each level of the independent variables. Also, the error terms do not need to be assumed to be normally distributed (Garson 2010).
However, the assumptions of the Binomial Logistic regression which must be met are as follows:

- The dependent variable is a dichotomous nominal variable.
- Logistic coefficients are coded meaningfully so that the greatest interest is 1 and the other is 0.
- The model is correctly specified and has an additive error term.
- Independence of irrelevant alternatives
- Error terms are assumed to be independent
- Low error in the explanatory variables
- No independent variable is a perfect linear function of any other independent variable.
- The regression utilizes large samples in which no less than 10% of the cell frequencies for the dependent variable are formed by one of the [options].

Following these assumptions, the model regression equations for each of the hypotheses are described below:

Hypothesis 1's Model Regression Equation

$$Yi=\beta0+\beta1\ln X1i+\beta2\ln X2i+\beta3X3i+\beta4X4i+\beta5X5i+\beta6\ln X6i+\beta7\ln X7i+\beta8X8i+\beta9X9i+\beta10X10i+\beta11X11i+\beta12X12i+\beta13X13i+\varepsilon i$$

Y: Intensity Level
X_1: Military Expenditures State A
X_2: National Capabilities Index score State A
X_3: Major Power Status State A
X_4: Nuclear Possession Status State A

X_5: Rivalry Status State A
X_6: Military Expenditures State B
X_7: National Capabilities Index score State B
X_8: Major Power Status State B
X_9: Nuclear Possession Status State B
X_{10}: Rivalry Status State B
X_{11}: Political Relevance
X_{12}: Saliance Index
X_{13}: Initiator of Conflict

Hypothesis 2's Model Regression Equation
$Yi=\beta0+\beta1\ln X1i+\beta2\ln X2i+\beta3X3i+\beta4X4i+\beta5X5i+\beta6\ln X6i+\beta7\ln X7i+\beta8X8i+\beta9X9i+\beta10X10i+\beta11X11i+\beta12X12i+\varepsilon i$

Y: Fatality Level
X_1: Military Expenditures State A
X_2: National Capabilities Index score State A
X_3: Major Power Status State A
X_4: Nuclear Possession Status State A
X_5: Rivalry Status State A
X_6: Military Expenditures State B
X_7: National Capabilities Index score State B
X_8: Major Power Status State B
X_9: Nuclear Possession Status State B
X_{10}: Rivalry Status State B
X_{11}: Political Relevance
X_{12}: Saliance Index

Hypothesis 3's Model Regression Equation
$Yi=\beta0+\beta1\ln X1i+\beta2\ln X2i+\beta3X3i+\beta4X4i+\beta5X5i+\beta6\ln X6i+\beta7\ln X7i+\beta8X8i+\beta9X9i+\beta10X10i+\beta11X11i+\beta12X12i+\beta13X13i+\beta14X14i+\beta15X15i+\beta16X16i+\beta17X17i+\beta18X18i+\varepsilon i$

Y: Number of Peaceful Attempts
X_1: Military Expenditures State A
X_2: National Capabilities Index score State A
X_3: Major Power Status State A
X_4: Nuclear Possession Status State A
X_5: Rivalry Status State A
X_6: Military Expenditures State B
X_7: National Capabilities Index score State B
X_8: Major Power Status State B
X_9: Nuclear Possession Status State B
X_{10}: Rivalry Status State B
X_{11}: Political Relevance
X_{12}: State GDP proportion of World GDP state A
X_{13}: State GDP proportion of World GDP state B

X_{14}: Claim Resolved by Challenger Dropping claim
X_{15}: Claim Resolved by Target Dropping claim
X_{16}: Claim Resolved through Third Party
X_{17}: Claim Resolved Bilaterally

Hypothesis 4's Model Regression Equation
$Yi=\beta0+\beta1\ln X1i+\beta2\ln X2i+\beta3X3i+\beta4X4i+\beta5X5i+\beta6\ln X6i+\beta7\ln X7i+\beta8X8i+\beta9X9i+\beta10X10i+\beta11X11i+\beta12X12i+\beta13X13i+\beta14X14i+\beta15X15i+\beta16X16i+\varepsilon i$

Y: Presence of Defensive Pact
X_1: Military Expenditures State A
X_2: National Capabilities Index score State A
X_3: Major Power Status State A
X_4: Nuclear Possession Status State A
X_5: State GDP proportion of World GDP state A
X_6: Military Expenditures State B
X_7: National Capabilities Index score State B
X_8: Major Power Status State B
X_9: Nuclear Possession Status State B
X_{10}: State GDP proportion of World GDP state B
X_{11}: Political Relevance
X_{12} Saliance Index
X_{13}: Claim Resolved by Challenger Dropping claim
X_{14}: Claim Resolved by Target Dropping claim
X_{15}: Claim Resolved through Third Party
X_{16}: Claim Resolved Bilaterally

Potential violations of assumptions in the regression models could result in errors due to specification, functional form, multicollinearity, serial correlation, and heteroscedasticity. All of these must be addressed to prevent biased and inefficient coefficients and/or deflated or inflated standard errors. Failure to fix the OLS violations and meet the assumptions could result in Type 1 or Type 2 errors where relationships are judged as significant when they are not or they are viewed as not significant when they are.

Specification errors
There are limitations in the model in terms of omitted variable bias. While every effort was taken to include the relevant variables, the complexities of factors which contribute to conflict were not available in the dataset and could not be accounted for. For example, motivation of conflict includes greed, grievance, political asymmetries, economic asymmetries, environmental factors, and demographic factors. While political and economic factors were included in the variables, the complexity of diagnosing which motivation techniques are present in various subsets of populations in different populations adds to complexity. Ultimately, the complexitities inherent in conflict could not completely be accounted for.
This study also is based on the assumption that the effect of nuclear weapons cannot be removed from thoughts/actions in conflict/resolution even if they are not mentioned or used. Furthermore, this study is based on the assumption that the effect of nuclear weapons cannot be removed in

conflict and resolution even if they are not mentioned or used. Such an assumption automatically results in omitted variable bias as it cannot be measured.

