UNIVERSITY OF CALIFORNIA, SAN DIEGO

Deproliferation Dynamics: Why States Give Up Nuclear Weapons Programs

A dissertation submitted in partial satisfaction of the
requirements for the degree Doctor of Philosophy

in

Political Science

by

Rupal Naresh Mehta

Committee in charge:

Professor David A. Lake, Co-Chair
Professor Erik A. Gartzke, Co-Chair
Professor Matthew Kroenig
Professor Susan L. Shirk
Professor Branislav L. Slantchev

2014

The Dissertation of Rupal Naresh Mehta is approved, and it is acceptable in quality and form for publication on microfilm and electronically:

_____

_____

_____

_____
Co-Chair

_____
Co-Chair

University of California, San Diego

2014

DEDICATION

To my parents, Vasanti and Naresh Mehta, and my sister, Sonal Mehta, for their unwavering and unconditional support, love, and encouragement.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

Every incoming graduate student is told the years in a graduate program are long, tiring, and lonesome. These words are only partly true – surprisingly, I've been relieved and excited to discover these past six years have been overwhelmingly filled with encouragement, collegiality, friendship, and love.

I will be forever grateful to my advisors for their continued support and guidance. It is certain that none of this could have been accomplished without David Lake, who, in addition to being a renowned scholar, researcher, and teacher is by far the best mentor I've ever had the privilege of knowing and will likely spend my life trying, in vain, to emulate. I thank him for setting the best example of an academic I know. I am also particularly grateful to Erik Gartzke for being much more confident in my abilities, research and otherwise, than me. Every opportunity that I have been lucky to get has been because of Erik's unwavering, and potentially misplaced, faith in me. Branislav Slantchev deserves a special thanks for his unbelievable commitment to me during the most stressful times of graduate school: I can scarcely count the number of hours he has spent with me discussing every aspect of my dissertation, research agenda, and future career plans. Matthew Kroenig has had the unique position of knowing me from my undergraduate days at UC Berkeley through to my start as an Assistant Professor and consistently provides well-reasoned, thoughtful, and unlimited support and feedback. Lastly, Susan Shirk fostered my professional and personal advancement throughout my time in graduate school. She sets an incredibly high standard for professionalism while simultaneously encouraging much deeper, more personal ties with her students. I am also

particularly grateful to Susan and her husband, Samuel Popkin, for continually going above and beyond to grant me unbelievable opportunities that I will forever cherish.

I have been especially fortunate to be surrounded by amazing friends from throughout various phases in my life who have provided love and encouragement often especially when I have been too busy to reciprocate. Thank you for forgiving me when I've canceled plans to write chapters or analyze data and for continuing to ask me to spend with you – always reminding me that those relationships are so much more meaningful and nourishing than that with my computer. Ashley Richter (who after knowing me for 15 years became one of my closest confidants when she moved to San Diego and always opens her home to me whenever I need a break), Anjali Mohlajee, Christina Reginaldo, Claire McConnell, and Sjuli Senn – I cannot thank you enough for demonstrating to me what long-lasting friendship truly means. I am equally lucky to have met my closest friends from college in my first few weeks there and in their own ways as doctors, lawyers, and business people have motivated my own hard work while promising unconditional friendship and love if I were to fail. Thank you Donya Ahourai Ladunga, Luhua Zhang, Naushin Hussain, Parisa Azizad-Pinto, Saied Pinto, and Sheena Reddy for believing in me and always being so excited for me – I am honored to know all of you.

Similarly, I have been lucky to be surrounded by some of the smartest, hardest-working, and interesting people throughout graduate school. Lindsay Nielson, Mona Vakilifathi, and Inbok Rhee helped form a motley crew of incredibly generous, thoughtful, and fun officemates that made 'coming into the office' an exciting and productive experience. Lindsay and I were fortunate to enter graduate school with 13

male colleagues that oscillated between protective older brothers and close friends and colleagues – thank you Jonathan Markowitz, Robert Bond, Chris Fariss, Paul Schuler, Kai Ostwald, Neil Visalvanich, Dimitar Gueorguiev, Jeremy Horowitz and others for fostering friendships that will surely last our lifetimes. I am also eternally grateful to older student mentors that illuminated a variety of paths to success and were always there to walk me through new challenges. Daniel Enemark, Cesi Cruz, Benjamin Tang, Devesh Tiwari, Benjamin Graham, Jaime Settle, Neil Narang, and Brad Leveck provide a high standard for personal and professional achievement.

While in graduate school at UCSD, I was incredibly fortunate to find such incredibly close friends both in and outside the department that provided me with unlimited amounts of love, support, and perspective. Karen Boyd, Brigitte Zimmerman, Lacey Micheals, Maya Duru, Perry Kirkland, Kelly Matush, Sasha Maliniak, Megan Becker, Kerri Seger fill my life with laughter, happiness, warmth, and joy and always made my home and theirs a wonderful place to be. It is also impossible that I could have written this dissertation without a consistent writing partner and colleague that perhaps surprisingly turned out to be my closest and most cherished friend in San Diego. Special thanks to Steven Oliver for being somewhat excited about all-day writing marathons, unconditionally supporting me both professionally and personally whenever I needed it, and for consistently demonstrating the true depth of our friendship.

Most importantly, I am eternally grateful for my family. Every child says that their parents are the best parents in the world and their sibling is the best sibling in the world but I can say, unequivocally, that this is absolutely true in my case. My sister, Sonal Mehta, is quite simply my best friend. She has always been and will remain my

closest friend and confidant that will move mountains for me, if I were to ask. Since we were children, she has consistently provided the greatest example for my life – in addition to being an incredibly successful lawyer at the age of 21 and instilling in me the true meaning of hard work and perseverance, she reminds me that the most important relationships in life are those with family. Despite her unbelievably busy life, she has never missed the big or small moments in my life – that has meant more to me then I can scarcely say. My parents, Naresh and Vasanti Mehta, have set a phenomenally high standard for me my entire life. In addition to teaching me fundamental basics and challenging me to work harder every day, they provide the greatest model for unconditional love and support. I truly admire their ability to handle the obstacles life has thrown their way with the utmost grace, confidence, and faith that it will always work out. My father's logical and compassionate approach to problems, and his favorite saying of "prepare for the worst but hope for the best," has been a consistently comforting mantra throughout graduate school and my mother's deeply affectionate words of unwavering love and support singularly provide me the strength I need in the future. I am so deeply honored to be your child and I will endeavor to continue to earn your pride and respect for the rest of my life. My accomplishments and future successes are due entirely to my family.

.

VITA

Academic Positions

University of Nebraska, Lincoln
Assistant Professor, Department of Political Science 2014 -

Belfer Center for Science and International Affairs, Harvard Kennedy School
Stanton Nuclear Security Postdoctoral Fellow 2014 -

Education

University of California, San Diego
Ph.D. in Political Science 2014
Advanced to Candidacy: 2011

M.A. in Political Science May 2010
Primary Field, Concentration: International Relations, International Security
Second Field: Comparative Politics

University of California at Berkeley May 2006
B.A. in Political Science

Publications

- "The Determinants of Nuclear Force Structure" with Erik Gartzke and Jeffrey Kaplow. *Journal of Conflict Resolution,* April 2014.

ABSTRACT OF THE DISSERTATION

Deproliferation Dynamics: Why States Give Up Nuclear Weapons Programs

by

Rupal Naresh Mehta

Doctor of Philosophy in Political Science

University of California, San Diego, 2014

Professor David A. Lake, Co-Chair
Professor Erik A. Gartzke, Co-Chair

My dissertation focuses on the conditions under which states that have embarked on nuclear weapons programs choose to stop their exploration. Since 1945, nearly three times as many states have stopped nuclear weapons activity after an initial pursuit than have maintained their weapons programs. Adapting models from the crisis bargaining literature, this project formalizes the bargaining dynamic between prospective proliferators and the international community. States with lower values for acquiring nuclear weapons are more likely to accept rewards as are those states with higher values

for nuclear weapons who believe the use of force is more likely against their program. Threats to use force or sanction states are more likely to be made against states with a higher value for acquiring weapons and, thus, are likely to be unsuccessful in persuading them against the pursuit of nuclear weapons. Using a new dataset on all nuclear weapons activity from 1945-2007, this dissertation tests these hypotheses regarding the proposed determinants of nuclear deproliferation using a spectrum of positive and negative inducements. This analysis suggests that political and military rewards are associated with an increase in the probability of nuclear reversal while, contrary to conventional wisdom, the use of economic sanctions and military force may reduce the likelihood that a state will deproliferate. This suggests a re-evaluation of traditional nonproliferation policy and a closer examination of tools that the international community can use to alter proliferation behavior.

CHAPTER 1: THE PUZZLE OF NUCLEAR REVERSAL

Introduction

Since the inception of nuclear weapons, more states have opted to give up their nuclear pursuit or relinquish existing weapons than have maintained their arsenals. In fact, roughly three times as many countries have reversed the status of their nuclear weapons programs (twenty-six) than stand today as nuclear weapons states or those seeking nuclear weapons (eight de jure and de facto nuclear weapons states and the two current proliferators, North Korea and Iran). This surprising, and seemingly counterintuitive, statistic begs the question: given the advantages nuclear weapons provide the states that possess them, why did these twenty-six countries with varying potential of ultimate success choose to reverse or dismantle their nuclear weapons programs?

These questions no doubt play a significant role in contemporary US foreign policy debates about how the United States, and the international community more broadly, should deal with Iran, North Korea, and future proliferators. As the nuclear club threatens to expand, especially with the introduction of actors that engage in increasingly bellicose behavior, questions remain regarding the most effective ways of curbing nuclear proliferation and ensuring international stability. In recent decades, in the United States for example, nonproliferation policy has oscillated between calls for preemptive action against 'rogue proliferators' (following in footsteps of the Israeli destruction of the Osirak facilities in Iraq in 1981and of the Al Kibar nuclear reactor in Syria in 2007), and

demand for continued diplomacy (mirroring US reaction to other instances of proliferation).

Indeed, the question of nuclear reversal lies at the crux of an expansive literature on nuclear weapons proliferation that helps inform important policy decisions toward current and future proliferators. Thus far, however, the majority of this scholarship has focused on asking two related questions: why do states pursue nuclear weapons and what is their effect on the international system?[1] This literature has been largely successful in understanding and identifying, both theoretically and empirically, the primary motivations behind nuclear weapons exploration and acquisition, namely threats in the security environment, technological capabilities, and domestic-level organizational factors. This scholarship has also made significant strides in analyzing the substantial impact that nuclear weapons have had on various other issue areas—regime change/transitions to or from democracy, inter-state conflict, economic growth, and civil strife—, suggesting that nuclear weapons have differential effects for their holders in conventional versus nuclear crises or broader bargaining interactions.

The prevailing wisdom, in both the academic and policy communities, is that states are more likely to give up nuclear weapons as a result of changes in domestic political factors, i.e. a resolution of a threat to national security, change in regime leader or type, or institutional changes in the domestic political structure (Sagan 1996/1997;

---

1 See Brodie (1946, 1959); Kissinger (1957); Schelling (1960, 1966); Waltz (1995); Bueno de Mesquita and Riker (1982); Jervis (1989); Mearsheimer (1990, 1993); Feaver (1993); Sagan (1993, 1995, 1996/97); Thayer (1994); Jo and Gartzke (2007, 2009); Betts (1977); Russett (1989); Huth & Russett (1993); Organski & Kugler (1980), Kugler (1984); Solingen (1994, 1998); Singh and Way (2004); *Journal of Conflict Resolution* Special Issue (2009).

Hymans 2006; Levite 2002; Reiss 1995; Solingen 2007). But is this the case for all of the states that have voluntarily reversed their nuclear ambitions? There is some evidence to suggest that changes at the domestic political level can contribute to reversal decisions.[2] Indeed, a fairly common explanation for cases such as Japan, South Africa, Brazil, and Argentina, among others, is that leaders or governments seeking to maintain their own political survival (through integration into the international community or satisfying domestic constituencies) sought to denuclearize (Solingen 2004, 2012). Is this actually a sufficient explanation for these and the other remaining cases of nuclear reversal?

In this dissertation, I contend that a key piece of the puzzle has thus far been absent from discussions about the decision to deproliferate, the role of the international community in influencing the process. Indeed, the key question here is: if the international community can exert pressure on proliferators to abandon their nuclear programs, which set of policy levers is more likely to work? While there is consensus among policymakers and scholars regarding the necessity for diplomacy and negotiation with proliferators, there is little agreement about the best forms of statecraft for the task. For example, it is clear that proliferators bargain with other powerful states in the system, namely the permanent-five members of the UN Security Council (and the only de jure nuclear weapons states) before choosing to stop their nuclear weapons program or relinquish an existing arsenal. Advocates of sanctions in the policy community, however, argue that inducements may actually encourage future transgressions and the diffusion of proliferation attempts in the international community, while those who favor inducements

[2] Hymans 2006; Levite 2002; Solingen 2007; Müller and Schmidt 2008; Reiss 1995; Walsh 2000; Reardon 2010; Rublee 2009.

fear that the use of force against states that are already concerned about security threats, will be even more resolved to pursue nuclear weapons. These multiple plausible stories beg for a closer theoretical and empirical examination to assess the types of factors that help to explain states' decisions to willingly deproliferate after years, or often decades, of significant economic and political costs.

In this dissertation, I take a step toward addressing this gap by conducting a novel systems-level analysis that incorporates the use of both rewards and punishments and includes a missing dynamic in the interaction – that between the proliferator and the international community. I argue that proliferating states are more likely to abandon their nuclear weapons programs if offered political or military rewards from the international community, while the imposition of sanctions or the use of military force may actually work to discourage some states from deproliferating. While rewards are likely to persuade weakly-motivated nuclear proliferators to stop their weapons pursuit, they are also likely to persuade more committed proliferators to abandon their nuclear weapons programs, if there exists a credible military threat.

In this study, I identify the conditions under which states can be induced or coerced to give up their programs and help determine which type of instrument is more effective in encouraging nuclear reversal. Neither carrots nor sticks work all the time, and thus existing studies in both political science and economics find mixed evidence of their effectiveness. Though it is important to consider the potential selection bias in these cases - the international community may levy sanctions and threats of attack at the most intransigent and belligerent of proliferators while it may prefer to reward dovish states or allies - by properly specifying how the international community can act to encourage

states to stop their weapons programs, I provide the first evidence of this kind that rewards, on average, are positively associated with encouraging deproliferation while sanctions may inadvertently prolong nuclear proliferation. An overarching finding from this model reveals an important and counter-intuitive finding: under certain conditions, the offer of rewards has a secondary, coercive purpose that it can effectively induce proliferators, even the most committed and persistent of states, to give up their weapons program rather than incur the costs of coercion by the international community. Ostensibly, rewards incentivize friends to reverse their nuclear weapons but they can also help reveal enemies. By revealing information about the preferences of a proliferator, the international community is better able to structure its negotiations on deproliferation.

In addition to providing a new theory of nuclear reversal that both differentiates between rewards and punishments and also yields an important implication about the overall efficacy of rewards, I employ an empirical strategy that combines large-n quantitative analysis on the determinants of deproliferation, a medium-n cross-case comparison of the role of inducements, and intensive case studies in a set of state comparisons to test these implications. I compile data on the thirty-six known instances of nuclear weapons activity from 1945 to 2007. Analysis of the data yields important initial findings. Specific positive inducements, like military assistance, economic aid, or security guarantees are more likely to be associated with states deproliferating. On the other hand, economic sanctions have a negative effect on the likelihood that a state decides to stop its nuclear program and become a non-nuclear state; interestingly, economic sanctions may actually contribute to the extension of some nuclear weapons programs. Based on archival research of primary documents from the National Security

Archives, I also conduct two detailed case study analyses of the Egyptian (1955-1980) and Indian (1964-) proliferation processes to further evaluate the findings and assess the causal mechanisms. Taken together, the empirical analyses and case studies move beyond the dominant view that domestic-level explanations primarily account for deproliferation decisions, and instead propose that successful instances of nuclear reversal may be due to application of pressure from the United States (and other key members of the international community).

I seek to expand our understanding of deproliferation in three ways. First, by using new, systematic time-series data on the universe of deproliferation cases, I answer generalizable, macro-level questions that were previously unanswered with a collection of case studies. To understand the pattern of nuclear reversal over time, examination of qualitative and quantitative data is imperative. Second, I adapt crisis bargaining models to develop a new logic of nuclear reversal that reveals the strategic interaction between proliferators and the international community, and the types of carrots and sticks that can be offered, and imposed, to persuade states to give up their weapons programs. The theory's main innovation is that it includes the international system (depicted as Player 1) in a strategic bargaining dynamic with the proliferator (Player 2). While previous scholarship has either emphasized the role of structural realist conditions (such as the alleviation of security threats) or focused on factors at the domestic level, I generate a formal model that illustrates the iterated bargaining sequence between the international system and the states in pursuit of nuclear weapons and highlights how the international community may be able to pull certain policy levers to encourage reversal.

Lastly, the formal theory, empirical analyses, and in-depth case studies lay the groundwork for establishing a set of policy recommendations for nuclear decision-makers in the face of current and future proliferators. My findings indicate that there may be a particular combination of positive inducements that can efficiently encourage deproliferation that is dependent of the international community's ability to levy a credible threat of the use of force against the proliferator. Contrary to existing US nonproliferation policy, sanctions and the use of military force may actually delay or, in some cases, prevent nuclear reversal among current or future proliferators. While none of this research is incompatible with the existing research on nuclear deproliferation, it sheds light on another dimension of bargaining that contributes to understanding the puzzle of why states give up nuclear weapons programs.

Research Design

In this dissertation, I address the patterns of nuclear reversal over time, focusing on the specific forms of positive—and the sporadic threat of imposition of some forms of negative—inducements from the international community that can help incentivize states to permanently stop pursuit of nuclear weapons and/or dismantle an existing arsenal. In the first part of this chapter, I briefly introduce and define key concepts. I begin by describing how states are selected into the sample through nuclear weapons activity and outline the process of reversal, expanding on the means by which states can actively give up their nuclear weapons programs. I then define and limit the construct of inducements, and include the set of initial theoretical predictions for how inducements may be implemented in these strategic interactions. Finally, I briefly review the literature that

forms the basis of this dissertation, i.e., the extant scholarship on the causes and consequences of nuclear proliferation.

In the second part of this chapter, I provide an extensive review of the relevant literature on deproliferation. I begin by outlining the consequences of nuclear proliferation in order to understand the motivations behind nuclear reversal. The extant literature on the phenomenon of nuclear deproliferation (referred to with various names) has tended to focus on leader-, domestic-, and regional-level dynamics (Solingen 1994, 2007; Hymans 2001, 2006; Muller and Schmidt 2009; Rublee 2009; Kiernan 2010; Walsh 2000). This scholarship has provided numerous theoretical contributions to our understanding of nuclear reversal by looking at the evidence of a given state's decision to dismantle its weapons program, while providing a thorough examination of specific, paradigmatic cases, such as South Africa, Argentina, and the former Yugoslavia (Solingen 1994, 2007; Hymans 2001, 2006; de Villers et.al. 1993; Potter et.al. 2000).

The third part of the chapter examines the implementation of positive and negative inducements as a critical component in other types of bargaining interactions.[3] There is broad foundation in political science for studying the use of rewards and sanctions in attempting to modify political or social behavior (Schelling 1966; Pape 1996; Art and Cronin 2003; Hirschman 1945; Keohane and Nye 1977; Baldwin 1995; Reardon 2008). In particular, I delve into the nonproliferation literature that evaluates the use of negative inducements, especially the threat or actual implementation of sanctions to prevent countries from starting a nuclear weapons program. I begin by describing the common arguments made about the role of positive and negative inducements in other

[3] I further develop the theory of inducements in Chapter 2.

bargaining frameworks and more specifically, in previous instances of military or security affairs, while providing a summary of the common critiques made about the limitations of positive 'carrots.' I argue that strictly enforced positive inducements may be more useful in guaranteeing long-term deproliferation, especially in comparison to the use of preemptive military action as a form of negative inducement. Finally, in the fourth part of the chapter, I provide an overview of the dissertation and provide brief introductions to each of the following chapters of the dissertation.