Because of this, omitted variable bias is likely in the model. The consequences of this bias result in artificially low standard errors and biased estimated variable coefficients. These two consequences can increase the likelihood of statistical significance the probability of making a Type I error.

I would consider adding a variable for length of conflict as well as a longitudinal index to consider the amount of time the nuclear country has held their nuclear weapons. Michael Horowitz (2009) found that while nuclear weapons make states more likely to reciprocate militarized challenges, over time, the effect is reversed (234). Such a time element could further influence nuclear weapons affect on conflict and resolution.

The model could be improved with better variables for intensity of conflict, and major power status. As previously discussed, intensity of conflict is a proxy for the various levels of hostility. Similarly, major power status is inherently biased in its construction and inherently related to nuclear weapons. Such bias could ultimately indicate that results are not based on whether states hold nuclear weapons in conflict but are major powers.

Functional Form

Efforts were made to put all variables in their correct functional form. Failure to have all the variables in their correct functional forms could create artificially statistically significant results. While most of the variables follow a lin-lin functional form, population and national capacity were logged as their relationship with the dependent variables increase at a decreasing rate. This is in line with theory that suggests that these relationships are not linear. For example, an increase in national capabilities may increase rapidly a state's ability to conduct war which may result in higher casualties/higher intensity. However, the social norm of not utilizing nuclear weapons which a state results in a level-off point as states national capacity may increase but they will limit their destruction to not using the nuclear weapons.

Serial Correlation

This analysis uses panel data and is therefore assumed to be affected by serial correlation. The consequence of this serial correlation is biased standard errors which are almost always deflated, causing artificially statistically significant results. Causes of serial correlation could be from the historical events of World War II (1945) in which nuclear weapons were used and resulted in the Cold War as well as 1989 when the Cold War ended. Cold War thinking could provide trends in error term which prevail across years. While this would bias the results, this research has attempted to control for this time-variant factor by viewing all regressions and models in conflict both from 1945 to the present and from 1989 to the present. Another partial fix for clustering would have been the inclusion of dummy variables for the region of the world in which the conflict took place. However, as data was available for the regions of both states involved in the conflict but not the region where the conflict took place, this study was not able to control for clustering in this manner. While correcting for the time-variant factor of the Cold War is only a partial fix, the nature of the topic and conflict does not lend itself to controlling for time-invariant factors by including a lagged dependent variable.

Multicollinearity

Multicollinearity is an issue in the models. Theoretically, possession of nukes is used both as an independent variable and as an element when considering military expenditures, another independent variable; which is also used as an element when calculating a state's national capabilities, a third independent variable. Similarly, great power status is subjective in that it is made of diplomatic recognition and national capabilities. Because of the interconnectedness of these independent variables as well as the fact that several of the independent variables were not statistically significant in various models, a test for multicollinearity was tested for using the Variance Inflation Factor (VIF).

The results of the VIF tests are discussed below and are presented according to each hypothesis. Assuming a threshold of 5.0, there was only multicollinearity in two of the four models. Hypothesis 1 and 2 did not have variables were the VIF was higher than 5. However, the model for Hypothesis 3 has high VIF among the variables with a mean of 7.91 for conflicts extending from 1945 to 2001 and 7.84 for conflicts extending from 1989 to 2001. This high VIF indicates an inflated standard error, which can artificially decrease significance. Similarly, the VIF of the variables in Hypothesis four is also high with a mean of 8.34 indicating inflated standard error.

However, as this is only a Type II error, nothing will be done to correct for multicollinearity in the model. However, an F test of the variables with VIFs higher than 5.0 in hypothesis three and four indicates an F statistic with a p value less than .001 for both models, in both years. This F test signals that although partial multicollinearity is present, the variables are still statistically significant as a group.

HYPOTHESIS 1:

	VIF	
	1945	1989
Ln of Military expenditures State A	4.82	4.82
Ln of Capabilities State A	4.78	4.78
Major Power Status State B	3.76	3.76
Major Power Status State A	3.24	3.24
Ln of Capabilities State B	3.23	3.23
Nuclear Possession State A	2.16	2.16
Nuclear Possession State B	1.68	1.68
Ln of Military expenditures State B	1.56	1.56
Rivalry State B	1.24	1.24
Rivalry State A	1.23	1.23
Political Relevance	1.18	1.18
Saliance Index	1.13	1.13
Initator of Conflict	1.03	1.03
Mean VIF:	2.39	2.39

HYPOTHESIS 2:

	VIF	
	1945	1989
Ln of Military expenditures State A	4.81	4.81
Ln of Capabilities State A	4.79	4.79
Major Power Status State B	3.75	3.75
Major Power Status State A	3.26	3.26
Ln of Capabilities State B	3.22	3.22
Nuclear Possession State A	2.17	2.17
Nuclear Possession State B	1.67	1.67
Ln of Military expenditures State B	1.55	1.55
Rivalry State B	1.23	1.23
Rivalry State A	1.22	1.22
Political Relevance	1.18	1.18
Saliance Index	1.13	1.13
Mean VIF	2.5	2.5

HYPOTHESIS 3:

	VIF	
	1945	1989
Major Power Status State A	21.59	12.78
Nuclear Possession State A	20.69	11.81
Ln of Military expenditures State A	15.79	18.64
Ln of Military expenditures State B	13.97	16.03
Ln of Capabilities State A	12.51	15.97
Major Power Status State B	12.12	15.75
Ln of Capabilities State B	11.6	12.23
Nuclear Possession State B	11.45	16.16
State GDP proportion of World GDP state A	3.84	3.11
State GDP proportion of World GDP state B	2.99	2.62
Rivalry State A	1.39	1.46
Political Relevance	1.29	1.31
Rivalry State B	1.24	1.26
Claim Resolved by Challenger Dropping claim	1.03	1.13
Claim Resolved by Target Dropping claim	1.03	1.06
Claim Resolved through Third Party	1.01	1.02
Claim Resolved Bilaterally	1.01	1.02
Mean VIF	7.91	7.84

HYPOTHESIS 4:

	VIF	
	1945	1989
Major Power Status State A	21.69	13.38
Nuclear Possession State A	21.07	12.49
Ln of Military expenditures State A	15.6	18.69
Ln of Military expenditures State B	14.05	16.17
Ln of Capabilities State A	12.46	15.55
Major Power Status State B	12.12	16.15
Ln of Capabilities State B	11.71	12.27
Nuclear Possession State B	11.46	16.29
State GDP proportion of World GDP state A	3.83	3.19
State GDP proportion of World GDP state B	3.01	2.52
Political Relevance	1.27	1.31
Saliance Index	1.11	1.2
Claim Resolved by Challenger Dropping claim	1.03	1.05
Claim Resolved by Target Dropping claim	1.03	1.13
Claim Resolved through Third Party	1.01	1.02
Claim Resolved Bilaterally	1.01	1.02
Mean VIF	8.34	8.34

Heteroscedasticity

The Breusch-Pagan test is used to determine whether there is heteroscedasticity in the models. The consequence of heteroscedasticity is biased deflated standard errors of the coefficients which would make it more likely to make a Type I error as results are artificially statistically significant. As the table below indicates, the test was statistically significant in every model, thus demonstrating false that there is constant variance in the error term. To correct for the heteroscedasticity of the models, the regressions used robust standard errors. While this slightly overcorrects for the problem and could possibly result in artificially insignificant results, the research is more concerned with correcting for the possibility of a Type I error in which results are artificially statistically significant and would rather be more conservative. As already explained, heteroscedasticity is not an issue when using Binomial Logistic regression.

Breusch-Pagan / Cook-Weisberg test for Heteroscedasticity		
Dependent Variable	1945	1989
Intensity Level	75.20 0.0000*	120.61 0.0000*
Fatality Level	5949.46 0.0000*	2251.59 0.0000*
Number of Peaceful Attempt	911.13 0.0000*	365.63 0.0000*

*p statistic for heteroscedasticity test.

Results

This section will discuss the results for each hypothesis individually.

Hypothesis 1: There is a relationship between nuclear possession and the level of intensity of a conflict.

		Regression Model 1			
		1945	P>t	1989	P>t
Ln of Military expenditures State A	Coefficient	0.2380003	0.000	0.2595173	0.000
	S.E	0.0256306		0.0586123	
Ln of Capabilities State A	Coefficient	-0.1728627	0.000	-0.1853962	0.000
	S.E	0.0225985		0.047808	
Major Power Status State A	Coefficient	-0.5987158	0.000	-1.499322	0.000
	S.E	0.1601527		0.4072032	
Nuclear Possession State A	Coefficient	0.3013221	0.059	0.9522042	0.019
	S.E	0.1594833		0.4039281	
Rivalry State A	Coefficient	0.1259379	0.000	0.1954807	0.000
	S.E	0.0175619		0.0356458	
Ln of Military expenditures State B	Coefficient	0.000127	0.000	0.0003562	0.001
	S.E	0.0000241		0.0001059	
Ln of Capabilities State B	Coefficient	0.0051379	0.616	0.0057304	0.767
	S.E	0.0102353		0.0193148	
Major Power Status State B	Coefficient	-0.7411341	0.000	-1.975883	0.000
	S.E	0.110968		0.5633097	
Nuclear Possession State B	Coefficient	0.3812331	0.000	1.45397	0.009
	S.E	0.1092344		0.5556431	
Rivalry State B	Coefficient	0.1761268	0.000	0.1774421	0.000
	S.E	0.0155775		0.0259243	
Political Relevance	Coefficient	0.2782569	0.000	0.2373687	0.002
	S.E	0.0399992		0.0747243	
Saliance Index	Coefficient	-0.0053821	0.499	0.0538214	0.001
	S.E	0.0079555		0.0162262	
Initiator of Conflict	Coefficient	3.156153	0.000	2.963658	0.000
	S.E	0.0487923		0.1097857	
Intercept	Coefficient	-2.160435	0.000	-2.812784	0.000
	S.E	0.2467987		0.5649602	

Based on the OLS regression results, the estimated regression equation for conflicts 1945-2001 is:

$$\hat{Y}_i = -2.160435 + 0.2380003\ln X_{1i} - 0.1728627\ln X_{2i} + 0.5987158X_{3i} + 0.3013221X_{4i} + 0.1259379X_{5i} + 0.000127\ln X_{6i} +$$

$$0.0051379\ln X_{7i} - 0.7411341X_{8i} + 0.3812331X_{9i} + 0.1761268X_{10i} + 0.2782569X_{11i} - 0.0053821X_{12i} + 3.156153X_{13i} + e_i$$

The estimated regression equation for conflicts 1989-2001 is:

$$\hat{Y}_i = -2.812784 - 0.2595173\ln X_{1i} - 0.1853962\ln X_{2i} + 1.499322X_{3i} + 0.9522042X_{4i} + 0.1954807X_{5i} + 0.0003562\ln X_{6i} + 0.0057304\ln X_{7i} - 1.975883 X_{8i} + 1.45397 X_{9i} + 0.1774421X_{10i} + 0.2373687X_{11i} + 0.0538214X_{12i} + 2.963658 X_{13i} + \varepsilon_i$$

These results of this regression model, adjusted to correct for the heteroscedasticity, are statistically significant at the 0.001 level (F-statistic= 643.92, Prob >F=0.000 in the 1945-2001 model; F-statistic=112.82, Prob>F=0.0000 in the 1989-2001 model), and the R^2 indicates that 41.96% of the variation in fatality levels can be explained by the independent variables when considering conflicts from 1945-2001 while 40.65% of the variation in fatality levels can be explained by the independent variables when considering conflicts from 1989-2001. In the 1945-2001 data, all the independent variables are statistically significant at the .05 level with the exception of national capabilities for State B, and the salience index. Nuclear possession of State A is marginally significant with a p-value of 0.059 . This could be the result of the overcorrected standard errors as a result of correcting for heteroscedasticity. In the 1989-2001 data, all the independent variables are statistically significant at the .05 level with the exception of national capabilities of State B.

Based on the marginally significant p value of 0.059 in the 1945-2001 data—which has been overly corrected for heteroscedasticity, and the statistically significant p value of 0.019 in the 1989-2001 data, I reject the null hypothesis as nuclear weapons possession corresponds to a significant change in intensity level. According to the standardized beta coefficients (Table 3), major power status of State A and major power status of State B had the greatest substantive effects on intensity level in the MID when considering conflicts from 1945-2001. This changes when MIDs are considered from 1989-2001, as, according to the standardized beta coefficients, nuclear possession of State A and State B have the greatest substantive effect on intensity level in MID.

When considering conflicts from 1945-2001, State A's possession of nuclear weapons corresponds to an increase of 0.3013221 points moving from one category to the next on a five point scale that measures the intensity of the MID, holding all other independent variables in the model constant. State B's possession of nuclear weapons corresponds to an increase of 0.3812331 points moving from one category to the next on a five point scale that measures the intensity of the MID, holding all other independent variables in the model constant.

When considering conflicts from 1989-2001, State A's possession of nuclear weapons corresponds to an increase of 0.9522042 points moving from one category to the next on a five point scale that measures the intensity of the MID, holding all other independent variables in the model constant. State B's possession of nuclear weapons corresponds to an increase of 1.45397

points moving from one category to the next on a five point scale that measures the intensity of the MID, holding all other independent variables in the model constant.

TABLE 3: STANDARDIZED COEFFICIENTS MODEL 1

Standardized Coefficients Model 1		
	1945	1989
Ln of Military expenditures State A	0.010655	-0.13937
Ln of Capabilities State A	0.0189	0.182823
Major Power Status State A	-0.61031	-1.82896
Nuclear Possession State A	0.26581	1.29195
Rivalry State A	0.171641	0.249951
Ln of Military expenditures State B	0.015896	0.090331
Ln of Capabilities State B	0.036844	-0.01742
Major Power Status State B	-0.77986	-2.2964
Nuclear Possession State B	0.337785	1.533084
Rivalry State B	0.19164	0.207154
Political Relevance	0.312994	0.405224
Saliance Index	-0.01834	0.058502
Initiator of Conflict	3.21102	2.988614

Hypothesis 2: There is a relationship between nuclear possession and the number of casualties.

		Regression Model 2			
		1945	P>t	1989	P>t
Ln of Military expenditures State A	Coefficient	0.12594190	0.000	0.1319497	0.009
	S.E	0.01986310		0.0505788	
Ln of Capabilities State A	Coefficient	-0.09278330	0.000	-0.0822297	0.011
	S.E	0.01399600		0.0321110	
Major Power Status State A	Coefficient	-0.45070390	0.000	-0.8202356	0.000
	S.E	0.12303600		0.2015509	
Nuclear Possession State A	Coefficient	0.27480760	0.030	0.6662838	0.001
	S.E	0.12652560		0.2020865	
Rivalry State A	Coefficient	0.01968130	0.027	0.0284316	0.013
	S.E	0.00892080		0.0114649	
Ln of Military expenditures State B	Coefficient	0.00001410	0.136	0.0000337	0.176
	S.E	0.00000945		0.0000249	
Ln of Capabilities State B	Coefficient	0.00229090	0.554	0.0005811	0.884
	S.E	0.00386720		0.0039787	
Major Power Status State B	Coefficient	-0.41632330	0.000	-0.6176610	0.003
	S.E	0.10225820		0.2102105	
Nuclear Possession State B	Coefficient	0.31685700	0.002	0.5529083	0.009
	S.E	0.10462270		0.2119645	
Rivalry State B	Coefficient	0.04894900	0.000	0.0401074	0.001
	S.E	0.00684130		0.0115009	
Political Relevance	Coefficient	0.12367760	0.000	-0.0027257	0.852
	S.E	0.01838860		0.0145630	
Saliance Index	Coefficient	-0.01771050	0.000	0.0231395	0.004
	S.E	0.00458600		0.0079323	
Intercept		-0.99335940		-1.2311560	
		0.15794060		0.4572913	

Based on the OLS regression results, the estimated regression equation for conflicts 1945-2001 is:

$$\hat{Y}_i = -0.99335940 + 0.12594190\ln X_{1i} - 0.09278330\ln X_{2i} - 0.45070390X_{3i} + 0.27480760X_{4i} + 0.01968130X_{5i} + 0.00001410\ln X_{6i} + 0.00229090\ln X_{7i} - 0.41632330X_{8i} + 0.31685700X_{9i} + 0.04894900X_{10i} + 0.12367760X_{11i} - 0.01771050X_{12i} + e_i$$