Defining Deproliferation

Over the past 60 years (essentially since the earliest nuclear weapons acquisition), deproliferation has taken on a myriad of forms. Norway, for example, is not widely remembered as one of the world's foremost nuclear entrepreneurs but it was one of the first states to acquire a nuclear reactor (Forland 1997). After years of experimental research at the start of the first wave of global nuclear proliferation in the 1950s, that included the difficult-to-attain capability to manufacture the fissile material necessary for a bomb (the separation of plutonium), Norway ultimately opted to end its nuclear weapons program in the late 1960s. Contrastingly, a state like South Africa quietly pursued nuclear proliferation in the 1980s, even successfully completing production of six operational weapons and acquiring suitable delivery vehicles, before ultimately agreeing to dismantle its weapons in adherence with IAEA regulations.

Before explaining why states that begin nuclear weapons programs choose to renounce their nuclear ambitions, it is important to first understand the proliferation process. Unfortunately, the definition of nuclear weapons programs has been subject to

wide variation in interpretation, but has resulted in two key points in the nuclear weapons development process: the opportunity/capability point and the willingness/decision point.[4] The difficulty arises when using one point or the other as the defining characteristic of starting a nuclear weapons program. By placing either intent or capability as senior to the other, one can introduce biases that result in over- or under-estimation of nuclear weapons programs. To mitigate this potential bias, I model the current standard in the literature and incorporate both simultaneously as necessary conditions. Thus, I define a nuclear weapons program as a motivated effort to acquire a nuclear explosive device and access to the necessary technical capabilities for building such as device.

Not surprisingly, the question of what constitutes nuclear reversal is similarly complex. To mirror initial proliferation decisions, a definition of deproliferation must also incorporate elements of action (e.g., dismantlement of existing facilities) and intention (i.e., adherence and compliance with the international nonproliferation regime). Similarly, nuclear reversal must be distinguished from a nuclear freeze, ambiguity in nuclear posture, or hedging.[5] For the purposes of congruence with other analyses in the field, I then adopt a definition suggested by Ariel Levite, ("the phenomenon in which states embark on a path leading to nuclear weapons acquisition but subsequently reverse course, though not necessarily abandoning altogether their nuclear ambitions…. including a governmental decision to slow or stop altogether an officially sanctioned nuclear weapons program") as a basis for selection into my population of interest (Levite

[4] Meyer 1984, Singh and Way 2004, Hymans 2006, Jo and Gartzke 2007, Montgomery and Sagan 2009
[5] Abraham; Levite 2002

2002; Mueller and Schmidt 2008). This definition allows for the option that despite intentions of the international community and proliferator, and the institutional mechanisms in place to ensure deproliferation, a proliferator may at some point in the future restart its program. I allow for this flexibility because it is most reflective of reality. As interstate relations evolve over time, states (such as Japan or South Korea) that seem unlikely to want to pursue nuclear weapons may opt to do so even after receiving incentives from the international community to discourage regional proliferation behavior.

This definition also provides a crucial theoretical and empirical condition (and ultimately, an assumption of the formal and econometric models): a state is required to have begun active pursuit of a nuclear weapon, and subsequently abandoned or discontinued its proliferation activity, to be considered in this study. Past scholarship has often differentiated between different phases in the nuclear process: exploration activities, intended pursuit of the bomb, and the final assembly and acquisition of the nuclear device (Singh and Way 2004; Bleek 2010; Muller and Schmidt 2010). This has, however, led to discrepancies in how states are coded both in regard to their nuclear activity and underlying preference for nuclear acquisition. For example, Singh and Way exclude West Germany from their analysis, while others argue that West Germany explored the bomb option but took only limited actions toward acquisition as a result of US-imposed restrictions on the possession of nuclear arms, not a weaker preference for a nuclear deterrent. Similarly, Singh and Way classify South Korea's shift from nuclear 'exploration' to renunciation as a diminished preference for nuclear weapons, while other evidence suggests that South Korea's change in policy, from 'pursuit' to reversal, was

instead the result of US pressure to renounce nuclear weapons.

To attempt to resolve these discrepancies, I aggregate these characteristics of nuclear ambitions into a broader construct that incorporates all three parts of the process—exploration, pursuit and acquisition—to establish the universe of cases for my analysis (Bleek 2010; Muller and Schmidt 2010). To be classified as engaging in nuclear weapons activity, there must be evidence of some form of technological behavior (such as indigenous production or receipt of nuclear technology or materials) and political behavior (discussions regarding a decision to pursue nuclear weapons program). To that end, I define deproliferation as the observation and process of reversing a state's decision to pursue nuclear weapons activity and a commitment to refrain from continued development, construction, or possession of nuclear weapons. Reversal can then take on one of the following forms: permanent abandonment of active nuclear development, returning full weapons systems to another state or non-governmental organization, or the voluntary dismantlement of an operational nuclear arsenal.

By incorporating all of the states that have ever pursued nuclear activity since 1945 in the scope of my analysis, I start to see a rather different image emerge. The expansion of this definition permits the examination of a much larger number of cases, resulting ultimately in much greater theoretical and empirical leverage for analysis. Figure 1 in Appendix 1 depicts the process of nuclear weapons activity over time.

This figure has several take-aways. First, deproliferation is not as rare as is often presumed in the literature, and in fact, reflects the behavior of the strong majority of states who have undertaken some form of nuclear weapons activity. The graph also reveals interesting variations over time. For example, a significant percentage of reversal

occurred around the same time. The introduction of new states with nuclear weapons activities stagnated in the mid-1970s, and ended essentially in the 1990s when the only new proliferators, Belarus, Kazakhstan, and Ukraine, had inherited their programs after the fall of the Soviet Union. On the other hand, deproliferation continues to grow in the late 1960s, stagnating and then ultimately skyrocketing after the mid-1980s. This variation lends itself to thorough theoretical and empirical investigation to help answer key questions about the evolution of nuclear reversal in the international system.

Cause of Nuclear Proliferation and Reversal

The majority of scholarship on nuclear weapons proliferation has centered on two major questions: how do nuclear weapons affect the structure of the international system and why do states pursue nuclear proliferation? (Thayer 1995; Waltz 1995; Sagan 1996/1997; Betts 1993; Campbell, Einhorn and Reiss 2004) These studies focus almost entirely on the initial decision to proliferate and the aftermath of these state decisions. Early theoretical literature and more recent empirical literature examines how nuclear weapons could be used, and how they affect the balance of power among nuclear states and between nuclear and non-nuclear states (Betts 1977; Russett 1989; Huth & Russett 1993; Organski & Kugler 1980, Kugler 1984; Jo and Gartzke 2007; Special Issue(s), *Journal of Conflict Resolution 2009, 2013*).

The second strand of scholarship on nuclear weapons, and in part, the foundation of this study, seeks to examine why states proliferate and the variance in proliferation, and to forecast which states are the most likely new proliferators (Sagan 1996/1997; Solingen 1994, 1998, Jo and Gartzke 2007; Singh and Way 2004). These scholars argue

that states pursue nuclear weapons for various reasons including the acquisition of power to increase internal security, organizational or bureaucratic interests, or enhanced prestige in the international community (Sagan 1996/1997).

Recent empirical studies have attempted to distill some of these initial theoretical findings by identifying the primary determinants of nuclear proliferation (in terms of both demand-side capability to build viable weapons and supply-side assistance from other nuclear states), isolating the mechanisms linking proliferation and conflict onset, and analyzing the effect of nuclear weapons on dispute initiation and/or bargaining outcomes and interstate relations more broadly (*Journal of Conflict Resolution,* Special Issue 2009).[6]

While the current state of the literature on proliferation has thus far been able to account for many cases, it has had limited predictive power for some key aberrations found in the empirical record. First, the majority of studies of nuclear reversal or dismantlement are detailed single-state or regional case studies emphasizing the role of state-specific domestic politics that provide idiosyncratic analyses for why some countries opt to dismantle their nuclear weapons programs (Hymans 2006; Levite 2002; Reiss 1995; Solingen 2007; Braut-Hegghammer 2011; Mitchell 2004; Potter et.al. 2000). This research has provided important analyses of these states and produced significant theoretical implications for further analysis of deproliferation. For example, common explanations for South Africa's renunciation of nuclear weapons center on its unwillingness to transfer control of the nuclear arsenal to the African National Congress

[6] Bleek and Lorber 2013; Fuhrmann 2009; Jo and Gartzke 2007; Kroenig 2009; Rauchhaus 2009; Sagan 2011.

on the eve of democratization, and other analyses suggest that Argentina and Brazil's decision to stop their pursuit of nuclear weapons is due to the resolution of the security risk each posed to the other (Hymans 2010, Reiss 1995). Whether these explanations are generalizable beyond this specific case requires further investigation.

To the extent that we seek to identify cross-national patterns to more effectively disincentivize future instances of proliferation, I deviate from the extant literature for three reasons. First, the literature seeks primarily to explain why states renounce nuclear weapons proliferation as a mirroring process to the initial pursuit of nuclear weapons. But this may or may not be the case. While many states (Germany, South Korea, Taiwan, Iraq, and Libya) may have chosen to proliferate nuclear weapons as a result of domestic political pressures, these states may in turn choose to voluntarily dismantle their weapons programs because they receive strategic incentives from the international community that are better than pursuit of nuclear weapons (e.g., by to revise the status quo and/or increase their share of the distribution of resources). This may have an indirect mitigating effect on internal pressures, but it may not necessarily be the precipitating cause of nuclear reversal. Indeed, these are not necessarily opposite processes, whereby the presence and subsequent absence of organizational biases explain state proliferation behavior; to the contrary, states may choose to proliferate for specific reasons and deproliferate for varied and unrelated reasons.

Second, the literature on deproliferation has centered on primarily realist-based, demand-driven explanations for state behavior that emphasize resolution of security concerns as a key motivation for nuclear reversal. Country-specific accounts for nuclear reversal, from Reiss's 1995 study to more recent analyses by Levite (2002), describe

nuclear renunciation as the result of an absence of external security threats. In this model, states make the decision to acquire nuclear weapons to deter potential aggressors and secure their territories from attack without acquiring more territory or developing substantially larger conventional military capabilities (Foran and Spector 1997; Thayer 1995; Waltz 2003; Sagan 1996; Reiss 1995; Levite 2002; Müller and Schmidt 2008).[7] In the event that this external threat is alleviated or a dispute is settled, proliferating states, such as South Korea, may decide to reverse their programs and stop development of a nuclear arsenal, retaining the capability to restart the program if another threat arises. However, these demand-driven models of proliferation fail to take into account supply-side or 'opportunity' factors that are necessary for successful acquisition of nuclear weapons. States may desire acquisition of nuclear weapons but may lack the capabilities necessary for successful weaponization.[8] An external security threat may persist but a proliferating state may ultimately decide to dismantle its program because the costs of continued development outweigh the benefits of deproliferation. This is especially true if the international community is able to provide an inducement, such as a security guarantee, or establish a military alliance that helps to alleviate an external threat that may have contributed to the initial decision to acquire nuclear weapons. Indeed, some have argued that while Japan and South Korea have both the opportunity (a high latent nuclear capacity) and willingness (an increasingly aggressive regional adversary, North

[7] T.V. Paul is among the first to highlight the logical inconsistencies in the neorealist argument about proliferation by noting the negative security externalities of proliferation: developing weapons program could trigger a reaction that may actually make the proliferating state less secure. Anticipating this would make a threatened state less likely to want to pursue nuclear weapons.

[8] Jo and Gartzke (2007) and Singh and Way (2004), among other recent quantitative work on nuclear proliferation, have emphasized the need to examine supply-side or opportunity variables in analyses of the determinants of nuclear proliferation.

Korea), they both remain non-nuclear states because of the promise of an extended nuclear deterrent. Both sets of determinants are crucial for explaining the process of proliferation, but neither is sufficient for understanding why states may voluntarily deproliferate.

Lastly, the most recent scholarship on nuclear deproliferation has focused primarily on providing state-level explanations, and often, although not exclusively, case-specific rationales, for why states decide to renounce nuclear weapons programs. Both Hymans and Solingen present domestic-level factors for deproliferation (Hymans 2006; Solingen 2007; Müller and Schmidt 2008). Hymans provides a leader-specific theory that argues that certain types of leaders are more likely to voluntarily stop developing nuclear weapons program, using the Australian case to illustrate his causal logic (Hymans 2006; Müller and Schmidt 2008). Solingen, on the other hand, looks to regime-specific factors to outline her argument that the political-ideological orientation of the ruling coalition in the country may determine if the state is likely to continue to pursue nuclear weapons (e.g., Argentina) or opt to voluntarily dismantle (e.g., Libya). She argues that domestic coalitions have varying preferences for nuclear policies, depending on how those coalitions view the effect of nuclear weapons on regime security. Outward-looking elites that place a premium on economic openness and integration in the international community see nuclear weapons as a source of friction and may choose to reverse course, while inward-looking elites see the nuclear deterrent as a means of security, prestige, and independence (Solingen 1994, 1998, 2007). On the other hand, Liberman's analysis of South Africa, for example, stresses the need for incorporating both domestic and system-level explanations into a single-case study. He argues that the South African case was

unique in that the decisions to arm and disarm were not mirroring. South Africa initiated its nuclear program in response to organizational and leader biases, while the improving security environment of the late 1980s and outward-looking politicians that sought the benefits of economic openness and interdependence drove its decision to give up its operational nuclear program (Liberman 2001). This study highlights two important assumptions that I rely on in my analysis: there may be a different mix of causal factors at work in proliferation and reversal decisions and it is necessary to consider different levels of explanations in our examination.

Taken together, these studies produce both important theoretical implications and other relevant factors that are necessary for case studies and a broader, large-n analysis. These foundational pieces provide the motivation for this dissertation's proposal to conduct a broader study that examines each state in the system that has undertaken some form of nuclear weapons activity in an effort to establish a more generalizable logic that can help explain if and why numerous states in the system may be acting in a similar manner when they renounce nuclear weapons programs. They also highlight the necessity of examining multiple explanatory factors at all relevant levels of analysis. In addition to identifying a more parsimonious explanation for states' decisions to reverse their programs, one additional contribution of a larger, systemic analysis is to forecast the types of positive inducements that are most associated with persuading future proliferating states to reverse their nuclear programs.

Bargaining with Carrots and Sticks

There is a substantial literature on the use of inducements to motivate changes in state behavior (Haass and O'Sullivan 2000; Cowhey 1993; Leeds 1999; Drury 1998). Numerous studies in political science have looked at the role of positive and negative incentives in various outcomes of interest: conflict resolution, state repression, adhering to treaty or international legal obligations, etc. (Litwak 2007; Pape 1997; Solingen 1995; Solingen et.al. 2012; Crumm 1995; Pevehouse 2002).

Positive and negative inducements refer to the various carrots and sticks that states can offer to influence or modify the behavior of other states. As defined, the employment of either positive or negative inducements is conditional – they are extended but made implicitly or explicitly subject to changes in the target state's status quo behavior. Contingent upon observing the target's compliance with the negotiated demands, the United States, or another sender, will deliver the positive inducements or follow through on its threat.

In the literature, inducements have been categorized into two broad classes: (1) political or assurances; or (2) the use of force or economic coercion, most commonly, economic sanctions (Schelling 1966; Pape 1996; Art and Cronin 2003; Hirschman 1945; Keohane and Nye 1977; Baldwin 1971, 1995; Reardon 2008). These options have generally been viewed as distinct, substitutive forms of influence. To some extent, this is a reasonable differentiation – the use of military force and the threat of economic sanctions, while costly to both actors, do tend to operate in different ways. Interestingly, the majority of the extant scholarship, especially in the field of international relations behavior, has focused on the negative end of the spectrum to modify behavior (Nincic

2010). Nincic and Reardon, among others, argue that this emphasis on the use of negative inducements for dealing with renegade regimes reflects the real-politik tradition in the field.

For theoretical and empirical reasons, I do not constrain ex ante the employment of either type of inducement. In this model, states may utilize a combination of positive and negative inducements, in political economic, or military categories, to encourage states to accept a negotiated settlement to deproliferate. States may use various types of inducements concurrently or in complementarity in different periods of the bargaining process. I adopt this single analytical construct for three reasons: one primarily theoretical, the second empirical, and the third for future policy recommendations. First, the use of any one form of inducement is often intimately connected with others, making it difficult to ensure causal identification of a single key independent variable. States often use or threaten the use of force or economic sanctions and promise the transfer of certain military or economic goods in the same offer, and accordingly, these policy choices operate along the same spectrum of available options for the international community. Second, factorial design of the "inducement treatment" provides me with greater empirical leverage to more accurately infer the causal effect of the inducement package on the likelihood of deproliferation. The observation of the treatment following each instance of deproliferation in the dataset can provide me with causal identification. Lastly, by allowing all forms of inducements concurrently in the theoretical and empirical models, I am better able to determine the set of inducements most closely associated with encouraging deproliferation among the existing states in the dataset and make better out-of-sample predictions for future proliferators.

Inducements and Conflict Bargaining Literature

Even within this single framework, there are numerous possible options for states to choose from to precipitate deproliferation. States have frequently used a strategic combination of positive and negative inducements to modify state behavior in the international system. In this section, I briefly outline some of the existing scholarship on positive and negative inducements in the international bargaining context.

The literature is divided into two parallel research agendas: one that focuses exclusively on the use of military coercion or assistance, and the other on how states can maneuver economic sanctions or perks to modify a state's behavior. From this review, a few broad themes emerge: (1) the dynamics or interactions are iterated—i.e., the use of any of these inducements generally occurs as part of a long sequence of bargaining; (2) both actors are operating under significant information asymmetries; and (3) states' bargaining decisions are shaped by their expectations of the future and a calculated analysis of how action now will affect future decisions. These theoretical implications operate as assumptions for the credible inducements theory presented later in this chapter.

The origin of both branches of the inducements literature can be traced back to the work of Thomas Schelling. In contrast to the leading work at the time that emphasized the role of military power as central to the success of a state and a predictor of state behavior, Schelling argued for a critical examination of the strategic interaction between states, specifically how states choose to act in response to another (Schelling 1960, 1966). He further drew the distinction between the blunt use of force and a limited, coercive use of force that could be used to compel or deter action of an adversary. This type of

coercion, according to Schelling, was essentially structured bargaining that depended on both a state's strengths and preferences.

Using this work and others as a foundation, the literature eventually diverged into two separate strands of debate about the use of military and economic inducements in bargaining. The literature on military coercion and bargaining has yielded powerful implications for a more general understanding of positive and negative inducements: (1) a state's preferences matter almost as much as the valuation a state places on the issue in question; (2) successful bargaining entails both coercion and cooperation, where a set of demands (and promised inducements) adapt as a result of changes in the environment; (3) the use of costly sanctions or military coercion may backfire, potentially resulting in the escalation of the use of force to inefficient levels; (4) positive inducements may encourage longer, cooperative relationships; and (5) information asymmetries create significant problems for effective, credible bargaining and the ultimate establishment of credible commitments (Schelling 1960, 1966; George 1971, 1974, 1994; Jervis 1976, 1983; Fearon 1994; Davis 2000).

Similarly, the literature on economic statecraft has resulted in a set of implications that mirror those of military inducements. The literature has evolved to address various aspects of the use of economic sanctions, but primarily, to answer the question of whether economic sanctions are ever effective (Baldwin 1971, 1995, 2000; Hufbauer, Schott, and Elliot 2007). A series of theoretical and empirical pieces followed but all of them hinged on the dependent variable, looking only at instances in which sanctions had been applied (ignoring cases where they had been threatened), and subsequently, if they had been

successful or not. This selection of cases may have resulted in a misleading estimation of the role of sanctions in international bargaining.

From both of these strands of the literature, rewards and punishments, we form a common set of assumptions and implications for analysis. Positive and negative inducement are forms of bargaining where states have strict preferences about the issues in question and negotiate with asymmetric information, with their ultimate actions reflecting a calculation of future payoffs and current costs.[9] In sum, the literature yields the following conclusions: rewards and sanctions are typically portrayed as simple inverses of one another with identical effects and that sanctions are widely expected to have no substantive effect.