The estimated regression equation for conflicts 1989-2001 is:

$$\hat{Y}_i = -0.99335940 + 0.1319497\ln X_{1i} - 0.0822297\ln X_{2i} - 0.8202356X_{3i} + 0.6662838X_{4i} + 0.0284316X_{5i} + 0.0000337\ln X_{6i} + 0.0005811\ln X_{7i} - 0.6176610X_{8i} + 0.5529083X_{9i} + 0.0401074X_{10i} - 0.0027257X_{11i} + 0.0231395X_{12i} + e_i$$

These results of this regression model, adjusted to correct for the heteroscedasticity, are statistically significant at the 0.001 level (F-statistic= 8.40, Prob >F=0.000 in the 1945-2001 model; F-statistic=3.11, Prob>F=0.0002 in the 1989-2001 model), and the adjusted R^2 indicates that 6.75% of the variation in fatality levels can be explained by the independent variables when considering conflicts from 1945-2001 while 11.15% of the variation in fatality levels can be explained by the independent variables when considering conflicts from 1989-2001. All of the independent variables are statistically significant at the .05 level with the exception of national capabilities and military expenditures for State B for both sets of years. The 1989-2001 conflicts also found political relevancy not to be a significant independent variable. As nuclear weapons are statistically significant and the coefficient is not equal to zero, the null hypothesis, which predicted no relationship between nuclear weapons and fatalities, is rejected. According to the standardized beta coefficients (Table 4), major power status of State A and major power status of State B had the greatest substantive effect on number of fatalities in the conflict when considering conflicts from 1945 and from 1989.

In the case of hypothesis 2, I reject the null hypothesis. When considering conflicts from 1945-2001, State A's possession of nuclear weapons corresponds to an increase of 0.27480760 points moving from one category to the next on a five point scale that measures the number of fatalities, holding all other independent variables in the model constant. State B's possession of nuclear weapons corresponds to an increase of 0.31685700 points moving from one category to the next on a five point scale that measures the number of fatalities, holding all other independent variables in the model constant.

When considering conflicts from 1989-2001, State A's possession of nuclear weapons corresponds to an increase of 0.6662838 points moving from one category to the next on a five point scale that measures the number of fatalities, holding all other independent variables in the model constant. State B's possession of nuclear weapons corresponds to an increase of 0.5529083 points moving from one category to the next on a five point scale that measures the number of fatalities, holding all other independent variables in the model constant.

TABLE 4: STANDARDIZED COEFFICIENTS MODEL 2

Standardized Coefficients Model 2		
	1945	1989
Ln of Military expenditures State A	0.02541	0.029765
Ln of Capabilities State A	-0.01689	-0.00766
Major Power Status State A	-0.47133	-0.88381
Nuclear Possession State A	0.269554	0.663864
Rivalry State A	0.043539	0.033261
Ln of Military expenditures State B	-0.01865	-0.01957
Ln of Capabilities State B	0.030266	0.032592
Major Power Status State B	-0.43288	-0.80768
Nuclear Possession State B	0.301178	0.681868
Rivalry State B	0.058902	0.043689
Political Relevance	0.155852	0.061139
Saliance Index	-0.02494	0.019914

Hypothesis 3: There is a relationship between nuclear possession and peaceful attempts.

		Regression Model 3			
		1945	P>t	1989	P>t
Ln of Military expenditures State A	Coefficient	0.0210243	0.058	0.0111425	0.681
	S.E	0.011096		0.0271378	
Ln of Capabilities State A	Coefficient	-0.0093028	0.543	-0.0058736	0.886
	S.E	0.0152832		0.0411372	
Major Power Status State A	Coefficient	0.1290512	0.121	0.400497	0.000
	S.E	0.083134		0.1041868	
Nuclear Possession State A	Coefficient	-0.2156995	0.007	-0.4265195	0.000
	S.E	0.0805369		0.0849793	
Rivalry State A	Coefficient	-0.0243185	0.032	-0.0680271	0.033
	S.E	0.0113403		0.0318542	
Ln of Military expenditures State B	Coefficient	0.0330734	0.000	0.0329087	0.196
	S.E	0.009288		0.0254247	
Ln of Capabilities State B	Coefficient	-0.0431995	0.000	-0.0286467	0.296
	S.E	0.0105348		0.0273678	
Major Power Status State B	Coefficient	0.0680115	0.377	0.6018079	0.076
	S.E	0.0769872		0.3383082	
Nuclear Possession State B	Coefficient	0.1243121	0.104	-0.0576801	0.858
	S.E	0.0765014		0.3213762	
Rivalry State B	Coefficient	0.0145683	0.157	-0.0240304	0.413
	S.E	0.010289		0.0293306	
Political Relevance	Coefficient	0.2100967	0.000	0.3141422	0.000
	S.E	0.0239426		0.0586115	
State GDP proportion of World GDP state A	Coefficient	-0.6174727	0.001	-1.603137	0.000
	S.E	0.1831581		0.3980591	
State GDP proportion of World GDP state B	Coefficient	-1.310148	0.000	-4.395688	0.000
	S.E	0.2081934		0.6833281	
Claim Resolved by Challenger Dropping claim	Coefficient	0.1130153	0.389	0.3673902	0.108
	S.E	0.1312301		0.228671	
Claim Resolved by Target Dropping claim	Coefficient	-0.042356	0.742	-0.1427947	0.503
	S.E	0.1286343		0.2128676	
Claim Resolved through Third Party	Coefficient	0.328606	0.025	0.4025194	0.372
	S.E	0.1465865		0.4504234	
Claim Resolved Bilaterally	Coefficient	0.4573415	0.000	0.4669111	0.118
	S.E	0.1005986		0.298168	
Intercept	Coefficient	-0.9552364		-0.5915124	
	S.E	0.1895065		0.7875521	