Dissertation Overview

Theoretical Framework and Introduction of Formal Theory

My theory analyzes the conditions under which states reverse their nuclear weapons programs and how the international community may provide incentives to them for doing so. This exertion of international pressure may take the form of a new security guarantee, military assistance, an international loan, or a combination of specific security or economic goods, in conjunction with the threat or actual use of force against a proliferating state. While the composition of the deproliferation deals vary among the different instances of deproliferation, it is also becoming increasingly important to

[9] I more closely examine the role of positive and negative inducements in the nuclear literature in Chapter 2.

examine how dynamics between these two primary actors may vary the bargaining interaction, and ultimately, the likelihood of deproliferation over time.

Notably, the foundation of this logic does differ from previous policy antidotes historically used to quell the likelihood of proliferation. For example, nonproliferation policy has primarily focused on providing a potential proliferator access to the nuclear industry, often in the form of civilian nuclear assistance or the acquisition of nuclear materials for nuclear power programs from the Nuclear Suppliers Group. This form of incentive assumes that proliferators are seeking nuclear weapons as an end in and of itself. In contrast, my argument does not require this assumption, predicated instead on the notion that proliferators may be seeking to acquire nuclear weapons as a means to a greater, and perhaps more strategic, end. Proliferators may engage in a weapons program to alter the status quo in their favor, to resolve a dispute, or to use the bargaining advantage nuclear weapons confer to their holders (Brodie 1959; Kissinger 1957; Bennett 1996; Fearon 1994; Gartzke and Jo 2009; Beardsley and Asal 2009; O'Neill 2007). Regardless of the initial causes of the proliferation decision, the international community may be more successful in encouraging states to deproliferate by offering some package of goods that provides the same benefits or outweighs the expected utility accrued from a successful and fully-operational nuclear weapons arsenal.

Chapter 2 introduces the formal model in this dissertation. This model shows the interaction between the international community and a proliferator after the proliferator has begun its nuclear pursuit. The game begins with the international community choosing between offering a reward to the proliferator (which is guaranteed if they actually stop the program) and coercing the proliferator. At this point, the international

community has some belief about what type of proliferator but is not certain about the value that the proliferator holds for the program. Some proliferators (hawks) have a high value for acquiring nuclear weapons, while others (doves) have a lower value for having a weapons program. The proliferator must then decide if they want to continue the program or stop it, by accepting the offer of reward or stopping after being coerced, with this action potentially revealing information about their type/value for the program.

The model predicts that rewards offered upfront are accepted by doves and can help to distinguish them from hawk proliferators. If the international community cannot credibly threaten to attack a proliferator, some doves may still "pool" with the hawks in hopes of acquiring a weapon. When the threat of an attack is credible, doves are more likely to accept rewards, as are those hawks that believe the use of force is more likely against their program. Threats to use force or sanction states are more likely to be made against states with high values for nuclear weapons and, thus, are likely to be unsuccessful in persuading them against the pursuit. Implications from the model yield the key argument of this dissertation: rewards can induce states who are not strongly inclined to develop to stop, as well as some proliferators with higher values for acquiring nuclear weapons, while coercion may actually prolong some nuclear programs.

This theoretical framework reveals several interesting dynamics. First, the model implies differential effects across proliferator type: high-value or hawk proliferators act significantly differently than low-value or dove proliferators. This difference allows the international community to potentially change course in how they bargain with the proliferator. Second, the interaction is strongly influenced by whether the international community demonstrates their willingness to attack; if not, both types of proliferators

would prefer to continue their program. Similarly, when examining how the international community initially chooses to interact with a proliferator, the model indicates that coercion results in a proliferator continuing their nuclear pursuit. Rewards, on the other hand, will be associated with the proliferator stopping their nuclear pursuit, the more so the greater the proportion of doves in the population.

Empirical Analysis

Unlike the extensive extant literature on proliferation, there has been little systematic quantitative analysis on nuclear reversal. The dataset compiled for this dissertation can help fill this gap. Using the framework set by the recent series of quantitative nuclear studies by Jo and Gartzke (2007), Singh and Way (2004) and the Special Issue in the *Journal of Conflict Resolution* (2009), this dataset incorporates the universe of states that have explored and pursued some form of nuclear activity since the introduction of nuclear weapons into the international system.

Chapters 3 and 4 present an overview of selected archetypal cases and introduce a new dataset of nuclear deproliferation cases since 1945, respectively. In the first half of the empirical portion of the dissertation, I introduce the large-n, quantitative analysis that examines the empirical determinants of nuclear reversal cases since 1945. This dataset includes all states that have explored nuclear weapons/engaged in nuclear weapons activity.[10] By establishing the universe of cases, I have significantly greater empirical leverage with which to identify patterns of behavior across proliferators and assess the ensuing probability of deproliferation, conditional on the likelihood of selecting into the

[10] Some of the other quantitative studies have differentiated between nuclear weapons pursuit and acquisition but I include all states that have explored nuclear weapons in the scope of my analysis. I go into more detail for my reasoning for this methodological choice in Chapter 4.

group of states that initially begin a nuclear program. I create a new dataset of nuclear weapons activity, where the deproliferation variable can take one of these three forms: (1) stopped development of nuclear program; (2) returned complete weaponized arsenal; and (3) dismantled complete weaponized arsenal. If any of these phenomena are observed, the state in question has deproliferated in a given country-year. I include a spectrum of inducements, ranging from military assistance, entrance into international organizations, economic assistance, to the threat and/or use of military force and economic sanctions. The disaggregated operationalization of my main explanatory variables allows me to better specify the exact combination of carrots and sticks most likely to efficiently and effectively lead to sustained deproliferation.

To test my hypotheses with these data, I use a binary time-series cross-section model that functions similarly to a hazard or survival model, with the addition of squared and cubed time trend terms, and splines for each set of explanatory variables, to account for temporal dependence in the data. The results are statistically significant in both a standard logit model and a rare events model. I employ both methods to ensure my findings are robust to various model specifications, including fixed effects and clustered standard errors. These also include specifications that control for variables that have been established in the literature as key explanatory factors for nuclear reversal outcomes.

The findings are also substantively significant. My initial findings suggest that deproliferation is a dynamic process. I also find support for my hypothesis that positive inducements may be more effective than negative inducements: certain types of rewards, such as military aid, is positively (and statistically significantly) associated with

deproliferation while some forms of punishments, such as sanctions or the use of force, have a negative effect on the likelihood of nuclear reversal. While this statement may initially seem intuitive, the theoretical prediction and the findings run counter to much of the conventional wisdom in the nuclear scholarship and may help produce interesting implications for scholars, policy-makers and practitioners who have stressed the role of sanctions and coercion in encouraging nuclear nonproliferation and reversal.

Chapter 4 presents a set of summary statistics about the full set of cases and provides a series of descriptive narratives of some selected deproliferated states. While the general consensus had been that nuclear reversal is a rare event—the most prominent example of which is South Africa—in reality, deproliferation accounts for a significant portion of total nuclear activity. Of the thirty-six states that have engaged in some form of nuclear weapons activity, twenty-six have reversed their development programs. The process by which deproliferation occurs is varied and complex. Though some general patterns can be isolated, the stories of the former Soviet satellites, for example, are markedly different from those of Syria or Taiwan. To assess this variation, I examine six broad models of deproliferated states based on the theoretical outcomes derived in Chapter 2 and highlight the role of inducements in their reversal processes.

Case Study Analyses

I conduct two detailed, matching case study analyses of the Egyptian and Indian nuclear weapons programs. The extended case analyses provide me with the opportunity to delve further into the constructions of my independent and dependent variables. By allowing me to extend the coding of standard economic and foreign aid variables, I am able both to verify the validity of these variables and understand the limitations of their

implementation in the empirical model. And beyond providing more fine-grained analyses of specific instances of deproliferation, the case studies also allow me to ensure that my measures are accurate and are adequate operationalizations of these complex constructs.

I conduct two detailed case study analyses of the Egyptian and Indian nuclear weapons programs, where some of the data was acquired through my archival work at the National Security Archives. To establish a valid comparison case, I closely match the two states on important domestic-level observables and allow them to differ only on the outcome variable, the presence or absence of a nuclear weapons program. Egypt and India provide interesting examples of two relatively similar states that both embarked on nuclear weapons programs, with only one ultimately acquiring a nuclear weapon. Both states were (and are) considered to be regional powers that often serve leading roles in regional and international politics. At the time of their initial exploration of nuclear weapons, both were considered to be viable and candidates for proliferation: they had latent nuclear capability for ease of development, economic and political resources, and serious external security concerns, to pave the way for political decision-makers to express their desire for nuclear weapons.

Yet, Egypt voluntarily deproliferated its nascent nuclear weapons program in the early 1980s despite strong evidence that it could have been a nuclear power in the Middle East. Indeed most analysts saw Egypt—given its security concerns, desire for national prestige, and early cooperation with other proliferators—as a natural candidate for a nuclear capability. Evidence suggests, however, that Egypt's decision to stop pursuit of nuclear weapons was the result of growing Egyptian dependence and vulnerability to the

international economic system. Given that Egypt has been the second largest recipient of foreign aid (after Israel) for the past three decades, Egyptian leaders were unwilling to embark on a costly nuclear program that would have jeopardized the country's economic and political stability.

India, on the other hand, accelerated its program and was ultimately successful in 1998 despite a series of sanctions and offers of sensitive nuclear assistance after the 1974 peaceful nuclear explosion. Since its last nuclear test, India has continued its nuclear program despite technological, financial and political concerns, and has evolved in its status as a de facto nuclear state. While both engaged in various negotiations and received numerous offers to deproliferate over time, only Egypt chose to voluntarily stop its nuclear activity and join the Nonproliferation Regime (and signed the Nonproliferation Treaty) as a non-nuclear weapons state. The extended case analyses offer insight into some within-state bargaining dynamics over time, specifically, which inducements proved to be effective in Egypt's case, while providing some implications for the nuclear reversal process for states with similar baseline characteristics.

Outline of the Dissertation

This chapter has posed the dissertation's central research question, described its motivation and significance, and previewed the argument, methods and data, and initial findings. The remainder of the dissertation proceeds in five additional chapters. Chapter 2 develops the formal causal logical of how inducements from the international system can encourage deproliferation. Chapter 3 contains a quantitative test of the primary hypotheses generated from the formal theory. Drawing on data from twenty-six known instances of deproliferation, I conduct various econometric analyses to test my theoretical

predictions. This chapter also contains a full description of the operationalization of the variables, potential biases in the data, and the empirical strategy for correcting these potential biases. Chapter 4 presents a detailed descriptive analysis of six archetypal cases of deproliferation and the types of inducements used for reversal. To complement this analysis, Chapters 5 examines two proliferation cases, India and Egypt. Chapter 6 concludes the dissertation by reexamining the dissertation's central question, argument, analysis and findings. Furthermore, it provides a discussion of the study's contribution to the nuclear weapons scholarship as well as a series of key policy implications for nuclear decision-makers in the 21st century.

Appendix 1

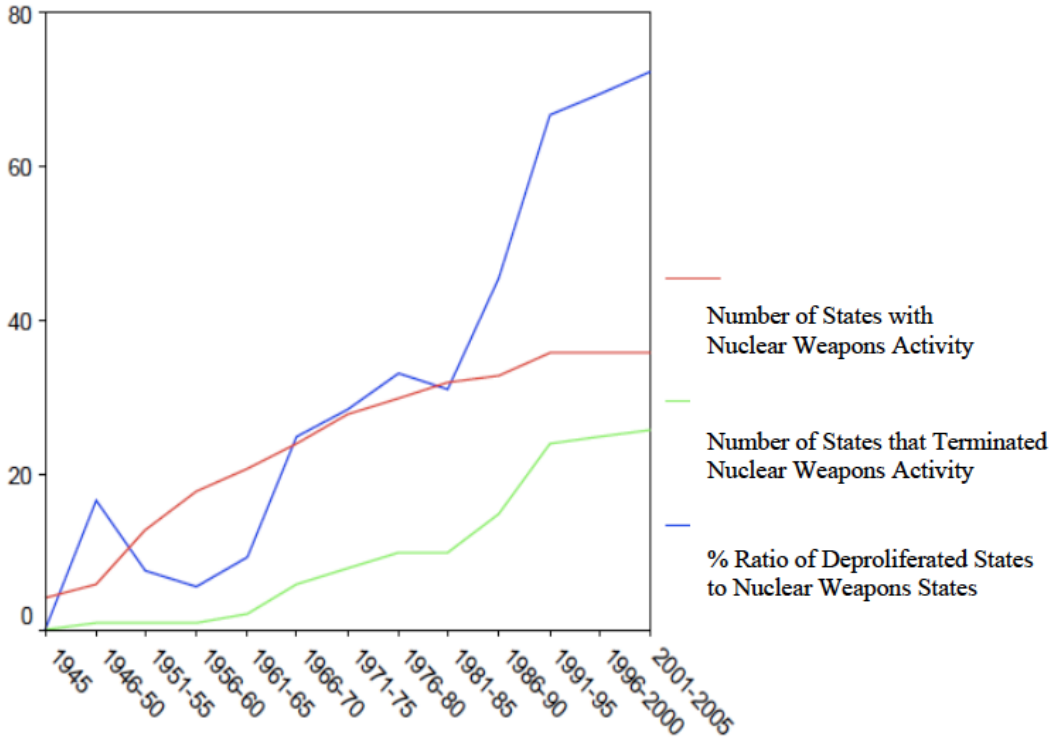

Figure 1.1: Nuclear Weapons Activity 1945-2010

CHAPTER 2: THE THEORY OF DEPROLIFERATION

Introduction

Previously, I presented the dissertation's central research question, described its motivation and significance, and previewed the argument, methods and data, and findings. Additionally, I briefly examined the broader literature on rewards and sanctions and the potential avenues for the international community to use these tools to alter behavior, particularly with regard to the development of a nuclear program. Specifically, I noted that the majority of the scholarship on positive and negative inducements has had trouble distinguishing between rewards and sanctions as mere opposites and more recently, has yielded mixed or often negative results regarding the efficacy of sanctions.

In this chapter, I develop my theory for how the use of rewards and punishments can encourage states to abandon their nuclear intentions. This model incorporates two novel additions to the prior literature on rewards and sanctions in international politics and on nuclear reversal. First, the theoretical model attempts to differentiate between the effects of rewards and sanctions by examining the interaction of the two tools in a strategic, formalized framework. If rewards and sanctions are not solely the inverse of one another, what difference in outcome can be attributed to the decision to employ one instrument over the other? By looking at these instruments in comparison to one another and the manner in which states can choose to implement one or the other tactic helps us to better isolate how they operate in a particular context and the independent, and potentially divergent, effects that they have on the outcome. Indeed, analysis is of the formal model suggests that positive and negative inducements do play different roles in

modifying the behavior of actors and that the offer of positive inducements may actually serve an additional, coercive purpose by helping to reveal previously unknown information about the type and preferences of the actors in the strategic interaction.

Second, while much of the scholarship on nuclear reversal is centered on the role that individual leaders, the regime, or regional security threats play in encouraging states to stop nuclear pursuit, this project seeks to examine a different strategic dynamic: that between the international system and the proliferator to determine the role that the international community, or specific member states, can play in encouraging the renunciation of nuclear ambitions (Hymans, 2006; Solingen. 2007; Rublee 2006; Mueller and Schmidt 2004; Levite 2002). Primarily, the extant literature on deproliferation has two limitations. First, by examining the phenomenon of *deproliferation* as the opposite process to *proliferation*, prior analyses unfairly assume that nuclear reversal is then the result of the removal of the incentives to proliferate in the first place and is thus, relatively idiosyncratic. In addition, much of the literature also has examined instances of deproliferation in isolation – focusing on state-specific motivations for stopped nuclear weapons programs. In this theoretical framework, the model emphasizes the significant role that the international community can play, in tandem with evolving domestic or state-level factors, specifically with the employment of rewards and sanctions to induce proliferators to abandon their nuclear programs.

Building on the foundational literature with these two additions, I focus on the bargaining dynamic between the international community and a proliferator as they negotiate to reach a preferred settlement. Adapted from crisis bargaining models, I introduce a game-theoretic model that demonstrates that carrots and sticks can play very

different and often counter-intuitive roles in pressuring states to reverse their nuclear course. This chapter argues that the international community's offer of rewards is more likely to encourage nuclear reversal, and can even do so with states with a high value for nuclear weapons, while the use of sanctions may actually provide incentives for some states to continue to proliferate. To arrive at these conclusions, I briefly examine some of the general implications of the model (the full proof of the formal model is included in Appendix 2.1). This chapter begins by introducing the overarching theoretical framework for the dissertation, specifically the model's key intuition and findings.

Theoretical Intuition

In this model, two actors are bargaining over a nuclear weapons program. The first actor, a member of the international community (here, I focus on the United States as the primary state involved), has observed that another state has begun a nuclear weapons program. In an attempt to limit the continued proliferation of nuclear weapons beyond the nuclear club, the United States opts to begin negotiations to the proliferator to encourage the latter to abandon its nuclear weapons program by offering some form of positive or negative inducement that will cause the state to give up its nuclear weapons program. The US has a variety of policy instruments from which to choose but primarily must decide between using some form of reward or sanction to modify the nuclear policy of the proliferator. The proliferator, in turn, must decide if the inducement being offered changes the value that it hold for acquiring nuclear weapons, such that it may be willing to give up the weapons program if offered a high enough reward.

Analysis of the game reveals some interesting and novel implications. First, as the interaction progresses, the proliferator must decide either to continue or stop its nuclear weapons program given the 'deal' it is offered: the United States is then able to learn more about the proliferator's type. States that are truly committed to acquiring nuclear weapons at any cost are more likely to reject offers of positive inducements by the United States and continue their program: in these instances, the value that the state acquires from an operational nuclear program exceeds whatever benefits being offered by the international community. In this regard, for some states, proliferation is a foregone conclusion.

For some proliferators, however, their behavior works to reveal their type – states that are truly committed to nuclear weapons or those that could be willing to give up their weapons program at the right price. As United States chooses to grant a reward or carry through on an initial threat to impose sanctions or use military force, an interesting dynamic emerges: the proliferator's response to this offer tells the US its value for acquiring nuclear weapons. If a proliferator chooses to continue its weapons program despite being offered a high reward, it has revealed its desire to become a nuclear weapons state. Given this revelation, the United States may decide that they only way to stop an ultimate successful proliferation is through the use of military force as sanctions are likely to be just as ineffective against what they believe to be a committed and persistent proliferator. If the proliferator knows that this is likely to be the outcome and isn't willing to bear the costs of a military attack, it will accept the reward offered and deproliferate. The model indicates then that rewards serve a critical, secondary purpose in strategic interactions (and one that works to differentiate them from sanctions): if an

actor opts to accept a reward given the costs that it would incur if it continues the interaction, rewards can serve to both identify and coerce actors into modifying their behavior in accord with the preferences of their opponent.

Analysis from the model also suggests that the efficacy of sanctions is somewhat dependent on the likelihood that the international community, specifically the United States, could use military force. If the use of military force is not an option against some proliferators, persistent proliferators that truly want nuclear weapons won't be deterred by the costs of sanctions and will continue their nuclear program. Without a strong fear of a costly military attack against their nuclear facilities, these types of proliferators are willing to withstand the threat and imposition of sanctions in order to acquire nuclear weapons. If a proliferator were unwilling to do so, it would rather accept the reward and stop its nuclear pursuit. In the event that the use of military force is a viable option for the United States, they would prefer to use force and permanently end the nuclear program than rely on sanctions that are unlikely to work, especially against the most intransigent of proliferators. In both instances, economic coercion has limited use and effectiveness against most types of proliferators, particularly those that truly desire nuclear weapons.

Thus, this model reveals several interesting implications. First, analysis of the strategic interaction works to distinguish between rewards and sanctions with respect to the outcome. Rewards are not simply the inverse of sanctions – rather, rewards can serve as an information-gathering tool that restructures the interaction between actors and can help facilitate an agreement that avoids costly conflict. Rewards can help identify a wolf in sheep's clothing.

The model also provides some additional evidence regarding the limited efficacy of economic sanctions as a policy tool, especially if the use of military force is a viable option. Lastly, the model suggests that despite the best efforts of the international community, especially the United States, proliferation may still occur. To better understand the theoretical framework, I next present, in detail, the structure of the strategic interaction between the international community and the proliferator. I begin by examining these actors, specifically the decision to model the interaction with the United States as the representative of the international community and what effects this may have on the implications of the model, and continue with an explication of the formalized strategic interaction between the United States and a proliferator.