Based on the OLS regression results, the estimated regression equation for conflicts 1945-2001 is:

$$\hat{Y}_i = -0.9552364 + 0.0210243\ln X_{1i} - 0.0093028\ln X_{2i} + 0.1290512 X_{3i} - 0.2156995 X_{4i} - 0.0243185 X_{5i} + 0.0330734\ln X_{6i} + -0.0431995\ln X_{7i} + 0.0680115 X_{8i} + 0.1243121 X_{9i} + 0.0145683 ln X_{10i} + 0.2100967 X_{11i} - 0.6174727 X_{12i} - 1.310148 X_{13i} + 0.1130153 X_{14i} - 0.042356 X_{15i} + 0.328606 X_{16i} + 0.4573415 X_{17i} + e_i$$

The estimated regression equation for conflicts 1989-2001 is:

$$\hat{Y}_i = -0.5915124 + 0.0111425\ln X_{1i} - 0.0058736\ln X_{2i} + 0.400497 X_{3i} - 0.4265195 X_{4i} - 0.0680271 X_{5i} + 0.0329087\ln X_{6i} - 0.0286467\ln X_{7i} + 0.6018079 X_{8i} - 0.0576801 X_{9i} - 0.0240304 ln X_{10i} + 0.3141422 X_{11i} - 1.603137 X_{12i} - 4.395688 X_{13i} + 0.3673902 X_{14i} - 0.1427947 X_{15i} + 0.4025194 X_{16i} + 0.4669111 X_{17i} + e_i$$

These results of this regression model, adjusted to correct for the heteroscedasticity, are statistically significant at the 0.001 level (F-statistic= 12.37, Prob >F=0.000 in the 1945-2001 model; F-statistic=9.08, Prob>F=0.0000 in the 1989-2001 model), and the R^2 indicates that 7.01% of the variation in number of peaceful attempts can be explained by the independent variables when considering conflicts from 1945-2001 while 15.24% of the variation in the number of peaceful attempts can be explained by the independent variables when considering conflicts from 1989-2001.

In the 1945-2001 data, national capabilities for State A, major power status for State A, major power Status of State B, Nuclear Possession of State B, rivalry of State B, and claim resolved by challenger dropping claim, and claim resolved through target dropping claim were all not statistically significant at the 0.05 level. The independent variable of military expenditures was marginally statistically significant at the 0.05 level. Given that the model is slightly overcorrected for heteroscedasticity, borderline proximity must be dually noted.

The independent variables of nuclear possession for State A, rivalry State A, military expenditures State B, national capabilities State B, political relevance, and State proportions of World GDP (significant for both State A and State B), and whether claim was resolved by third party, or resolved bilaterally were statistically significant. In the 1989-2001 data, military expenditures for both States A and B, national capabilities for both States A and B, Nuclear Possession of State B, rivalry of State B, and all four of the claim resolutions (challenger dropping claim, target dropping claim, third party, and bilateral) were all not statistically significant at the 0.05 level. The independent variables of major power status for State A, Nuclear Possession of State A, rivalry of State A, political relevancy, and the State proportions of World GDP (for both State A and State B) were statistically significant.

While the majority of the variables did not originally seem significant, despite the high R^2's, the previous VIF test indicated a high amount of multicollinearity in this model. The mean VIF for the 1945-2001 data was 7.91 while the mean VIF for the 1989-2001 data was 7.84 indicate an inflated standard error which can artificially decrease significance. The F test of the variables with VIFs higher than 5.0 gave statistically significant results with a p value less than .001 for both sets of data indicating that the variables are still significant.

As the nuclear possession of State A was statistically significant in both time periods but the nuclear possession of State B is not statistically significant except when viewed through the F-test of significance due to high multicollinearity and the coefficients are not equal to zero, the null hypothesis, which predicted no relationship between nuclear weapons and peace attempts, can be rejected. According to the standardized beta coefficients (Table 5), state GDP as a proportion of World GDP in both states A and B had the greatest substantive effect on the number of peaceful attempts when considering conflicts from 1945-2001 and from 1989-2001.

Thus, when considering conflicts from 1945-2001, State A's possession of nuclear weapons corresponds to an average 0.2156995 decrease in the number of peaceful attempts on a claim, holding constant all other independent variables in the model. State B's possession of nuclear weapons corresponds to an average 0.1243121 increase in the number of peaceful attempts on a claim, holding constant all other independent variables in the model.

When considering conflicts from 1989-2001, State A's possession of nuclear weapons corresponds to an average 0.4265195 decrease in the number of peaceful attempts on a claim, holding constant all other independent variables in the model. State B's possession of nuclear weapons corresponds to an average 0.0576801 decrease in the number of peaceful attempts on a claim, holding constant all other independent variables in the model.

TABLE 5: STANDARDIZED COEFFICIENTS MODEL 3

Standardized Coefficients Model 3		
	1945	1989
Political Relevance	0.210097	0.314142
Ln of Military expenditures State A	0.021024	0.011143
Ln of Capabilities State A	-0.0093	-0.00587
Nuclear Possession State A	-0.2157	-0.42652
State GDP proportion of World GDP state A	-0.61747	-1.60314
Major Power Status State A	0.129051	0.400497
Rivalry State A	-0.02432	-0.06803
Nuclear Possession State B	0.124312	-0.05768
State GDP proportion of World GDP state B	-1.31015	-4.39569
Major Power Status State B	0.068012	0.601808
Rivalry State B	0.014568	-0.02403
Ln of Military expenditures State B	0.033073	0.032909
Ln of Capabilities State B	-0.0432	-0.02865
Claim Resolved by Challenger Dropping claim	0.113015	0.36739
Claim Resolved through Third Party	0.328606	0.402519
Claim Resolved Bilaterally	0.457342	0.466911
Claim Resolved by Target Dropping claim	-0.04236	-0.14279

Hypothesis 4: There is a relationship between nuclear weapons and the probability of a defense pact.