Description of the Actors: The International Community and the Proliferator

International Community

In this theoretical framework, I focus on the dynamic between the international community and the proliferator in a crisis over the latter's nuclear program. A single actor represents the international community and is primarily responsible for negotiating with the proliferator and contributing the rewards or applying the sanctions/use of force for a specific proliferation case. While the international community's identity may vary over time and among various proliferation instances, the underlying structure of his interaction with a proliferator remains the same. In the initial stage(s) of the bargaining process, the international community does not know the value that the proliferator holds for the program and makes an ultimatum offer to the proliferator, who must either accept the offer as presented or continue its program and potentially face negative consequences,

such as a military strike that prohibitively disrupts the progress of the program. If the international community opts not to attack the proliferator, the proliferator may begin to learn about the international community's value for deproliferation: if it is unwilling to threaten/use military force, the international community has revealed information about the value it places on encouraging reversal for that proliferator.

By framing the interaction as one between the 'international community' and the proliferator, I can more easily allow for variation in these interactions: the actor in each deproliferation event may differ depending on the cost of action, whether rewarding, sanctioning or attacking a particular proliferator. The incorporation of this dimension into the model allows me to move beyond the specific preferences of the most powerful states in the international community by getting traction on two different parameters that affect the strategy of the international community: a) the value that it places on the proliferator reversing its program; b) the costs associated with inducing the proliferator to deproliferate (whether through the offer of rewards or coercive action).

The small community of actors most responsible for negotiating with a proliferator, namely the UN Security Council Permanent-5 members/nuclear weapons states, may have different values and costs associated with a particular state's deproliferation. For example, while most of these states could agree that a nuclear Sweden does not provide a significant threat to international security, they may disagree on the threat posed by a nuclear Iran or North Korea. Indeed, for more recent instances of nuclear proliferation, there has been a sharp divide in the assessments of how dangerous Iran may be if it acquires nuclear weapons and how best to manage an increasingly belligerent nuclear North Korea. Russia and China, for example, have

repeatedly blocked attempts by the remaining nuclear weapons states, under the auspices of the UN, to enact sanctions against Iran, but have more recently sided and cooperated more with its nuclear cohort to negotiate North Korea's deproliferation. This, no doubt, has a considerable influence on the value that the international community places on deproliferation and their willingness to credibly threaten to attack a potential proliferator or offer potentially commensurately costly rewards to induce nuclear reversal.

Proliferator

Based on their value for obtaining nuclear weapons, the proliferator is able to form its own expectations about the likelihood of success. The decision to stop the nuclear program is thus based on the payoffs it is likely to receive from the international community rewarding, sanctioning, or attacking him. Essentially, the proliferator's strategy is based on the expected utility of the outcomes, such that the payoff for him is a function of the expected value of the program in the future if it is completed. If the international community offers a reward that is greater than what the proliferator can expect to receive from a nuclear weapons program, given its expectation of what the international community will do if it continues the program, it is likely to stop its nuclear pursuit. If the proliferator opts to continue the program, the expected payoff from continuing is conditioned on whether the international community then chooses to implement sanctions or the use of military force, or simply ignore him.

It becomes important then to distinguish between different types of proliferators. Proliferators vary in their valuation for their nuclear program – essentially, the extent to which they are willing to go to acquire a weapons program. 'Hawk' types are those states that have a high valuation for a nuclear program and/or are willing to suffer

potentially severe costs to differentiate themselves from other proliferators to alter the bargaining dynamic and obtain nuclear weapons. On the other hand, 'dove' types have lower valuations for their nuclear program and while they may want to mimic the behavior of hard types, they are ultimately unwilling to endure the costs of doing so (Fey and Ramsay 2007; Slantchev 2011). Imagine, for example, a dove-type proliferator, such as Australia, that pursues a nuclear weapons program and has a lower value for a nuclear program. Given this, it may be more willing to accept an offer to voluntarily dismantle rather than incur the costs of continuing, given its expectations of what the international community will do in response. Indeed, if the international community can credibly threaten to use military force to further incentivize the state to accept the deal offered, almost universally dove proliferators will stop the program because they are not willing to endure multiple instances of coercion to continue a nuclear program. In this way, credibly threatening to punish or coerce the proliferator may be used effectively in conjunction with positive inducements to encourage nuclear reversal for some proliferators: the threat of attack may be sufficiently costly that dove-type proliferators aren't willing to mimic higher-value proliferators to extract more concessions from the international community.

How does the strategic interaction change with a hawk-type proliferator that has a higher valuation for a nuclear future? A hawk-type proliferator, such as Pakistan, can be thought of having a higher expected utility of a successful nuclear weapons program and thus greater willingness to suffer multiple coercive costs to acquire nuclear weapons. A hawk-type proliferator' also benefits from the international community's uncertainty about the proliferator's valuation for a weapons program. Hawk proliferators may opt to

continue their program because the payoffs from doing so outweigh the costs imposed by the international community, even if it later chooses to sanction the proliferator. These hawk-type proliferators can also include states that have successfully proliferated. In these cases, proliferators that have built or acquired an operational nuclear arsenal, such as South Africa or Belarus, can choose to accept a reward offer and dismantle their operational weapons, if the expected utility from doing so exceeds the payoffs from continuing given their expectations of how the international community will respond.

Given a continued higher value for pursuing weapons, hawk states are more intractable and less likely to willingly to stop a program, despite increasingly attractive offers from the international community to do so or seemingly high sanctioning costs. If the international community can credibly threaten to attack the proliferator if it chooses to continue its program, this may alter even the hawk's strategic calculation, such that it may be more willing to stop the program. However, if sanctioned, some proliferators may continue to proliferate with varying degrees of success. It is in these instances where despite a high value for reversing a hawk's program, the international community may not be willing to incur the necessary costs of action to ensure permanent reversal and we can see the successful outbreak of nuclear proliferation among hawk states such as North Korea or Iran.

Model of Strategic Interaction

Underlying Framework

This formal model shows the interaction between the international community and a proliferator after it has begun its nuclear pursuit. The game begins with the

international community choosing between offering a reward to the proliferator (which is guaranteed if it actually stops the program) and coercing the proliferator. At this point, the international community has some belief about what type of proliferator it is but is not certain about the value that the proliferator holds for the program. Some proliferators, hawks, have a high value for acquiring nuclear weapons, while others, doves, have a lower value for having a weapons program. The proliferator must then decide if it wants to continue the program, by accepting the offer of reward or stopping it after being coerced, with this action potentially revealing information about its type/value for the program.

If, for example, the proliferator rejects the reward, this may reveal to the international community, the high value that the proliferator holds for acquiring nuclear weapons and that it is unlikely to be deterred from its pursuit. This then can alter the strategy employed by the international community in inducing deproliferation. Indeed, the offer of carrots not only provides an incentive for some actors to change their strategy but may also help reveal information about the type of the actor in the interaction that may facilitate reaching an agreement. In effect, rewards are not just simply about buying off allies – they can help to identify an enemy, in this instance, a persistent and committed proliferator.

Sequence of Moves

Two actors, $i \in \{1,2\}$, are in a crisis over the development of nuclear program by the latter. The international community (Player 1 or "she") detects that a proliferator (Player 2 or "he") has an active nuclear program. She is attempting to prevent its completion. Player 2 can be either a dove who values having nuclear weapons at $V_D>0$

or a hawk who values having them at $V_H > V_D$ (where the value of hawk's program is greater than a dove's). Player 1's valuation of stopping proliferation is $V_1 > 0$. The international community's valuation for stopping proliferation is unrelated to the type of the proliferator: this valuation is a function of how much the proliferator is willing to endure to obtain the weapons, not how dangerous he is to the international community. The value of having no weapons is 0 to the proliferator, and the value of successful proliferation to the international community is normalized to 0 as well. I assume that the international community prefers to stop the expansion of the nuclear club.[11]

At the outset, Player 2 knows his own type but Player 1 only has a belief $h > 0$ that he is a hawk (this prior is common knowledge). Having detected proliferation activity, Player 1 can choose between two actions: reward and coerce. These actions are fully committing: if Player 2 complies when promised a reward, Player 1 will deliver on that promise, and if Player 2 fails to comply when threatened with coercion, Player 1 imposes the costs of coercion on him. I assume that compliance is observable or at least verifiable (i.e. delivery of the reward or abstention from sanctioning can be made conditional on satisfactory inspections by the IAEA or other international nuclear regulatory bodies).[12] The size of the reward is $R_i > 0$, and the cost of implemented sanctions is $S_i > 0$.

---

[11] Given the disproportional distributive benefits of nuclear weapons, nuclear weapons states want to restrict the number of states that possess nuclear weapons to maintain the status quo distribution of advantages specific to nuclear weapons states.

[12] I abstract away from commitment problems for two reasons. First, I am interested in the fundamental workings of the two basic strategies (reward and coercion), each of which is likely to come with their own set of commitment issues. I leave the study of these issues for future work. Second, and perhaps more importantly, this assumption favors the international community since the proliferator will have no doubts that she can deliver on her promises. If we find that the international community has trouble preventing proliferation, then adding commitment problems can only further erode her ability to do so and biases against the results of the game.

After Player 1's action, Player 2 decides whether to stop his nuclear program or continue. If he stops, the interaction ends: if Player 1 offers a reward, it is delivered; if she threatens with sanctions, they are not implemented. If Player 2 continues development, any promised reward is foregone, and any threatened sanctions go into effect. In response, Player 1 now chooses between doing nothing, initiating a military attack, and sanctioning. If she does nothing, Player 2 finishes the program and acquires nuclear weapons. If she chooses the military option, the attack succeeds and destroys the program but imposes significant war costs, $C_i>0$, on each side. In either case the game ends. If, however, Player 1 threatens with sanctions, Player 2 can then choose to stop or continue. If he stops, the game ends and no sanctions are implemented. If he continues the programs, sanctions will go into effect and impose additional costs of mS_i ($m>2$). The proliferator finishes the program and acquires nuclear weapons, thus ending the interaction.

The difference between the types of proliferators in this model has to do with their willingness to push a program to its successful completion when the international community threatens him with a sanctioning regime. I assume that hawks value having nuclear weapons so much that they would endure multiple rounds of sanctions in order to obtain them, whereas doves are willing to endure at most one round of sanctioning. Formally,

Assumption 2a: $V_H> R_2 > V_D$
Assumption 2b: $R_2>V_H$

Figure 2.1. in Appendix 2 presents the extensive form of the interaction and the payoffs.

Analysis

The solution concept is perfect Bayesian equilibrium (or simply, "equilibrium"). In this section, I present an intuitive description of the results, whose mathematical derivation can be found in Appendix 2.1. The analysis focuses on the unique equilibrium where beliefs are consistent with the strategies.[13] The two main cases are whether the international community has the option to use military force and one in which she does not.

No Military Option ($V_1 < C_1$)

First, let's consider a case where the international community does not have a military option. If the international community is sufficiently convinced that the proliferator is a hawk ($h>h^*_{cn}$), then the international community offers a reward that either both types will accept and subsequently stop their programs or only the dove proliferator will accept the moderate reward and stop. If, however, the international community attempts to coerce, both types always continue the programs and proliferate. Thus, if the international community can offer a high enough reward, she will be able to stop proliferation with both types of proliferators. If she can only offer a moderate reward, she will at least stop some proliferators, the dove proliferators with low values for acquiring nuclear weapons. Interestingly, coercion is very counter-productive here as it is certain to fail: it will not stop either proliferator and will result in successful proliferation.

[13] As the Appendix shows, the game might also have a continuum of equilibria where player 2 stops regardless of type but these are supported by beliefs that require player 1 to infer that player 2 is a dove whenever he continues. I find these beliefs implausible even though they cannot be eliminated using the Intuitive Criterion. These equilibria are also uninteresting analytically because the strategies are supported with beliefs assigned by the analyst rather than derived in the context of the interaction.

However, if the international community thinks that there is a high enough likelihood that the proliferator is actually a dove, the outcome becomes more complicated. As in the first instance, if the international community can offer a high enough reward, both types would accept it and stop their nuclear programs, and if she offers a moderate reward, she is at least likely to induce the dove to accept it. Unlike before, coercion may work here, specifically against a proliferator with low values for nuclear weapons. If coerced, a hawk proliferator will always continue and proliferate. However, if the international community does decide to coerce, it is possible that the threat of sanctions might be sufficient to get the dove proliferator to stop. However, there is also a chance that the threat will not be enough to persuade a dove to stop and he will continue, leaving the international community uncertain as to whether the proliferator is a hawk or a dove. After observing the proliferator continue, the international community will update her prior belief about the probability that the proliferator is a hawk (as doves are less likely to continue than hawks) and may decide to not take action to avoid 'risking' sanctioning a hawk, against whom sanctions are useless and costly. If the international community does nothing, even a dove will want to continue and proliferate. However, sanctioning the proliferator will stop a dove but not a hawk, which will choose to continue. In general, rewards seem to be a very appealing and effective strategy under these conditions. If the international community is unwilling to put together a high enough reward, coercion might still be an option.

Military Option ($V_1 > C_1$)

How do these dynamics change if the international community has an option to use military force? We can imagine this instance, where the international community can

credibly commit to using military force against a proliferator, as a case where military force is strategically and tactically viable. For example, it is equally unlikely that military force would be used against a proliferator with whom the United States shares preferences such that the use of force would have costly, and potentially long-term, consequences for both states and the international community more broadly. An attack on this type of dove proliferator, for instance, would no doubt endanger the positive political, economic, and strategic interdependent relationship the two states have successfully cultivated. On the other hand, we could see the use of force against states with which the US does not share preferences or have this type of interdependent relationship, whereby the consequences of a military strike against the state would have long-term effects for the US and other states in the international system. Here, we can imagine a state such as Syria, where the US or other members of the international community are willing to use military force to induce the state to abandon its nuclear weapons program, because the proliferator does not have similar preferences to key members of the international community – the use of military force would not damage a positive relationship between the states. Indeed, this happened in 2007 when Israel launched a military strike against a suspected Syrian nuclear facility in Deir Alzour.

If the international community initially offers a reward, she loses the option to coerce a second time: if the offer is rejected, additional sanctions will be useless, even against a dove proliferator. The international community then has to choose between successful proliferation, after more sanctions, and attacking. Given these options, the international community prefers to attack than allow a proliferator to succeed in acquiring nuclear weapons, after paying the additional costs of useless sanctions. If the proliferator

rejects the reward, the international community will exercise its military option and attack. Neither a hawk nor a dove proliferator wants to be attacked, so neither type will reject the reward. Interestingly, this equilibrium is independent of the size of the reward R_2, which can be arbitrarily small or even zero (as rejection results in war and a negative payoff for the proliferator). Thus, the reward here works because it is, in fact, highly coercive: if a proliferator rejects the offer, war is certain.

Let's consider the case where the international community initially coerces. If a dove proliferator continues after being sanctioned, he will either be attacked or suffer from even more sanctions. If sanctioned again, the dove would quit since attacking results in high war costs. Thus, the dove strictly prefers to stop its program after the first coercive threat. In any equilibrium, if the international community observes a proliferator continue, she will infer that he is a hawk, against whom sanctions will be ineffective (since hawks are willing to endure multiple rounds of sanctions to acquire nuclear weapons). To prevent proliferation and to avoid paying the costs of coercion, the international community would prefer to attack and will do so if she sees a proliferator continue. Even a hawk proliferator would prefer not to be attacked and will deterred from continuing his program. Thus, the unique PBE here is that both types of proliferators stop immediately after the first sanctioning threat. When the international community has the option to use military force, both rewards and sanctions can work to stop proliferation, but rewards are, in fact, highly coercive. Since threatening sanctions imposes no cost to the international community, and the commitment to paying rewards is not without cost, the international community strictly prefers to make threats, rather than promise to reward. Regardless, proliferation will never occur if there is a military

option; this is one instance where the international community prefers to punish, rather than reward.

Finally, how can we determine whether the international community will reward or coerce? In presenting the results, I first focus on the cases where the international community does not have the military option. Recall, under this condition, the model predicts that if the international community initially chooses to coerce a proliferator, both hawks and doves would prefer to continue their program than stop.[14] Essentially, then, the international community pays the costs of coercion without achieving its desired result – the proliferator's abandonment of the weapons program. If instead the international community begins by promising a reward, the outcome depends on the value of the reward, where R_i can stop a dove but not a hawk, or it can stop both. I focus on four cases:

> 1a) Hawk rejects reward and gets program (*by Assumption 2a*);
> Dove rejects reward and stops and Hawk proliferates always, Dove stops if rewarded but proliferates if coerced (when $h > h_{cn}^*$).
>
> 1b) Hawk rejects reward and gets program (*by Assumption 2a*);
> Dove rejects reward and stops and Hawk proliferates (even after 2 rounds of sanctions); Dove stops if reward and when coerced (when $h < h_{cn}^*$).
>
> 1c) Both types accept reward and stop (by *Assumption 2b)*;
> Both accept reward and stop; proliferate if coerced (when $h > h_{cn}^*$).
>
> 1d) Both types accept reward and stop (by *Assumption 2b)* ;

[14] If the international community decides to coerce a hawk proliferator, she will continue the program, as she is willing to pay the additional costs of sanctions to acquire a nuclear program. Similarly, if the international community opts to initially coerce a dove, a proliferator with a low-value for a nuclear program, he is still willing to 'pool' with hawks and continue his nuclear program, given that the international community does nothing.

Hawk stops if rewarded, proliferates if coerced; Dove stops if rewarded (when $h < h_{cn}^{*}$)

In the first case, the international community will offer a reward if the cost for doing so is less than how much they value inducing the proliferator to stop its nuclear program. In addition, the international community may also try to reward proliferators if their belief about the proliferator's value for nuclear weapons, h, is high enough such that they are likely to do nothing if the proliferator continues their program and obtains a nuclear weapon. The international community would prefer to try to offer a reward that can satisfy a hawk than let it continue and acquire nuclear weapons. The international community may still decide to coerce if the cost of the reward they would offer to the proliferator is greater than the former's value for inducing a proliferator to stop its weapon's program in addition to the costs of sanctions. Second, the international community would prefer to reward the proliferator as the cost of doing so is lower than the cost of coercion, where either type of proliferator is likely to continue. Here, the size of the reward is enough to compensate a hawk proliferator but less than the costs that the international community would pay for imposing sanctions again a proliferator.

In the third instance, the international community faces a trade-off. If they choose to coerce and pay those costs, a hawk will continue and a dove will sometimes continue, with positive probability q_D. If this happens, the international community does not receive its desired outcome of deproliferation. On the other hand, the international community may instead decide to offer a very costly reward that she does not want to pay and hopes that if the proliferator is a hawk, she will reject the deal. If, however, the hawk proliferator does actually accept the reward and stop her program, the international

community would still prefer this outcome to one where they pay the costs of coercion and still do not succeed in inducing the proliferator to reverse its nuclear program. This dynamic is even more evident when offering a reward to a dove: given the lower costs of inducing a dove, the international community prefers to reward than coerce.

Lastly, in this case, the international community would again prefer to offer a reward as it will stop both a dove and a hawk from acquiring nuclear weapons. Though the costs of the reward are high, significantly greater than the value a hawk places on obtaining nuclear weapons, the international community would prefer to do this than threaten to coerce the proliferator (which would result in a hawk proliferator continuing his program). Indeed, as the value of the reward increases, the international community is more likely to be able to induce even the most hawkish of proliferators to stop their nuclear programs. Thus, the results from this model indicate that if the international community does not have a credible threat to use force and promises to reward a proliferator, it is much more likely to receive its preferred outcome, deproliferation, than if they begin by coercing the proliferator.

In the second broader case, where the international community *can* credibly threaten to use military force against the proliferator, both types of proliferator stop their nuclear programs. Given that, the international community can avoid paying the costs of rewarding the proliferator by threatening to coerce from the outset and prefers this strategy. Thus, the international community does not pay the costs of the sanction and still receives its desired outcome - the proliferator stops the program.