		Regression Model 4			
		1945	P>t	1989	P>t
Ln of Military expenditures State A	Coefficient	-0.0244431	0.003	0.060461	0.001
	S.E	0.0081583		0.0181911	
Ln of Capabilities State A	Coefficient	-0.0694466	0.000	-0.1175861	0.000
	S.E	0.0106534		0.0226188	
Nuclear Possession State A	Coefficient	-0.4930885	0.000	-0.74091	0.000
	S.E	0.0667451		0.0968238	
Major Power Status State A	Coefficient	0.0457537	0.501	0.2074919	0.043
	S.E	0.0680603		0.1024372	
State GDP proportion of World GDP state A	Coefficient	5.367104	0.000	4.884606	0.000
	S.E	0.1624245		0.2991447	
Ln of Military expenditures State B	Coefficient	0.0279729	0.001	0.0053405	0.767
	S.E	0.0080635		0.0180065	
Ln of Capabilities State B	Coefficient	0.0106257	0.260	-0.0126206	0.518
	S.E	0.0094239		0.0195315	
Major Power Status State B	Coefficient	-0.1926811	0.000	0.0977205	0.449
	S.E	0.0491767		0.1289238	
Nuclear Possession State B	Coefficient	-0.4486215	0.000	-0.6601984	0.000
	S.E	0.0481226		0.1262368	
State GDP proportion of World GDP state B	Coefficient	2.419854	0.000	3.595911	0.000
	S.E	0.1411255		0.3556138	
Political Relevance	Coefficient	0.0196344	0.360	-0.1083964	0.005
	S.E	0.0214624		0.0386883	
Saliance Index	Coefficient	0.0224314	0.000	-0.0135851	0.029
	S.E	0.0029969		0.0061985	
Claim Resolved by Challenger Dropping claim	Coefficient	-0.2323444	0.001	-0.1745975	0.068
	S.E	0.0715258		0.0956518	
Claim Resolved through Third Party	Coefficient	0.0200331	0.773	0.1763593	0.194
	S.E	0.0695756		0.1356012	
Claim Resolved Bilaterally	Coefficient	0.0854199	0.109	-0.1404061	0.188
	S.E	0.0532485		0.1065336	
Claim Resolved by Target Dropping claim	Coefficient	-0.12422	0.355	-0.0114565	0.967
	S.E	0.134358		0.2746513	
Intercept	Coefficient	0.0674846	0.618	-0.870897	0.075
	S.E	0.1351983		0.4878569	

Based on the OLS regression results, the estimated regression equation for conflicts 1945-2001 is:

$$\hat{Y}_i = 0.0674846 - 0.0244431 \ln X_{1i} - 0.0694466 \ln X_{2i} - 0.4930885 X_{3i} + 0.0457537 X_{4i} + 5.367104 X_{5i} + 0.0279729 \ln X_{6i} + 0.0106257 \ln X_{7i} - 0.1926811 X_{8i} - 0.4486215 X_{9i} + 2.419854 X_{10i} + 0.0196 34 X_{11i} + 0.0224314 X_{12i} - 0.2323444 X_{13i} + 0.0200331 X_{14i} + 0.0854199 X_{15i} - 0.12422 X_{16i} + e_i$$

The estimated regression equation for conflicts 1989-2001 is:

$$\hat{Y}_i = -0.870897 + 0.060461 \ln X_{1i} - 0.1175861 \ln X_{2i} - 0.74091 X_{3i} + 0.2074919 X_{4i} + 4.884606 X_{5i} + 0.0053405 \ln X_{6i} - 0.0126206 \ln X_{7i} + 0.0977205 X_{8i} - 0.6601984 X_{9i} + 3.595911 X_{10i} - 0.1083964 X_{11i} - 0.0135851 X_{12i} - 0.1745975 X_{13i} + 0.1763593 X_{14i} - 0.1404061 X_{15i} - 0.0114565 X_{16i} + e_i$$

These results of this regression model are statistically significant at the 0.001 level (LR chi2(16)= 1531.56, Prob>chi2=0.0000 in the 1945-2001 model; LR chi2(16)=443.46, Prob>chi2=0.0000 in the 1989-2001 model), and the R^2 indicates that 30.17% of the variation in success or failure in making a defense pact can be explained by the independent variables when considering conflicts from 1945-2001 while 37.13% of the variation in success or failure in making a defense pact can be explained by the independent variables when considering conflicts from 1989-2001.

As the nuclear possession of State A and State B were statistically significant in both time periods and the coefficients are not equal to zero, the null hypothesis, which predicted no relationship between nuclear weapons and a defense pact, can be rejected. According to the changes in probability (Table 6) using binomial logistic regression using the 1945-2001 data, State A's possession of nuclear weapons corresponds to an average 63.04% decrease in the probability of having a defense pact, holding all other independent variables at their means. State B's possession of nuclear weapons corresponds to an average 45.69% decrease in the probability of having a defense pact, holding all other independent variables at their means.

The changes in probability using binomial logistic regression using the 1989-2001 data are greatly increased: State A's possession of nuclear weapons corresponds to an average 99.89% decrease in the probability of having a defense pact, holding all other independent variables at their means. State B's possession of nuclear weapons corresponds to an average 99.83% decrease in the probability of having a defense pact, holding all other independent variables at their means.