Comparative Statics

What are the effects on the outcomes of interest - whether the proliferator continues or stops its program- if we change some of the parameters, such as the value that the international community holds for stopping proliferator (V_1) or the size of the reward that the international community is willing to offer (R_1)? First, I focus on cases where the international community does not have the option to use military force. In this instance, if the international community's value for stopping a proliferator's program increases, her belief that the proliferator is a hawk increases such that she will prefer to use will use just one round of sanctions. She knows that using multiple rounds of sanctions against a hawk is ineffective, as the hawk will just continue to proliferate, and she will give up. If she does nothing, both hawk and dove proliferators will continue. Thus, as the value for stopping a program increases, so does the likelihood that both proliferators will continue their programs. Interestingly, the international community's value for stopping the program does not affect the likelihood that it will offer a reward, such that it affects whether the proliferator will continue or stop its program

Indeed, the parameter that does affect the proliferator's behavior is the size of the reward. As the reward offered by the international community increases, it is likely to induce more states to accept the reward and stop their programs, even without the coercive threat of military force. As R_2 increases such that it becomes greater than the value that even a hawk holds for acquiring nuclear weapons, both types of proliferators are certain to stop.

Let's next consider these dynamics in the case where the international community can exercise the military option. First, if V_I increases significantly such that the international community's valuation for stopping a proliferator's program is greater than

the costs of coercion, she will consider the military option. In this case, where $V_1 > C_1$, and the international community prefers to go down the coercion route, an increase in the international community's valuation for stopping a proliferator's program makes it is more likely that she will exercise her military option and attack. Both proliferators will stop their programs if the international community will attack them.

If, on the other hand, the international community prefers to reward the proliferator, but retains the option to implement a military strike against the proliferator, the size of the reward is irrelevant. By offering a reward, the international community loses the opportunity to coerce a dove proliferator, which makes the option for further sanctioning useless and the threat of an attack credible. For both proliferators, an attack imposes such great costs such that they would prefer to accept any offer of a reward (and the subsequent promise not to attack), regardless of its size. In this case, an increase in the size of the reward does not affect the outcome, as even an offer of $R_2 = 0$ will work to stop a proliferator's program.

Hypotheses

The theoretical model presented in this chapter provides the basis for the derivation of hypotheses for the empirical analysis conducted in the remainder of the dissertation. First, an implication from the theory of deproliferation is that proliferators, especially those less inclined to acquire nuclear weapons, may be more willing to renounce their nuclear ambitions when offered a reward than when coerced by the international community. This implication about the differential effect of positive and negative inducements as policy instruments of the international system fundamentally

distinguishes this theory of nuclear reversal from alternative arguments and existing non/counter-proliferation policy. Under the strategic bargaining theory, the international community plays a substantial role in providing incentives—either benefits that are initially offered and guaranteed upon proof of stopping or dismantling a weapons program, or heavy costs that are imposed by one or more members of the international community—to states that have embarked on some nuclear weapons activity. If the international community begins these bargaining interactions by offering rewards, rather than coercing the proliferator, the theory suggests that the offer and acceptance of rewards will cause the state to deproliferate – even among the most committed of proliferators. The theory of nuclear reversal further refines this implication: if the international community begins by coercing the proliferator, there are very few conditions under which any type of proliferator (either those with high or low values for acquiring nuclear weapons) will abandon their weapons program. The theory does not imply that rewards 'work' every time for all types of proliferators or that coercion will never result in successful deproliferation. Rather, implications from the formal theory suggest that rewards may be a better lever for the international community to encourage a state to give up its weapons program, while the use of coercion may actually backfire especially if aimed at proliferators who may be willing to go to extreme lengths to acquire nuclear weapons.

To capture variation among proliferators, the model provides differential implications between 'hawk' proliferators (those states that place a high value on acquiring nuclear weapons) and 'dove' proliferators (that have a lower valuation for their nuclear pursuit). To distinguish themselves from other proliferators, hawks are willing to

send costly signals about their value for nuclear weapons to alter the behavior of the international community in the next stage of interaction. To some extent, this strategy works—given that hawk proliferators are willing to suffer the cost of coercion—these negative inducements are likely to be unsuccessful in persuading them against the pursuit of nuclear weapons. If a hawk is less likely to deproliferate when sanctioned, the international community prefers to do nothing than endure the costs of sanctioning with no hope of success. If the international community takes no action against a proliferation attempt, even states with low values for proliferation will want to continue their programs. Thus, once the international community begins coercion, both hawk and dove proliferators are more likely to persist in their nuclear pursuit. On the other hand, if the international community chooses to offer rewards, doves are more likely to accept rewards as are those hawk proliferators who believe the use of force is possible or if the rewards offered are of commensurate value, are more likely to abandon their nuclear program and accept these deals. These different implications allow a test between them.

The hypotheses for testing:

Rewards Hypothesis: Offering rewards that are guaranteed by the international community increase the likelihood that a state will stop its nuclear program.

Sanctions Hypothesis: Imposing the costs of coercion, specifically sanctions, decrease the likelihood that a state will stop its nuclear program.

Concluding Remarks

In this chapter, I present my theoretical framework for deproliferation. I begin by examining the scholarship on 'carrots' and 'sticks' in international relations, how states use these tools to more bargain, and some of the theoretical and empirical limitations they

may pose for effective nuclear proliferation policy. With this foundation, I develop a theory of deproliferation that examines how the international community can bargain with proliferators to induce nuclear reversal. Adapted from crisis bargaining models in international relations, I illustrate these dynamics through a formal model that depicts the bargaining dynamic between the international community, Player 1, and the proliferator, Player 2, where the international community begins the interaction by either choosing to reward or coerce, the proliferator chooses to continue or stop its nuclear program, and the international community may then respond by either choosing to do nothing, sanction, or attack. The model predicts that rewards, offered upfront, are accepted by doves and help to distinguish them from hawk proliferators. If the subsequent threat to use force is not credible, some doves may still "pool" with the hawks in hopes of acquiring a weapon.

However, if the international community has the option to attack, doves are more likely to accept rewards, as are those hawks who believe the use of force is more likely against their program. Threats to use force or impose sanctions are more likely to be made against hawks and, thus, are likely to be unsuccessful in persuading them against the pursuit of nuclear weapons. Implications from the model yield the primary argument of this dissertation: rewards can induce states who are not strongly inclined to develop to stop, as well as some proliferators with higher values for acquiring nuclear weapons, while coercion may actually prolong some nuclear programs.

Analyzing the formal model yields these core theoretical implications. These implications essentially vary based on the international community, primarily the United States' willingness to use force against a particular proliferator – ostensibly, whether they would prefer to allow the proliferator to succeed rather than use military force to stop

them. If we imagine an interaction with a proliferator where the US is not willing to attack the state or where war is not an option but, where the US is sufficiently convinced that the proliferator is a hawk, then the international community can offer a reward that all proliferators will accept and subsequently stop their programs. Sanctions will certainly not work against hawk proliferators, as they do not fear the use of military force if they continue. If the US believes the proliferator is a dove, she can either use rewards or coercion to induce the proliferator to stop the program. In the instance, rewards can stop both hawks and doves and sanctions can be counter-productive, actually working to encourage some hawk proliferators to continue their programs.

If, however, the US were willing to use force, she would prefer to do so than impose costly and ineffective sanctions against the proliferator so she will attack and stop the weapons program. Interestingly, in this instance where the US could use force but instead chooses to offer a reward, they serve a different and unexpected role. Dove proliferators, with low values for nuclear weapons, will always want to accept a reward and stop their nuclear weapons program to avoid an attack. If a proliferator decides to reject an offer of reward, they reveal to the US their high value for nuclear weapons and raise the likelihood that the United States would be willing to go to war to stop their program. To avoid the costs of war, most hawk proliferators will want to accept the reward and stop their pursuit. In this way, rewards are very effective instruments at stopping both hawks and doves from continuing their weapons programs. These analyses match the implications from the theoretical model: offering rewards, rather than imposing the potentially inefficient costs of sanctions, increases the likelihood that a state will deproliferate (the result is robust especially when controlling for potential omitted

variables identified in the literature and to various model specifications). However, given that this is an observational, cross-national analysis, it is still possible that another omitted variable is influencing the likelihood of nuclear reversal or that another mechanism can explain the relationship between inducements and deproliferation. To examine whether the mechanisms predicted by the formal model are working in this empirical analysis, I briefly examine some cases of nuclear reversal. I explore these mechanisms and implications below.

Discussion of Implications in the Historical Record

First, as stated above, the formal theory implies two sets of conditions, broadly differentiated based on whether the international community can credibly threaten to attack a proliferator. I find support for this general distinction: there is evidence to suggest that the international community is often unwilling to use, or even threaten to use, force against some proliferators. This is especially likely to be the case with states, such as Sweden or Canada, with low-value for nuclear program and who do not pose a great threat to international security. Interestingly, however, this may also be true for states for whom acquisition is a foregone conclusion: it is not likely that the international community would have preferred to attack a proliferator, such as Pakistan or Iran, given its high latent nuclear capacity and strong commitment to proliferation.

It is also possible to determine whether it is possible that the international community can sometimes choose to do nothing, rather than provide positive incentives or impose high coercion costs on a proliferator. Recently declassified documents from the Kennedy and Johnson administrations, acquired from the National Security Archives, reveal the ambivalence and course of non-action that the United States chose in

addressing the increasingly likely Chinese acquisition of nuclear weapons. The evidence suggests that although US intelligence was relatively confident that China would successfully conduct a nuclear test in the early 1960s, it was much less certain about the appropriate course of action to contain or neutralize a Chinese nuclear capability (Burr and Richelson 2001). In January 1963, advisors to President Kennedy suggested that the US cooperate with Moscow to 'compel China to stop nuclear development,' where concern of a nuclear China, and the potential threat of a nuclear Germany, would form the basis for an anti-China alliance. After months of inaction and ambivalence about how to manage the Chinese threat (whether to use military force or enter into a tenuous political alliance with the Soviets), the administration began to consider the possibility that a nuclear China may not act as recklessly or belligerently as predicted (Burr and Richelson 2001). By 1964, the United States had ostensibly ran out of time to prevent Chinese proliferation and had "fully anticipated the possibility of Peking's entry into the nuclear weapons field and had taken it into full account in determining our military posture" (Burr and Richelson 2001).

What accounts for the US's non-response to the threat of a Chinese proliferation, and potentially other instances in which the international community chooses to do nothing to stop proliferation? First, it is possible that the US delayed acting to stop China's acquisition of nuclear weapons because it lacked a strong ally in the Soviets and did not want to engage China without assistance from the Soviets (who at the time of China's proliferation would have preferred to close the nuclear club). Evidence also suggests that, although the US was concerned about the prospect of a nuclear-armed China, they were also worried about the proliferation repercussions throughout Asia.

This inherent policy tension, and the lack of other viable partners with whom to cooperate to incentivize reversal, may have stunted and ultimately prevented the US and other members of the international community from effectively responding to the increasing likelihood of a nuclear China.

Evaluation from among the deproliferation cases also provides evidence of the rewards mechanism at work. I provide a few brief illustrations of this from my larger case study work. In a variety of instances where both low-value/dove proliferators and high-value/hawk proliferators embarked on a nuclear weapons program, we can see that specific benefits worked to incentivize the proliferators to abandon their nuclear program, given their expectations about what the international community would do in response if they continued their pursuit. Sweden, for example, pursued a nuclear weapons program beginning in 1945. The main aim of the research was to determine how Sweden could best protect herself from a nuclear weapons attack. One of the first and most important tasks, for the newly founded Atomic Commission, was to acquire uranium – ostensibly putting Sweden on the proliferation fast-track (Jonter 2010). In an initial effort to shift Sweden's focus from weapons production to a civilian nuclear program, the United States began to offer technological assistance and collaboration on nuclear research and development. In addition to this burgeoning nuclear cooperation between Sweden and the US, the latter began to offer military assistance, such as selling US robot systems (the Falcon, Sidewinder, and the Hawk). Indeed, the evidence suggests,

> The increasingly close cooperation between the two states in the area of military technology led to the use of formal and, primarily, informal channels to communicate what was permissible for Sweden if it wished to see this cooperation continue. The more Sweden's nuclear related R&D became dependent on U.S. military assistance and collaboration,

> the more the United States could use its superiority to steer Sweden away from its nuclear weapons plans (Jonter 2010).

The US and its promise of military assistance played a similar role in the Japanese nuclear program. Japan's status as a non-nuclear state is an interesting counter-example to nuclear proliferation theory that suggests that external threats play a defining role in motivating states to pursue nuclear weapons. For some, the Japan's high latent nuclear status (a significant economic power with a large civilian nuclear energy program that could quickly turn to the development of nuclear weapons) and its ongoing external security threats, make it a prime candidate for the next wave of proliferators. Others, however, suggest that the Japanese case effectively demonstrates the importance of normative and cultural values in affecting policy outcomes (Katzenstein 1996; Katzenstein and Okawara 1993). One additional explanation could lie with Japan's ongoing relationship with the United States and the capacity for the latter to help provide security in the event of foreign aggression. Indeed, some argue: "Japan's most significant insurance policy against nuclear threats is its bilateral alliance with the United States" (Hughes, 2007). In this instance, the offer of a security guarantee and military assistance (initially offered in the Mutual Defense Assistance Act of 1954) provides Japan with a significant incentive to maintain its non-nuclear status after an initial exploration of an indigenous nuclear program (Hughes, 2007).

Lastly, we can examine the role of sanctions as potential obstacles to deproliferation. Iran's proliferation story, for example, is in some ways very similar to those of the de facto proliferators: as a hawk state that has placed a high value on acquiring nuclear weapons, it seems unlikely that Iran will reverse its program and

equally unlikely it will give up its nuclear deterrent when it successfully acquires one. While the United States has taken the lead on negotiating with the Iranians, sometimes offering a set of carrots—e.g., renewal of US-Iranian diplomatic relations and halting hostile behavior towards Iran, the abolishment of sanctions, and access to peaceful WMD (bio/chemical/nuclear) technology—, the international community has generally turned to sticks, to no avail. To date, Iran has not agreed to accept these conditions and reverse its nuclear progress, resulting in a stalemate between the Iranians and the international community. Iran's path to proliferation can help to illuminate the limitations of negative inducements, especially economic sanctions, on affecting a significant change in nuclear policy decisions. Iran has been the target of repeated economic sanctions from the international community, and though it has not been deterred in its nuclear ambitions, it has been argued that economic sanctions were effective in bringing Iran to the bargaining table for the Iranian Nuclear Deal (JPA) proposed in November (Kroenig 2014). Iran's nuclear trajectory highlights an implication from the formal model that suggests that some states, with a high resolve for nuclear weapons acquisition, may be undeterred from stopping their program, especially when coerced.

The mechanisms in these cases—resulting in both success and failures—operate as the formal theory of deproliferation predicts. Many instances of proliferation are sufficiently curbed when the target state is offered a reward, such as military assistance. It also seems to be the case that when proliferators are coerced with economic sanctions, and sometimes the use of military force, they are less willing to forego their nuclear ambitions, and may instead decide to continue down their path to proliferation.

The following chapters of the dissertation incorporate a series of empirical analyses to test these hypotheses. Chapter 3 provides a novel large-n quantitative analysis of the empirical determinants of nuclear deproliferation over time. Chapter 4 assesses a variety of instances of deproliferation and proliferation by examining the role of rewards and sanctions in their nuclear trajectories. Lastly, Chapter 5 includes an in-depth examination of these causal processes in two case study analyses of the Egyptian and Indian nuclear weapons programs.

Appendix 2

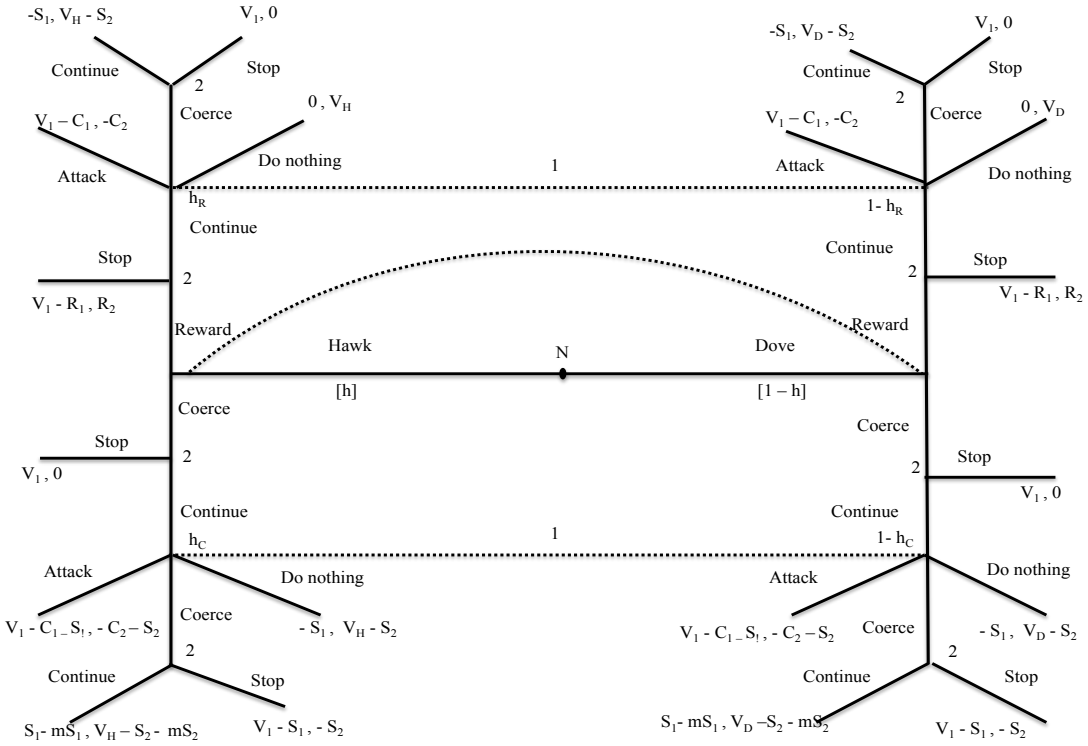

Figure 2.1: Formal Model: Proliferator and International Community

Proof of Formal Model

Overview of Equilibrium:

The International Community Has Option to Use Military Force: $V_1 < C_1$

Outcome varies on beliefs about h, where $h > h^*_{cn}$

a) $h > h_{cn}$,* then Player 2 continues regardless of type and player 1 does nothing

Equilibrium outcome: proliferation

b) $h < h_{cn}$,* then Hawk continues, Dove continues with q_D^* and Player 1 sanctions again with probability, $p_{D.}^*$

Three possible equilibrium outcomes:

(i): Unsuccessful multiple rounds of sanctions (if Hawk)
(ii): Successful first round of sanctions (if Dove who continues)
(iii): Successful deterrent threat (if Dove stops)

Outcome varies on size of R_i

1) both Hawk and Dove continue, and IC does nothing
$R_2 < 2V_D < 2V_H$: reward cannot stop either type,
2) Hawk continues, Dove stops, and IC does nothing.
$2V_D \leq R_2 \leq 2V_H$: reward stops Dove but not Hawk.
3) Hawk and dove stop, IC does nothing.
$2V_D \leq 2V_H \leq R_2$: reward stops both Dove and Hawk.

The International Community Has No Option to Use Military Force: $V_1 > C_1$

Unique PBE:

Coercive Subgame:
Both hawk and dove proliferators always stop.
Reward Subgame:
Independent of size of reward (or $R_i=0$), both hawk and dove proliferators always stop.

Case 1: No Military Option ($V_1 < C_1$)

Do nothing = n
Attack = a
Coerce =c

$V_1<C_1 \Rightarrow n \succsim a$ (doing nothing strictly dominates attacking), so 1 chooses between coerce and do nothing. There will be no a in any equilibrium.