TABLE 6: PREDICTED PROBABILITIES MODEL 4

	Predicted Probabilities Model 4									
	1945					1989				
	min->max	0->1	-0.5	--+sd/2	MargEfct	min->max	0->1	-0.5	-+sd/2	MargEfct
Claim Resolved by Challenger Dropping claim	-0.3239	-0.3239	-0.2798	-0.026	-0.2855	-0.3577	-0.3577	-0.3105	-0.0447	-0.3186
Claim Resolved through Third Party	0.0106	0.0106	0.0107	0.001	0.0107	0.2096	0.2096	0.2909	0.028	0.2976
Claim Resolved Bilaterally	0.1075	0.1075	0.1218	0.0148	0.1223	-0.2017	-0.2017	-0.1793	-0.0216	-0.1808
Claim Resolved by Target Dropping claim	-0.3222	-0.3222	-0.2782	-0.0138	-0.2839	0.3104	0.3104	0.9718	0.0909	1.9297
Ln of Military expenditures State A	-0.5912	-0.0654	-0.073	-0.1546	-0.0731	-0.8269	-0.0255	-0.1534	-0.3303	-0.1544
Ln of Capabilities State A	-0.529	-0.0046	-0.0466	-0.1442	-0.0466	0.7993	0.0067	0.0683	0.2033	0.0684
Ln of Military expenditures State B	0.5075	0.0261	0.0371	0.1104	0.0371	0.0057	0.0005	0.0005	0.0015	0.0005
Ln of Capabilities State B	0.2193	0.0155	0.0206	0.048	0.0206	-0.0109	-0.0012	-0.0012	-0.0027	-0.0012
Major Power Status State A	0.089	0.089	0.093	0.0409	0.0932	0.9778	0.9778	0.9992	0.9332	3.4387
Major Power Status State B	-0.2879	-0.2879	-0.2651	-0.1223	-0.27	0.9783	0.9783	1	0.977	5.1241
Political Relevance	-0.014	-0.014	-0.0141	-0.0047	-0.0141	-0.0908	-0.0908	-0.0967	-0.0362	-0.0969
Saliance Index	0.3563	0.0354	0.0299	0.0673	0.0299	-0.1977	-0.0148	-0.0198	-0.0442	-0.0198
Nuclear Possession State A	-0.6304	-0.6304	-0.5689	-0.2722	-0.6287	-0.9989	-0.9989	-0.9998	-0.9703	-4.1363
Nuclear Possession State B	-0.4569	-0.4569	-0.4118	-0.1931	-0.4316	-0.9983	-0.9983	-1	-0.9886	-5.7438
State GDP proportion of World GDP state A	0.7275	0.7277	1	0.5838	8.3905	0.8349	0.8351	1	0.7427	12.1243
State GDP proportion of World GDP state B	0.3872	0.4128	0.9889	0.1817	2.32	0.3874	0.4047	0.9995	0.2025	3.6313

Conclusions

The results of this analysis show that nuclear weapons have a significant effect on conflict and resolution, despite their non use. Their very presence affects the intensity of a conflict, fatalities of a conflict, number of peaceful attempts, and the possibility of a resolution and a defense pact. This implies that policies targeting nuclear nonproliferation, conflict resolution, and going into conflict should be considered very careful for the US. The US, is both a major power and a nuclear possessor state. Thus, although the aims and objectives in the international system may be otherwise, according to the results, should the US engage, based on its possession of a nuclear arsenal alone, fatalities would increase, intensity level would increase, there would be less opportunities of peaceful attempts, and there would be a decreased probability of a defense pact. Furthermore, the research argues that the US nuclear arsenal is a fungible tool of state power—even if bringing undesired results. Every policy decision must be made knowing that whether they are mentioned or not, the other country is considering its position in relation to the fact that the US holds nuclear weapons.

Future research should be done before any substantial policy decisions are made. Another element that should be further explored is the impact and effect of the Cold War factor on results. In some of the models, changing the time period from which the sample was viewed doubled the amount of variation explained. While this research focused solely on the effects of nuclear weapons, future research should consider nuclear status and major power status. At the same time, nuclear weapons and major power status are theoretically interconnected causing methodological issues such as multicolinearity. A state's possession of nuclear weapons, especially as this research supports Art's fungibility of force theory, would add to their consideration as a major power. This undefined causality though beckons for more research when, during this research, opposing results were produced. For example, as Major power status increased, fatalities and intensity of conflict decreased. This was directly opposite to the effect of nuclear weapons. A more complex model may be needed to capture this relationship between major power status and nuclear weapon status. Furthermore, while the subject area can benefit from quantitative analysis, it must be done in conjunction with qualitative research due to the very nature, unpredictability, and politics of conflict.

Appendix A

Saliance Index

Territorial claims:
• Resources: +2 points if present
• Strategic location: +2 points if present
• Populated: +2 points if present
• Homeland: +1 point for each state where relevant
• Identity basis: +1 point for each state where relevant
• Historical sovereignty: +1 point for each state where relevant

River claims:
• Homeland: +1 point for each state where relevant
• Navigation: +1/2 point for each state with local use, +1 for national/international
• Populated area served by river: +1/2 point for each state with towns/villages, +1 for major cities
• Resources: +1/2 point for each state with local use, +1 for national/international
6
• Hydroelectric power generation: +1/2 point for each state with local use, +1 for national/international
• Irrigation: +1/2 point for each state with local use, +1 for national/international

Maritime claims:
• Homeland: +1 point for each state where relevant
• Strategic location: +2 points if present
• Fishing: +2 points if present
• Migratory fish stocks: +2 points if present
• Resources (besides fish and oil): +2 points if present
• Oil: +2 points if present

Code description taken Codebook of Claim-Level Summary Data (Correlates of War).

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