1a) Reward Subgame

U_1 (c | reward) = h_r $(-S_1)$ + $(1-h_r)(-S_1)$ = $-S_1$
(hawk continues) (dove continues)
U_1 (n| reward) = 0

$\Rightarrow n \succsim c$ (strict dominance)
$\therefore$ If reward is rejected, Player 1 does nothing

2a) Coerce Subgame

U_1 (c | coerce) = h_c $(-S_1 - mS_1)$ + $(1-h_c)(V_1 - S_1)$
(hawk continues) (dove stops)
$=V_1 - S_1 - h_c(V_1+mS_1)$
U_1 (n| coerce) = $-S_1$

Player 1 coerces again iff $\frac{V_1}{V_1+mS_1} > h_c$

Let $h_{cn}^* = \frac{V_1}{V_1+mS_1}$

$\therefore$ If Player 2 continues despite one round of coercion, Player 1 coerces again if and only if, $h_c < h_{cn}^*$ Otherwise, she does nothing (if $h_c = h_{cn.}^*$ she can mix)

p=Pr (coerce again) = 1 if $h_c < h_{cn}^*$
0 if $h_c > h_{cn}^*$
mix if $h_c = h_{cn.}^*$

Consider now Player 2:
a) if offered a reward, he knows that rejecting it will cause Player 1 to give up, so he will get the program.
Hawk accepts the reward if and only if, $V_H > R_2$.
Dove accepts the reward if and only if, $V_D > R_2$.

Assumption 2a: $V_H > R_2 > V_D$
Assumption 2b: $R_2 > V_H$

Lemma 1:
Under A2a, Hawk rejects reward and gets program, Dove accepts reward and stops.
Under A2b, Both types accept reward and stop

If coerced, Player 1 will either do nothing (with probability, 1-p) or will coerce again (with probability, p).

U_H (c | coerced) = p ($V_H - S_2 - mS_2$) + (1-p)($V_H - S_2$)
(hawk continues after 2nd round of coercion)
$= V_H - S_2 - pmS_2$
U_H (s | coerced) = 0

=> Hawk continues when coerced iff $p < \frac{V_H - S_2}{mS_2} \equiv p_H^*$

U_D (c | coerced) = p($-S_2$) + (1-p)(V_D-S_2)
(dove stops after one round of coercion)
$= V_D - S_2 - pV_D$

U_D (s | coerced) = 0
=> Dove continues when coerced iff $p < \frac{V_D - S_2}{V_D} \equiv p_D^*$

Since $p_H^* > p_D^*$

$\frac{V_H - S_2}{mS_2} > \frac{V_D - S_2}{V_D}$ under A1, [$V_D(V_H - mS_2) > S_2 (V_D - mS_2)$]

It follows that if the Dove continues (w/ positive probability), so must Hawk (w/ certainty) and if the Hawk stops (w/ positive probability), so must dove (w/ certainty).

Let q_H be the probability that the Hawk continues and q_D the probability the Dove continues.

$q_D > 0 \Rightarrow q_H = 1$
$q_H < 1 \Rightarrow q_D = 0$

(i) There are no separating equilibria:

1) ($q_H = 1, q_D = 0$) $\Rightarrow h_c = 1 > h_{cn}^* \Rightarrow p=0 \Rightarrow q_D = 1$
2) ($q_H = 0, q_D = 1$) $\Rightarrow h_c = 0 < h_{cn}^* \Rightarrow p=1 \Rightarrow q_D = 0$

(ii) There is a pooling on continuing PBE only if $h_c > h_{cn}^*$
($q_H = q_D = 1$) $\Rightarrow h_c = h$
a) $h_c > h_{cn}^* \Rightarrow p=0$, PBE

b) $h_c < h_{cn}^*$ => p=1, qD=0

(iii) There is a pooling on stop PBE if we assign $h_c < h_{cn}^*$:
($q_H=q_D=0$) => h_c is off path. Assign $h_c < h_{cn}^*$ => p=1 => $q_D=0$ and
since $V_H - mS_2 - S_2 < 0$, $q_H = 0$ too.
This PBE always exists regardless of prior. It can't be eliminated with intuitive criterion.
(iv) There is a semi-separating PBE where Hawk continues, Dove mixes, and Player 1 mixes too:

$q_D \in (0, 1]$ => $q_H=1$ => $h_c = \frac{h}{h+(1-h)q_D}$

Since Dove mixes, $p = p_D^*$ => Player 1 must mix too
=> $h_c = h_{cn}^*$

$\frac{h}{h+(1-h)q_D} = h_{cn}^*$ => $q_D^* = \frac{(h)}{(1-h)} \times \frac{(1- h_{cn}^*)}{(h_{cn}^*)}$

Check $qD < 1 \Leftrightarrow h < h_{cn}^*$
∴ This PBE only exists if $h < h_{cn}^*$

(v) There are no other semi-separating PBE: only possibility to check:
$q_H \in [0, 1)$ => $q_D=0$ => $h_c = 1 > h_{cn}^*$ => p = 0

Lemma 2: In coercive subgame, the PBE is:

a) $h > h_{cn}$,* then Player 2 continues regardless of type and player 1 does nothing
Equilibrium outcome: proliferation

b) $h < h_{cn}$,* then Hawk continues, Dove continues with q_D^* and Player 1 sanctions again with probability, p_D.*

Three possible equilibrium outcomes:

(i): Unsuccessful multiple rounds of sanctions (if Hawk)
(ii): Successful first round of sanctions (if Dove who continues)
(iii): Successful deterrent threat (if Dove stops)

Additionally, there is "successful deterrence" PBE regardless of h, but is not interesting since Player 1 threatens Player 2 with beliefs).

Lemmata 1 and 2 imply there are four cases to consider:

1a) Assumption 2a and $h > h_{cn}^*$: Hawk proliferates always, Dove stops if rewarded but proliferates if coerced.

1b) Assumption 2a and $h < h_{cn}^*$: Hawk proliferates (even after 2 rounds of sanctions); Dove stops if reward and when coerced.

1c) Assumption 2b and $h > h_{cn}^*$: Both accept reward and stop; proliferate if coerced.

1d) Assumption 2b and $h < h_{cn}^*$: Hawk stops if rewarded, proliferates if coerced; Dove stops if rewarded.

Case 2: Military Option ($V_1 > C_1$)

=> a $\succsim$ n (attacking strictly dominates doing nothing), so Player 1 chooses between coerce and attack. There will be no n in any equilibrium.

2a) Coercive Subgame: Dove always stops:

U_D (s | coerce) = 0

U_D (c | coerce) = {$-S_2 - C_2$ if Player 1 attacks; $-S_2$ if Player 2 coerce again}

=> $h_c = 1$

=> U_1 (a | coerce) = $V_1 - S_1 - C_1$

U_1 (c | coerce) = $-S_1 - mS_1$ (since Hawk won't stop)

Since $V_1 - C_1 > 0 > -mS_1$

=> Player 1 will attack

=> Hawk will stop because $0 > -S_2 - C_2$

Lemma 3: when Player 1 has military option, both types will stop when threatened with sanctions.

It is interesting that since sanctions will be ineffective against Hawk, he will get attacked if he ignores threat and continues. Dove will strictly prefer to stop when he expects either an attack or more sanctions. If Player 1 sees Player 2 continue, she would infer that the proliferator is a hawk, which will make it preferable to strike.

2b) Reward Subgame: Sanctions won't work:

U_1 (c | reward) = $-S_1$ (one round can't stop Dove)

U_1 (a | reward) = $V_1 - C_1$

Since $V_1 - C_1 > 0 > -S_1$, then Player 1 attacks if reward offer is rejected. But then neither type will reject the reward because $R_2 > 0 > -C_2$.

Lemma 4: When Player 1 has the military option, both types accept reward and stop.

It is interesting that by offering reward, Player 1 foregoes to option to coerce the Dove (since she misses one round of sanctions). This may make further sanctioning useless since neither type would stop for just one round, which makes the attack threat credible and makes the reward offer work. The reward is actually very coercive since if

Player 2 rejects it, he will be met with force. The size of R_2 is irrelevant => even $R_2 = 0$ will work.

With the military option on the table, proliferation will never happen. Any reward would be accepted but even the threat of sanctions will work by itself. This means that Player 1 is strictly better off with sanctioning threats rather than paying the cost of the reward.

Case 1: No Military Option: $V_1<C_1$

Coerce:

1) Both hawk and doves continue (Pooling) where, $h > h^*_{cn}$
2) Hawk continues, Dove mixes (Semi-separating), where $h < h^*_{cn}$

a) If international community does nothing:

Hawk continues and Dove continues with $q_D = \frac{h}{1-h} \times \frac{h^*_{ns}}{1 - h^*_{ns}}$

b) If international community sanctions with probability, p: $\frac{1 - S_2}{2V_D}$:

Hawk continues, Dove stops

Reward:

1) Dove stops, Hawk continues if $2V_D \leq R_2 \leq 2V_H$
2) Both Hawk and Dove stop if $2V_H \leq R_2$

Four Cases:

1a) *Assumption 2a:* Hawk rejects reward and gets program; Dove rejects reward and stops and $h > h_{cn}^*$*:* Hawk proliferates always, Dove stops if rewarded but proliferates if coerced.
1b) *Assumption 2a:* Hawk rejects reward and gets program; Dove rejects reward and stops *and* $h < h_{cn}^*$*:* Hawk proliferates (even after 2 rounds of sanctions); Dove stops if reward and when coerced.
1c) *Assumption 2b:* both types accept reward and stop and $h > h_{cn}^*$: Both accept reward and stop; proliferate if coerced.
1d) *Assumption 2b:* both types accept reward and stop and $h < h_{cn}^*$: Hawk stops if rewarded, proliferates if coerced; Dove stops if rewarded.

Recall:

$$\frac{V_1}{V_1 + mS_1} \equiv h^*_{cn} \qquad q_D = \frac{h}{1-h} \times \frac{h^*_{cn}}{1 - h^*_{n}} \qquad p = \frac{1 - S_2}{2V_D}$$

Case (i): $h > h^*_{cn}$ and $V_D \leq R_2 \leq V_H$

U_{IC} (coerce) = - S_1 $\quad\quad$ U_{IC} (reward) = h (-V_1) + (1-h)(V_1 – R_1)

-V_1 – S_1 ? V_1 – 2hV_1 – (1-h)R_1
-S_1 ? (1-h)(2V_1-R_1)
If 2V_1 – R_1 ≥ 0, then offer reward
If 2V_1 – R_1 < 0, then
a) offer reward if:
-S_1 < (1-h)(2V_1-R_1)
$$h > \frac{2V_1-R_1+S_1}{2V_1 - R_1}$$

b) otherwise coerce

Can: $h > \frac{2V_1-R_1+S_1}{2V_1 - R_1}$ and $h < \frac{2V_1- R_1+S_1}{2V_1 - R_1}$

$$mR_1 > 2V_1S_1 + 2V_1mS_1 + mS_1^2$$

$$R_1 > \frac{2V_1}{m} + 2V_1 + S_1$$

Case (ii): $h < h^*_{cn}$ $\quad$ and $\quad$ $V_D \le R_2 \le V_H$

U_{IC} (coerce) = h(1) + (1-h)(q_D) x
[pr (P continues) x U_{IC} (continue) + Pr(P stops) x U_{IC} (stop)]
=(h+(1-h) q_D)(-V_1-S_1) + (1-(h+(1-h) q_D)(V_1)
U_{IC}(reward) = V_1 – 2hV_1 – (1-h)R_1

V_1 – 2(h+(1-h)) q_D(V_1) – (h+(1-h) q_D(S_1) < V_1 – 2hV_1 – (1-h)R_1
-2V_1(1-h) q_D < (h+(1-h)(q_D)S_1 –(1-h)R_1

$$-4V_1^2 \text{ x } h < h\left(1 + \frac{2V_1}{mS_1}\right) S_1 - (1-h)R_1$$

$$R_1 < h\left[R_1 + S_1 + \frac{2V_1}{m} + \frac{4V_1^2}{mS_1} \right]$$

$$\frac{R_1}{R_1 + S_1 + \frac{2V_1}{m} + \frac{4V_1^2}{mS_1}} < h < h^*_{ns} < \frac{2V_1}{2V_1 + mS_1}$$

Case (iii): $h > h^*_{cn}$ $\quad$ and $\quad$ $V_H \le R_2$

U_{IC} (coerce) = - S_1 $\quad\quad$ U_{IC} (reward) = V_1 – R_1

$$V_1 - R_1 > -S_1$$
$$R_1 < V_1 + S_1$$

For reward: $R \in (2V_H, 2V_1 + S_1)$

Case (iv): $h < h^*_{cn}$ and $V_H \leq R_2$

U_{IC} (coerce) = $h(1) + (1-h)(q_D)$ x
[pr (P continues) x U_{IC} (continue) + Pr(P stops) x U_{IC} (stop)]
$=(h+(1-h)\, q_D)(-V_1-S_1) + (1-(h+(1-h)\, q_D)(V_1)$

U_{IC}(reward) = $V_1 - R_1$

$V_1 - 2(h+(1-h))\, q_D(V_1) - (h+(1-h)\, q_D(S_1) < V_1 - R_1$
$-2V_1(1-h)\, q_D < (h+(1-h)(\, q_D)S_1 - R_1$

$$-4V_1^2 \text{ x } h < h(1 + \frac{2V_1}{mS_1})\, S_1 - R_1$$

$$R_1 < h\,[\, S_1 + \frac{2V_1}{m} + \frac{4V_1^2}{mS_1}\,]$$

$$\frac{R_1}{S_1+\frac{2V_1}{m}+\frac{4V_1^2}{mS_1}} < h < h^*_{ns} < \frac{2V_1}{2V_1 + mS_1}$$

Case 2: The International Community Has a Military Option: $V_1 > C_1$

U_{IC} (coerce) = V_1
U_{IC} (reward) = $V_1 - R_1$

$V_1 > V_1 - R_1$
$R_1 > 2V_1$

IC prefers to coerce than reward.

CHAPTER 3: THE EMPIRICAL DETERMINANTS OF DEPROLIFERATION: EXAMINING THE EFFECT OF INDUCEMENTS ON NUCLEAR REVERSAL

Introduction

Under what conditions will nuclear aspirants reverse their programs? In Chapter 2, I presented a formal model that illustrated the strategic interaction between the international community and a proliferator as they bargain over nuclear reversal. Based on the model's results this chapter makes the following argument: proliferators, especially those with lower values for nuclear weapons, are more likely to stop their nuclear pursuit when offered rewards than when punished with economic sanctions. This chapter tests the primary set of empirical implications that determine when positive and negative inducements are associated with encouraging a state to deproliferate.

Through a cross-national, time-series analysis of the factors that induce states to give up their weapons programs, this chapter shows that strategic economic or military rewards are positively associated with persuading states to abandon their nuclear programs while sanctions actually decrease the likelihood that states will stop their nuclear pursuit. More specifically, this analysis indicates that economic sanctions imposed by the United States decrease the probability that a state that has embarked on nuclear weapons will stop their pursuit. It also provides initial evidence that the expected mechanisms support these correlations. In the following chapters, I investigate these mechanisms through comparative in-depth case study analyses. It is often difficult to establish causal identification or relationships through observational data but these chapters seek to use a variety of quantitative and qualitative data to test whether the

empirical implications of the theory approximate reality. Through these analyses, I find initial evidence that they do. In contrast to some of the extant literature on the nonproliferation and traditional US foreign policy, this chapter suggests a reexamination of the strategic tools that the international community, and the United States in particular, may be able to employ to better bargain with current and future proliferators to increase the likelihood of nuclear reversal. Overall, these findings lend support for my theory of deproliferation (given the assumptions and scope conditions of the formal model presented earlier), thus providing cause for optimism as to the role of the international system in more effectively and permanently encouraging deproliferation.

This chapter assesses these hypotheses in cross-national data using a series of logit models. I focus my analysis on states that have engaged in nuclear weapons activity, ranging from exploration to weapons acquisition, from the end of the Cold War to the present. Most of the comparison in the analysis occurs across different types of rewards and coercion, but some of the comparison occurs among proliferators. Groups diverge along two key dimensions: sometimes states proliferate and do not stop their nuclear programs; among those that do stop, some do so when offered a set of carrots, rather than sticks. The analysis, then, focuses on conditions under which proliferators reverse their nuclear programs, comparing the likelihood that positive and negative inducements are associated in persuading states to do so.

The Dependent Variable

The dependent variable of interest is whether a state that has begun nuclear weapons activity ends its nuclear pursuit in a given year – essentially, the year that a state

deproliferates. To be included in the dataset, the state must have at least begun an initial pursuit of nuclear weapons, or engaged in nuclear weapons activity. To code the start and stop years of the program, I use coding rules from three different datasets: Bleek (2013), Way (2012), and Mueller and Schmidt (2004). Mueller and Schmidt's study in nuclear reversal provide the most expansive list of states for which there is evidence of some form of nuclear activity that subsequently stopped. Similarly, both Bleek and Way provide proliferation coding dates in their datasets on nuclear weapons proliferation. To establish the broadest possible list of states that initially explore nuclear weapons, I combine these data together to create a new dataset of nuclear weapons activity from 1945-2007.[15]

These datasets distinguish between four levels of nuclear weapons activity—no activity, exploration, pursuit, and acquisition—arrayed on a continuum ranging from no interest to possession of a nuclear arsenal (Bleek 2013; Way 2012). Every country that has ever exploded a nuclear device or built an operational nuclear weapon is coded as a nuclear state in the year of its first explosion or as having acquired a functional nuclear weapon until the date that it abandons the program. States are designated as having 'pursuit of weapons' if they made an active effort to pursue nuclear weapons as a proliferator, such as a political decision by cabinet-level officials, moves towards weaponization, or specialized development of single-use technology for military purposes. Lastly, exploration (the most comprehensive indicator of proliferation) codes states as nuclear proliferators from the year that they originally considered building

[15] Every model specification includes three coding dates: Bleek, Way, and my own. Across the three datasets, I find similar results for each model specification.

nuclear weapons. This is based on evidence of nuclear research conducted by or associated with the military or a political authorization to begin nuclear exploration. States that initially engaged in some form of nuclear weapons activity and later stopped exploration (or pursuit and acquisition) of nuclear weapons and renounced their nuclear ambitions are coded as deproliferated states and the focus of this study.

There are observable coding differences across the Bleek, Way, and Mueller and Schmidt datasets. Both Bleek and Way, for example, omit the former Soviet satellite states that inherited nuclear weapons after the breakup of the Soviet Union (Ukraine, Kazakhstan, and Belarus) from their analysis. I include them in my analysis because, though there was no independent decision to explore or pursue nuclear weapons, there was an active decision to return their substantial arsenals (Ukraine being the 3rd largest with its inheritance) to the Russians (Mueller and Schmidt 2004; Blanc 2008). In this way, returning an operational nuclear arsenal is seemingly more similar to South Africa's decision to dismantle its clandestine program and deproliferate than to a decision to not embark on nuclear weapons activity initially.

Furthermore, Mueller and Schmidt argue for the inclusion of other states, such as Spain and Canada, that they believe began nuclear exploration before choosing to renounce their nuclear ambitions (Blanc 2008; Juan C and Garrido 2001; Vinat 1985). Spain's production of weapons-grade plutonium at the Coral-1 experimental reactor, its decision to not sign the Nonproliferation Treaty (NPT) in 1968, and its feasibility studies of the likelihood of successfully developing nuclear weapons, sparked suspicion that they had moved from no interest to nuclear exploration (which subsequently ended in 1975). Similarly, Mueller and Schmidt add Canada to their list of nuclear aspirants. As an

original member of the Manhattan Project, Canada is one of the first states to seriously explore the nuclear option, with its development of a pressurized heavy water reactor and expertise in uranium mining, refining, and conversion. Canada reverted to an official non-nuclear status when it signed the NPT and removed US nuclear weapons from Canadian bases in the 1970s (Blanc 2008; Paul 2000).

Using this broader list of nuclear weapons activity, I identify the years in which a given proliferator begins and ends its nuclear program using data from Bleek, Way, Mueller and Schmidt and a variety of secondary sources as confirmation of these dates.[16] Table 3.1 located in Appendix 3 presents the full universe of cases up to 2007 and the subsequent start/stop (if applicable) dates for each program. In accord with the existing literature on reversal, the dependent variable in this analysis can take three different forms: 1) stopped development of nuclear program; 2) return of complete weaponized arsenal; and 3) dismantlement of complete weaponized arsenal. If any of these phenomena are observed in the years of the analysis (from 1945-2007), the state in question has deproliferated in a given country-year (value of '1'). If none of these are observed in a given country-year, the dependent variable takes on a '0' value.

The resulting dataset contains 35 instances of nuclear weapons activity between 1945 and 2007. Nuclear reversal or deproliferation occurs in 25 states, or about 71% of all instances of nuclear weapons activity. The minimum duration for a nuclear program is 1 year (West Germany) and the longest nuclear program without acquisition lasted 35

[16] In contrast to Mueller and Schmidt, I exclude Nigeria because there is insufficient evidence to suggest that they engaged in nuclear weapons activity and then reversed their decision. Additionally, there is evidence to suggest that Germany initially began its pursuit of nuclear weapons in 1939 but the program was cancelled at the end of World War II with the Fall of Berlin. This is not included in the analysis as the program started and stopped before my study begins in 1945. However, West Germany's subsequent exploration of nuclear weapons in the mid-1950s is included in the analysis.

years (Brazil). The average length of a nuclear program that results in nuclear renunciation is approximately 17.5 years.

Main Explanatory Variables

What exactly are the types of inducements that the international community can offer or threaten/use when bargaining with proliferators? To provide incentives to a proliferator to abandon its nuclear ambitions, the international community can choose from a variety of instruments that generally fall under two primary branches: rewards or coercion. Thus, the primary explanatory variables of interest (positive and negative inducements) can be measured or operationalized in a number of ways in an empirical analysis. Both branches of inducements are found in most cases, and at least one in all cases. Some of the empirical models include aggregate measure of positive and negative inducements, respectively, to assess how the combination of inducements offered in tandem may impact the likelihood of deproliferation across the cases.[17]

The extant scholarship outlines the role of positive and negative incentives in different but related outcomes of interest: conflict resolution, state repression, adhering to treaty or international legal obligations, etc. (Litwak 2007; Pape 1997; Solingen 1995; Solingen et.al. 2012; Crumm 1995; Pevehouse 2002). States (in this specific interaction, the international community) have an array of policy tools with which they can influence or alter the policies or behavior of other states (in this instance, the proliferator). In using this range of explanatory variables, I echo the substantial literature in political science

[17] Additional models not presented in this chapter include a measure for *inducements* broadly – the impact of both positive and negative inducements on the likelihood of deproliferation. This provides an interesting basis for examining a fundamental question of this dissertation: can international pressure influence nuclear reversal decisions.

and economics where rewards are generally organized into three broad categories—political, military, or economic—and coercion is broadly distinguished between economic sanctions and the use of military force (Stein 2013; Solingen 2013; Nincic 2013).

Positive political inducements can take on the form of entrance into or membership in trade or regional organizations, international organizations, or the (re)instatement of diplomatic relations.[18] The logic here suggests that one way the international community may be able to persuade states to abandon an early nuclear program is by offering them membership in an organization that they may otherwise not have been able to enter or with diplomatic recognition. North Korea, for example, has demanded that any agreement with the international community must include provisions that allow for the resumption of 'normal diplomatic relations' with the United States prior to any denuclearization deal (Niksch 2010). Similarly, Libya's tumultuous experience with its pursuit of nuclear weapons highlights the importance of reintegration into the international community. According to former Libyan Prime Minister Shukri Ghanem "[m]anufacturing weapons of mass destruction costs a lot of money and… gives an erroneous sense of power" such that "[i]t creates more problems than it resolves" (Braut-Hegghammer, 2009). The Libyans were concerned about the impact of continuing the program on their increasing isolation, which influenced their eventual decision to abandon their nuclear ambitions. To best capture the construct of positive political

[18] In the robustness section, I consider alternative operationalizations of these variables to include in my analysis. To avoid collinearity in a given model, I include only one operationalization of each construct at a time. The models included in the robustness check evaluate whether the other operationalizations result in the same general types of effects

inducements, I include a variable for entrance into the United Nations that is coded as '1' if it occurs in a given state-year.[19]

In the same vein, the international community may extend a positive military inducement such that a proliferator may be more willing to sacrifice pursuing its own nuclear deterrent. The literature measures the impact of positive military inducements in a variety of ways: the creation of security guarantees/defense pacts or inclusion in a nuclear umbrella (mainly under US or Soviet/Russian spheres of influence) or broader bilateral military alliances. In these instances, though states may opt to pursue and engage in nuclear weapons activity for a variety of reasons, one way to increase the likelihood of nuclear reversal may be to offer protection under a nuclear umbrella. Japan, for example, has a high latent capacity for producing nuclear weapons and could, relatively quickly, successfully build an operational nuclear deterrent upon deciding to do so. However, in exchange for maintaining their non-nuclear status, Japan receives protection against potential foreign aggression through US extended deterrence. In the dataset, to measure the effect of a positive military reward, I include a binary variable that indicates whether the proliferating state received military assistance from the United States in a given state-year.

Lastly, to assess how the international community can incentivize nuclear reversal through economic means, we can incorporate measures of positive economic inducements, such as US economic aid, entrance into economic organizations, and economic openness. The international community or specific member states may offer

[19] I include other operationalizations of this variable, including entrance into NATO or WTO but those may reflect potential economic or military benefits rather than a strictly political reward that is offered by the international community.

these financial incentives to induce reversal for several reasons. First, for some states that do not have a high valuation for a nuclear weapons program, such as Sweden or Norway, the offer of a tangible reward may be a sufficient compensation for foregoing the program. For other states, financial assistance from an international organization or a specific state may be necessary for domestic stability. Disruption or loss of this foreign aid may prove to be costlier than what the state could expect to receive from an operational nuclear weapons program. Egypt, for example, is the second largest recipient of US foreign aid. Evidence suggests that the continuation of this economic assistance was contingent on the Egyptians agreeing to stop their exploration of nuclear weapons (that most likely would have resulted in an operational nuclear deterrent). Ultimately, Egypt agreed to sign the NPT as a non-nuclear state and adhere to the IAEA's Safeguards Agreement in exchange for a bilateral economic alliance with the United States (Rublee 2006; Solingen 2007; Campbell, Einhorn, and Reiss 2004). To best measure the theoretical construct of positive economic influence, I include a binary variable that indicates whether the proliferating state received economic assistance from the United States in a given state-year. The aggregate measure, *positive inducements,* is a count variable, which includes the total number of positive inducements a state receives in a given state-year.

Coercion or negative inducements, on the other hand, are broadly defined as the threat or use of military force or the threat or use of economic sanctions to influence or alter another actor's behavior. To assess the impact of negative military inducements, I incorporate a measure of militarized dispute action taken against target states. Surprisingly, there are relatively few instances of the use of military force against

proliferators. Perhaps the most famous example of the use of force to stop nuclear pursuit occurred in 1981 with Israel's attack on the Osirak nuclear facility in Iraq. On June 7, 1981, an Israeli Air Force fighter aircraft, with an escort of F-15s, bombed and heavily damaged the Osirak reactor (originally an Osiris-class nuclear reactor from France). To justify the bombing, Israel claimed that the attack was in self-defense as the reactor was less than one month away from being 'critical' and capable of aiding in the development of nuclear weapons (Reiter 2005; Fuhrmann and Kreps 2011).[20]

More commonly, however, the international community (through the United Nations) or specific member states may instead impose some form of negative economic pressure, primarily through sanctioning instruments, to encourage states to stop their proliferation attempt or to abandon a nascent nuclear program. To avoid punishing the civilian population, these sanctions are often directed at state-level elites or impose bans on specific goods or technology, with varying degrees of efficacy. Indeed, the estimated impact of some of these sanctions differs wildly, but can often result in an almost negligible effect on GNP. In the literature and other datasets, sanctions have several forms – including total embargos, bans on import/export, blockades, asset freezes, the termination of foreign aid, or the suspension of economic agreements (Bapat and Morgan 2009; Hufbauer et.al. 2007). To best capture the theoretical construct of economic sanctions, I include a measure of US-imposed economic sanctions (Hufbauer et.al. 2007). I focus on US-imposed sanctions because the literature on economic sanctions suggests that collective or multilateral sanctions may be less effective than unilateral sanctions due

[20] Though the exact status of the Osirak reactor is in dispute, it represents one of the few (and the most famous) instance of the use of military force in preventing proliferation.

to free-riding or reneging. The aggregate measure, *negative inducements,* is a count variable, which includes the total number of negative inducements a state receives in a given state-year.

Data on the positive inducements are collected and merged from existing large-n datasets, including the Correlates of War (COW), Alliance Treaty and Obligations (ATOP), Jo and Gartzke nuclear data, Singh and Way nuclear data, and the *Journal of Conflict Resolution* Special Issue 2009 nuclear data, as well as new data I collected from USAID on US foreign assistance over time. I also add data from the Hufbauer Economic Sanctions data, and data on militarized interstate disputes from the COW dataset to capture the spectrum of negative inducements. Most of these variables are operationalized as the presence or absence (1/0) of the inducement in a given state-year, with certain exceptions.

Alternative Operationalizations

To address any potential concerns about whether these operationalizations of the main explanatory variables best capture their underlying theoretical constructs, I include alternative operationalizations of the independent variables of interest. To account for states that are already members to the United Nations or for whom entrance does not provide an additional benefit, I also examine other 'positive political inducements' that indicate whether the proliferator enters into the World Trade Organization (WTO), North Atlantic Treaty Organization (NATO), or Organization for Economic Cooperation and Development (OCED). For example, it is unlikely that a state such as Sweden could be persuaded to abandon its nuclear effort with the promise of ease of entrance into the United Nations and the broader political system, but more likely that such an incentive

could be enough for a state such as Libya or Kazakhstan that seeks to enter/re-enter the international community. To analyze the different political effects of organizational membership on different states, I include these other variables in my analysis (Leeds et.al. 2002).

In the same vein, I include alternative measures of economic and military benefits. The extant literature and data often include the presence or absence of nuclear alliance (or the nuclear umbrella) as an indicator of whether a proliferator receives the protection of a more powerful ally. To account for the possibility that a proliferator would prefer this type of military support (i.e., a nuclear security guarantee), I include a binary variable that indicates whether the proliferator has a security guarantee with a nuclear power. (Singh and Way 2004) With this operationalization, I am also able to determine if the proliferator receives assistance from other nuclear powers, such as the Soviet Union/Russia, in addition to examining the US nuclear security umbrella. I also capture economic interdependence or emergence into the global economy with a variable that measures 'economic openness' - imports and exports as a share of GDP (Singh and Way 2004).

On the other side of the spectrum, I include alternative operationalizations of negative inducements. To determine whether the proliferator is affected by threats or the use of coercion, I include a measure of militarized dispute involvement, a five-year moving average of dispute involvement (Ghosn, Palmer, and Bremer 2002). It may be the case that a proliferator is not just the target of blatant threats or the use of force by the United States or other powerful members of the international system, but rather, that it suffers from smaller instances of threats or coercion from a broader network of

adversaries. Similarly, it could be that a potential proliferator may be influenced by sanctions imposed by the United Nations, perhaps seen as a signal of international condemnation. To account for this possibility (though a more rare occurrence over time), I include a measure of United Nations economic sanctions (Hufbauer et.al. 2007). Table 3.2 in the Appendix presents the broader theoretical constructs and their predicted effect on the dependent variable, as well as their measures and sources.

Covariates

To control for other factors that may influence both the dependent variable directly and the independent variable through another, unobserved mechanism, I refer to the existing literature to identify other variables that are correlated with nuclear weapons activity in other studies. To account for the overall capabilities of states, both latent nuclear and conventional, I use Jo and Gartzke's latent nuclear capacity variable and the Composite Index of National Capability (CINC) scores for each state (Jo and Gartzke 2007, Singer 1987). States that have significant conventional capabilities may decide that they do not need the additional advantages of a nuclear deterrent and abandon their nuclear pursuit. If this is the case, I exclude this variable to ensure that the primary motivation for nuclear reversal is not a state's technical inability to produce a successful weapon.

Alternatively, states that have a low latent nuclear capability may decide that a weapons program is too costly to undertake. By including a measure of latent nuclear and conventional capacity in my analysis, I better capture the role international/systemic factors play above and beyond the underlying capability of a proliferating/target state. I control for the regime type of proliferator using data from the Polity IV project, including

a polity score that measures regime type on a -10 to 10 scale (Marshall, Jaggers, and Gurr 2010). I also include a logged measure of GDP per capita to control for the effect of economic capacity and relative power (Singer 1987). Lastly, I include a nuclear risk variable that assesses how 'at a risk' the state was at nuclear weapons acquisition, when it enters and leaves the 'risk pool' (Singh and Way 2004).

Modeling Approaches

The first phase of the large-n quantitative analysis examines the impact of the primary explanatory variable, positive and negative inducements, on the likelihood of nuclear reversal. The disaggregated operationalization of my main explanatory variables allows me to better specify the exact combination of carrots and sticks most likely to efficiently and effectively lead to sustained deproliferation. To test my hypotheses with these data, I primarily use a binary time-series cross-section model that functions similarly to a hazard or survival model, with the addition of squared and cubed time trend terms, fixed effects, and clustered standard errors. The following model captures my prediction:

$$\mathbf{D_t = \alpha + \beta_1 PP_t + \beta_2 PM_t + \beta_3 PE_t + \beta_4 NM_t + \beta_5 NE_t + \beta_6 O_t + u_t.}$$

The dependent variable $\mathbf{D}_t$ is the state-year in which a proliferator stops their nuclear weapons program or pursuit. This variable denotes the number of years before a state reverses its program: α is the constant term and u_t is the stochastic term.

I disaggregate positive inducements into three groups of variables: $\mathbf{PP}_t$ (positive political inducements used in year *t*), $\mathbf{PM}_t$ (positive military inducements in year *t*), and $\mathbf{PE}_t$ (positive economic inducements in year *t*). I also differentiate between types of negative military inducements/the use of military force in year *t*, $\mathbf{NM}_t$, and negative

economic inducements/sanctions in year *t*, $\mathbf{NE}_t$. Lastly, $\mathbf{O}_t$ denotes the other possible variables for why states may decide to give up their weapons programs. In the models that include the aggregate the positive and negative inducements, the following model captures my prediction.

$$\mathbf{D_t = \alpha + \beta_1 PI_t + \beta_2 NI_t + \beta_6 O_t + u_t.}$$

Primarily, I use the binary time-series cross-section (BTSCS) multivariate model that is designed to estimate the instantaneous effects of the independent variables on the likelihood of deproliferation. However, BTSCS observations are likely to violate the independence assumption of an ordinary logit or probit model (Beck 1997, Beck et.al. 1998, Tucker 2000). To help identify the causal mechanism at play and for the sake of simplicity, I also use discrete time methods for analysis. The discrete hazard at time *t* is the conditional probability of an 'event' at time *t* given 'survival' through time *t*-1. Thus, probit or logit analysis of BTSCS operates exactly like the estimation of a discrete hazard function, which is one of the more commonly used model in quantitative nuclear studies (Beck 1997, Beck et.al. 1998). To address concerns about the independence of observations, I also add three smoothing functions of time, *time*, $time^2$, and $time^3$, since the last event to the specification.

As a robustness check on the results, I include a linear regression model and a rare events logit model. I first include an OLS model to ensure that the effect still holds in this basic linear model specification. I do not present the results from the OLS model but they are consistent with other model specifications presented below. Additionally, as the binary dependent variable accounts with far fewer events (1s) than nonevents (0s) in this analysis, I include a different model specification, a rare events logit, as a robustness

check on the binary time-series cross-section logit model. Much of political science, especially international relations, includes the study of rare events, such as war, protest movements, or terrorist activity. In these types of data, there are many more (potentially thousands more) 'zeros' or nonevents than 'ones' or events of interest. To more efficiently assess the effect of positive and negative inducements in this analysis, I include models with a rare events logit. For ease of interpretation, variables with positive coefficients are associated with an increased likelihood of deproliferation, while negative coefficients suggest the opposite. Since observations may be related by state, I cluster standard errors (when applicable), so the tables present robust standard errors when indicated. Lastly, I include models with the alternative operationalizations and coding rules, as specified earlier.[21]

Findings

The analysis first examines the role of positive and negative inducements in the likelihood that a state reverses its nuclear program. In this section, I examine the differential effects of rewards and punishments. The basic model, without any covariates, indicates that rewards are associated with successful deproliferation, while certain negative inducements may actually reduce the likelihood that a state will stop its nuclear program. In Table 3.3 in Appendix 3, Models 1 and 2, the binary time-series cross-section models (with fixed effects and clustered standard errors), indicate that the coefficient on one variable, *US military assistance,* is positive and statistically significant,

[21] Models that use the alternative coding rules are included in the analysis but not presented here. The models yield similar results across case codings.

while one measure of punishments, *MID involvement,* is negatively associated (and statistically significant at the 0.05 level) with deproliferation, holding other variables constant.[22] Interestingly, the variable indicating *entrance into the United Nations*, is statistically significantly and negatively associated with deproliferation. One explanation could be that some states that reverse their program are already members of the United Nations such that ease of entrance provides no real benefit to a potential proliferator. To address this possibility, I further examine the effect of positive political inducements using alternative operationalizations that may better reveal the relationship between this type of reward and whether a state is willing to abandon its nuclear program. These three predictors are all significant at the 0.05 level in this model, holding other variables constant. Table 3.3 in Appendix 3 presents these results below, where Model 1 includes the set of positive inducements (without negative inducements) and Model 2 includes the set of negative inducements (without the set of positive inducements).

Controls and Additional Model Specifications

When I add the controls and use different model specifications, the results on rewards is consistent, while the variables that measure negative inducements remain negatively associated with deproliferation but sometimes lose statistical significance (I discuss this in detail in a broader discussion of findings at the end of this section). For the rest of the analysis, I examine the effect of positive and negative inducements on deproliferation, with a full set of controls, using a linear regression model, a binary time-series cross-section model, and a rare events logit model. I also include models that

[22] Due to limited data on nuclear attacks on suspected nuclear facilities, to achieve convergence in this model, I include the alternative operationalization of use of force, MID involvement, to provide an initial cut at the role of negative inducements on reversal.

include aggregates of positive and negative inducements, respectively, and the alternative operationalizations of the key explanatory variables discussed earlier. The remainder of this section presents the results from these analyses.

In Table 3.4 in the Appendix, I present the results from the BTSCS model. In these, and subsequent models, I include aggregate variables of positive and negative inducements. It could be that these variables are used in tandem or as substitutes. If, for example, a state such as Switzerland would prefer military assistance and economic aid rather than some form of political reward, the international community may choose to offer a reward that incorporates multiple, complementary positive inducements to encourage deproliferation. In the same vein, the international community may choose to both issue threats of military force and impose economic sanctions on a proliferator to incentivize reversal. These aggregate variables, *positive inducements* and *negative inducements*, allow for the cases where these policy instruments are used jointly.

The BTSCS model with fixed effects and clustered standard errors is the most constrained model type; similarly, the rare events logit captures the effect of inducements on a narrower model specification that more efficiently identifies relationship between inducements and deproliferation (King and Zeng 2001). Both of these models represent the hardest tests for my theory: if I find consistent results in these models, I can be more confident that these results are robust to model variation. Across model specifications, I find similar results. The aggregate variable, *positive inducements,* and *military aid* are positively and statistically significantly associated with the likelihood that a state will deproliferate, holding all other variables constant. Furthermore, we see that punishments remain negatively associated with the probability a state will stop its nuclear pursuit.

Tables 3.4 and 3.5 found in Appendix 3 present the results from the BTSCS and rare events logit models. Model 1 includes each separate inducement variable while Models 2 and 3 include the aggregate measures of positive and negative inducements, respectively. Lastly, I present the results from the rare events logit. Given the infrequency of my dependent variable in the analysis (it only occurs 26 times), the rare events logit may be able to efficiently correct for potential underestimation in a logistic regression (King and Zeng 2001). The results from the rare events logit reveal similar findings to previous model specifications: positive inducements, broadly, and military assistance from the United States, specifically, increase the probability that a state will reverse its nuclear program. The variable, *positive inducements*, is positive and statistically significant at the 0.05 level, suggesting a strong association between the offer of rewards and the likelihood of deproliferation. Table 3.5 presents the results from the rare events logit model examining the effects of inducements on deproliferation. Model 1 presents the set of explanatory variables and Models 2 includes aggregate measures of positive and negative inducements.

Overall, positive inducements, specifically military assistance, are associated with a statistically significant increase in the probability of deproliferation in a basic model with no controls and both model specifications with controls. In addition, the analysis also indicates that punishments, such as the threat or actual attack on nuclear facilities, threat or actual involvement in militarized dispute, and economic sanctions have a negative association on the likelihood of nuclear reversal.

Alternative Operationalizations of Explanatory Variables

In addition to adding controls and varying model specification, I also run the analysis with alternative operationalizations of the explanatory variables of interest. First, I replace the main positive inducements variables that capture political, military, and economic rewards with variables from existing datasets: entrance into OECD, security guarantee/defense pact with a nuclear state, and economic openness. Similarly, I include different measures of negative inducements, replacing the threat of nuclear attack with MID involvement, and UN economic sanctions rather than those imposed by the United States. In accord with the previous series of models, I also combine these alternative positive and negative inducements into two aggregate count variables. I employ a binary time-series, cross-section logit design and a rare events logit to examine the effects of these different operationalizations on deproliferation. In general, we see similar patterns as with the first set of variables: rewards, generally, are positively associated with the likelihood of deproliferation while punishments decrease the likelihood that a state will stop its nuclear pursuit. However, certain model specifications reveal some interesting results.

First, a proliferator's involvement in militarized interstate disputes (over a five year average), potentially with key members of the international community, is negatively associated with stopping a program (the coefficient on *MID involvement* is negative and statistically significant*)*. This is not surprising: external threat concerns are one of the primary motivations for proliferation in the first place (Sagan 1996/1997; Singh and Way 2004; Jo and Gartzke 2007). Receiving threats of the use of force or engaging in conflict with the United States, other nuclear states, or non-nuclear adversaries may serve to actually persuade a proliferator of the need of nuclear weapons

and encourage a continuation of a nuclear program. This is likely to be especially true for high-value nuclear proliferators, for whom the initial value of the nuclear program may be a result of regional or international security threats. This evidence suggests that engaging in conflict, though not a specific attack on a nuclear facility, with some proliferators may be associated with prolonged proliferation. This result provides strong evidence for the theory's overarching prediction that while a nuclear strike will permanently end a nuclear program, hostile or coercive interactions are likely to extend some nuclear programs. Table 3.6 in Appendix 3 presents the results from this logit analysis on the effect of inducements on deproliferation, with alternative measures. Model 1 includes the set of explanatory variables and Models 2 includes the aggregate positive and negative inducements.

In addition, findings from the rare events logit with alternative operationalizations indicate that UN economic sanctions may be associated with encouraging states to reverse their nuclear programs. Indeed, this is in contrast to earlier findings that suggest that US economic sanctions may actually do more harm than good: while sanctions imposed by the United States encourage states to continue to proliferate, UN sanctions may serve a limited role in providing incentives to states to abandon their nuclear efforts after enduring the cost of these sanctions.[23] This aligns with conventional wisdom regarding the effectiveness of unilateral versus multilateral action: inducements, like economic sanctions, can work when they have a buy in from all the great powers. The limitation of the number of instances of UN-imposed sanctions limits the extent to which

[23] One explanation, however, for this finding is that there are far fewer instances of UN-imposed sanctions in these data. Future work will expand on these data by analyzing the specific content of these sanctions to determine their direct effect of a proliferator state, especially at the domestic level.

we can make strong claims about the efficacy of this type of coercion over others. Lastly, these measures of positive inducements, though positively associated with deproliferation, are less statistically significant in determining the likelihood that a state will stop its nuclear program. One implication is that, contrary to traditional foreign policy, proliferators may be less motivated by the promise of a US extended deterrent than by the offer of military assistance by the United States. Table 3.7 in the Appendix presents the results from the rare events logit analysis using the alternative measures of the theoretical constructs. Model 1 includes the set of explanatory variables and Models 2 includes the aggregate positive and negative inducements.

Differential Effects for Hawks vs. Doves

How do these dynamics vary when distinguishing between proliferators with high or low values for nuclear weapons? To provide an initial test of these differences, I create a series of regression models that interact the set of positive and negative inducements with nuclear capacity. This measures of how likely a state is to acquire nuclear weapons, based on a seven-point scale of latent capacity or opportunity. While this variable can get at whether a state is more or less likely to be successful in acquiring nuclear weapons, which, in turn, influences their value for proliferation, it cannot provide information about the 'desire' to do so. In Table 3.8 in Appendix 3, I present the analysis from one these regressions, the results from interacting nuclear capacity with military assistance. The coefficient on this interaction term is positive and statistically significant, suggesting that aid is more strongly associated with states stopping their weapons programs as states increase their latent capability. Unsurprisingly, if states with high latent capacity do not receive military assistance, they are less likely to deproliferate.

New Leaders and Foreign Aid

As a second cut at the effect of positive and negative inducements on nuclear deproliferation, I begin by examining the impact of new leaders on changes in foreign aid, specifically military assistance, amongst states that have begun nuclear weapons activity. Specifically, I examine whether there is any relationship between new leaders coming into office and impacting the likelihood that the state will then give up its nuclear weapons program. To do this, I use data from the Archigos database on leaders from 1875-2004 (Goemans, Gleditsch, and Chiozza 2009). In particular, I look at the years in which states stopped their nuclear weapons activity and whether it coincides with changes in state leadership. If the theoretical framework is correct in suggesting that new leaders may be eager to reveal an evolving preference for nuclear weapons, either signaling an increase or decrease in the value that the leader and state hold for nuclear weapons, we might see changes in proliferation behavior coincide with regime turnover. Specifically, the theory presented earlier should predict an increase in the amount of rewards being given to all proliferators, but specifically to some hawk states that would prefer to deproliferate and receive a reward than risk a potential military attack. Indeed, an examination of the data on regime change among states that have engaged in nuclear weapons activity reveals that out of the 26 states that have started and stopped nuclear weapons activity since 1945, 14 of them experienced regime change immediately (less than 12 months) prior to agreeing to deproliferate and permanently stop their nuclear weapons program.

Given this relationship between regime change and deproliferation, the next step is to examine whether regime turnover influenced a change in rewards. If the theoretical

framework presented earlier is correct, new leaders may be eager to signal a changing preference or value for nuclear weapons by broaching negotiations with the international community and either accepting or rejecting the rewards offered by the international community, or key member states. Thus, we may expect to see increases in rewards, such as military or economic assistance, occurring in conjunction with regime change, proximate to deproliferation. Using data from USAID on US military and economic assistance over time, we see that there is a clear relationship between increases in military aid and deproliferation, especially among states with new leaders. Indeed, for some proliferators, we see significant increases in military assistance from the United States immediately after the proliferator makes the decision to stop their nuclear weapons program. Table 3.9 in the Appendix provides a snapshot of states that have engaged in nuclear weapons activity. The table includes data on whether a leader that came to power prior to dismantling the state's nuclear weapons program, and if applicable, the percent increase in US military assistance from the year prior to and after the states decides to stop its nuclear weapons program.

The results provide some preliminary evidence that there is a positive relationship between increases in foreign aid, specifically military assistance, and deproliferation. There are some states for which the US did not (and continues to not have) a military assistance or foreign aid relationship. For some of these cases, the US or other members of the international community were perhaps able to provide some other type of reward, a security guarantee or renewed diplomatic relationship, to induce nuclear reversal in that proliferator. While not conclusive or accounting for other key factors in the relationship between inducements and deproliferation, this analysis provides a preliminary and

informative look at how the international community, especially the United States, can impact a state's decision (especially if there is a new leader in power) to deproliferate.

Discussion and Conclusions

The most important conclusion regarding the theory of deproliferation that emerges from the empirical analysis is that rewards offered by the international community are associated with a strong and statistically significant increase in the likelihood that a state will deproliferate. This is the main implication of the theory that I am testing in this chapter, and across model specification, the effect is robust. Additionally, the use of economic sanctions and military force largely seem to be negatively associated with nuclear reversal. Through an examination of potential omitted variables suggested by the literature, included as standard controls in the analysis, none of these appear to be driving the relationship.

The theory of deproliferation, formalized earlier in the dissertation, reveals that rewards seem to be a more effective policy instrument to provide incentives to states, both dove proliferators that don't have a particularly high value for nuclear weapons and even among hawk states that do. Given their effectiveness, the international community should be more inclined to use these rather than coercive tools. Indeed, in the examples of Sweden and Japan, specific offers of military aid, encouraged both states to stop their nuclear pursuit and remain non-nuclear states. I further examine these implications through comparative case studies in Chapter 4. Threats to use force or sanction states are more likely to be made against hawks and, thus, are likely to be unsuccessful in persuading them against the pursuit of nuclear weapons. The analysis suggests, in

contrast to conventional wisdom and foreign policy, sanctions and the use of military force against proliferators has an effect in the opposite direction, which may imply that punishing proliferators may actually work against broader international interests.

In this analysis, I also include several alternative operationalizations of the independent variables of interest that help to isolate the patterns of deproliferation in these models. In aggregate, we see similar patterns as with the first set of variables: rewards, generally, are positively associated with the likelihood of deproliferation, while punishments decrease the likelihood that states will stop its nuclear pursuit. In both sets of operationalizations of the variables, I include a host of model specifications to test the robustness of the effects. I employ three model types and find consistent results across each: positive inducements are positively and robustly associated with an increase in the probability that a state will stop its weapons programs, while negative inducements tend to work in the opposite direction. These results suggest a reexamination of the types of policy instruments that the international community can use to affect a change in proliferation behavior.

Of course, this analysis does not imply that rewards will work every time with every proliferator or that sanctions are completely without use. Indeed, it could be that sanctions and threats and/or the use of force are specifically used against states that warrant them. The logic would then suggest that the only way to effectively deal with a state such as Iran or North Korea is to issue grave threats against them to incentivize reversal, while other states such as Switzerland can be more easily influenced by 'carrots.' While this may be the case, it is also important to note that coercion has still not been effective in either Iran or North Korea: though the international community has

imposed sanctions and issued threats against both, neither has been deterred by those policy tools. Indeed, it appears as though both proliferators may have intensified their efforts in response to these negative inducements. This selection problem is an important question that demands closer examination of particular cases. Thus, there is further work to be done to analyze why coercion can backfire and the conditions under which we can convince even the most hawkish of proliferators to deproliferate. Yet, it is important to note that while the theoretical framework does imply that rewards should work even on the most committed and persistent of hawk states that want to avoid the use of military force against them, there are still some proliferators that will ultimately be successful in acquiring nuclear weapons.

I begin to address these concerns using comparative case study analysis in the following chapters. Chapter 4 includes six case study analyses that illustrate the equilibria derived from the theoretical framework, presented in Chapter 2, in detail. Specifically, it looks at how variation in the value for nuclear weapons, ostensibly the difference between hawk and dove proliferators, and the option for the use of force, affect the bargaining dynamic between the proliferator and international community. This chapter delves into the coding and operationalizations used to capture the key constructs in the large-n, quantitative analysis. While this analysis provides an overarching examination of how deproliferation manifests overtime, confidence in the findings also requires a more in-depth probe into these variables and how accurately they describe the phenomena in question. The comparative cases presented in Chapter 4 provide a preview of the two detailed case analyses presented in the remainder of the dissertation.

In Chapter 5, I expand on these relationships in greater detail by providing a in-depth analysis of the Egyptian and Indian nuclear weapons programs over time. In sum, these different empirical analyses help provide a fuller picture of the conditions under which states are willing to give up their nuclear weapons programs and the policy instruments that are most effective at doing so. Specifically, they reveal the importance of rewards as policy tools for the international community to offer to proliferators, even the most committed of states, to persuade them to abandon their nuclear weapons programs.

Appendix 3

Table 3.1: Nuclear Weapons Activity (Start/Stop Dates)

Country	Start	Stop	Duration
Algeria	1983	1991	8
Argentina	1968	1990	22
Australia	1956	1973	17
Belarus	1991	1996	5
Brazil	1955	1990	35
Canada	1944	1969	25
Chile	1974	1995	21
China	1955		
Egypt	1955	1980	25
France	1946		
W. Germany	1957	1958	1
India	1948		
Indonesia	1965	1967	2
Iran	1974		
Iraq	1976	1995	19
Israel	1949		
Italy	1955	1958	3
Japan	1945	1970	25
Kazakhstan	1991	1995	4
Libya	1970	2003	33
North Korea	1965		
Norway	1949	1962	13
Pakistan	1972		
Romania	1985	1993	8
Russia	1945		
South Africa	1969	1993	24
South Korea	1959	1978	19
Spain	1974	1988	14
Sweden	1954	1969	15
Switzerland	1946	1969	23
Syria	1976	2007	31
Taiwan	1967	1988	21
Ukraine	1991	1996	5
United Kingdom	1945		
United States	1945		
Yugoslavia	1954	1988	34

Table 3.2: Theoretical Constructs, Measures and Sources

Construct	Measure	Source
Positive Political Reward	Binary indicator of entrance into UN	Leeds et.al. 2002
	Alternatives: binary indicators of entrance into NATO; WTO; OECD	*Leeds et.al. 2002*
Positive Military Reward	Binary indicator of US military aid	USAID
	Alternatives: Binary indicator of defense pact with nuclear state	*Singh and Way 2004*
Positive Economic Reward	US foreign economic assistance	USAID
	Alternative: Economic openness (trade ratio of imports to exports)	*Singh and Way 2004*
Negative Military Inducement	Binary indicator of threat or actual attack against nuclear facility	Fuhrmann and Kreps 2012
	Alternative: MID involvement (5 year average)	*Ghosn, Palmer and Bremer 2004*
Negative Economic Inducement	US economic sanctions	Hufbauer et.al. 2007
	Alternative: UN economic sanctions	*Hufbauer et.al. 2007*

Table 3.3: The Effect of Inducements on Deproliferation

	Model 1	Model 2
US Economic Aid	0.61	
	(0.517)	
US Military Aid	1.036**	
	(0.509)	
Entrance into UN	-0.709**	
	(0.352)	
US Economic Sanctions		-1.85
		(1.259)
MID Involvement		-0.382**
		(0.193)
Time	-0.069	0.007
	(0.105)	(0.094)
$Time^2$	0.004	0.001
	(0.005)	(0.004)
$Time^3$	0	0
	(0)	(0)
Constant	-4.453***	-4.458***
	(0.618)	(0.652)
Observations	2,068	1,927
Number of CCODE	37	36
Clustered Standard Errors		
* p<0.10, ** p>0.05, *** p>0.01		

Table 3.4: The Effect of Inducements on Deproliferation (BTSCS)

	Model 1	Model 2
Positive Inducements		0.593***
		(0.155)
Negative Inducements		-1.921
		(1.511)
US Economic Aid	0.49	
	(0.506)	
US Military Aid	1.047**	
	(0.493)	
UN	-0.117	
	(0.246)	
US Economic Sanctions	0	
	(0.947)	
Attack on Nuclear Facility	-1.76	
	(1.45)	
Democracy	0.017	0.008
	(0.027)	(0.027)
Nuclear Capacity	0.008	0.04
	(0.103)	(0.107)
Conventional Capability	-36.424	-38.881
	(29.434)	(28.26)
Type of Proliferator	-0.019	-0.019
	(0.019)	(0.019)
Economic Development	0.014	-0.013
	(0.242)	(0.25)
Time	-0.027	-0.027
	(0.094)	(0.092)
$Time^2$	0.004	0.004
	(0.004)	(0.004)
$Time^3$	0	0
	(0)	(0)
Constant	-4.759**	-5.139**
	(2.081)	(2.091)
Observations	1,886	1,886

Table 3.4: The Effect of Inducements on Deproliferation (BTSCS), Continued

	Model 1	Model 2
Number of States	36	36
Fixed Effects; Clustered Standard Errors (State)		
Numbers in parentheses are standard errors for the beta coefficients		
* p<0.10, ** p>0.05, *** p>0.01		

Table 3.5: The Effects of Inducements on Deproliferation (Rare Events Logit)

	Model 1	Model 2
Positive Inducements		0.636***
		(0.235)
Negative Inducements (w/MID)		-0.388
		(0.255)
US Economic Aid	0.443	
	(0.562)	
US Military Aid	1.027*	
	(0.597)	
UN	-0.338	
	(0.636)	
US Economic Sanction	-0.997	
	(1.206)	
MID Involvement	-0.283	
	(0.218)	
Democracy	0.024	0.019
	(0.039)	(0.037)
Nuclear Capability/Proliferator Type	-0.021	-0.02
	(0.135)	(0.134)
Conventional Capability	-26.243	-22.965
	(38.783)	(36.512)
Nuclear Risk	-0.019	-0.02
	(0.02)	(0.019)
GDPCAP_log	-0.183	-0.102
	(0.357)	(0.355)
Time	-0.019	-0.012
	(0.102)	(0.101)
$Time^2$	0.003	0.003
	(0.004)	(0.004)
$Time^3$	0	0
	(0)	(0)
Constant	-2.365	-3.893
	(2.843)	(2.739)
Observations	1,874	1,874

Robust Standard Errors;
Numbers in parentheses are standard errors for the beta coefficients
* p<0.10, ** p>0.05, *** p>0.01

Table 3.6: The Effect of Inducements on Deproliferation with Alternative Operationalizations (BTSCS)

	Model 1	Model 2
Alternative Positive Inducements		0.007
		(0.006)
Alternative Negative Inducements		-0.450**
		-0.214
Defense Pact (w/Nuclear Power)	0.075	
	(0.339)	
Economic Openness	0.009	
	(0.007)	
Entrance into OECD	-0.039	
	(0.325)	
MID Involvement	-0.538*	
	(0.281)	
UN Economic Sanctions	1.596*	
	(0.828)	
Democracy	0.001	-0.01
	(0.034)	(0.029)
Nuclear Capacity/Proliferator Type	0.112	0.045
	(0.142)	(0.128)
Conventional Capability	-18.69	-21.918
	(19.319)	(21.295)
Nuclear Risk	-0.019	-0.02
	(0.02)	(0.02)
GDPCAP_log	-0.183	-0.103
	(0.285)	(0.292)
Time	-0.01	-0.009
	(0.096)	(0.092)
$Time^2$	0.003	0.003
	(0.004)	(0.004)
$Time^3$	0	0
	(0)	(0)
Constant	-3.301	-3.447
	(2.362)	(2.481)

Table 3.6: The Effect of Inducements on Deproliferation with Alternative Operationalizations (BTSCS), Continued

	Model 1	Model 2
Observations	1,844	1,844
Number of States	35	35
Fixed Effects; Clustered Standard Errors (by state)		
Numbers in parentheses are standard errors for the beta coefficients		
* p<0.10, ** p>0.05, *** p>0.01		

Table 3.7: The Effect of Inducements on Deproliferation (Alternative Operationalizations; Rare Events Logit)

	Model 1	Model 2
Alternative Positive Inducements		0.01
		(0.013)
Alternative Negative Inducements		-0.308
		(0.21)
Defense Pact (w/Nuclear Power)	0.025	
	(0.506)	
Economic Openness	0.012	
	(0.013)	
Entrance into OECD	-0.081	
	(0.398)	
MID Involvement	-0.374	
	(0.269)	
UN Economic Sanctions	1.632*	
	(0.916)	
Democracy	0.015	0.004
	(0.043)	(0.038)
Nuclear Capacity/Proliferator Type	0.068	0.021
	(0.157)	(0.162)
Conventional Capability	-6.351	-11.211
	(21.171)	(24.106)
Nuclear Risk	-0.019	-0.02
	(0.02)	(0.02)
GDPCAP_log	-0.256	-0.184
	(0.377)	(0.386)
Time	0.007	-0.004
	(0.104)	(0.102)
$Time^2$	0.001	0.002
	(0.004)	(0.004)
$Time^3$	0	0
	(0)	(0)
Constant	-2.477	-2.733
	(2.757)	(2.842)
Observations	1,844	1,844
Robust Standard Error; Numbers in parentheses are standard errors for the beta coefficients		
* p<0.10, ** p>0.05, *** p>0.01		

Table 3.8: Interaction of Proliferator Capacity and Military Assistance (BTSCS)

	Model 1
Interaction of Capability/Proliferator Type and Military Assistance	0.369*
	(0.213)
US Military Assistance	-0.648
	(1.26)
Nuclear Capacity/Type	-0.206**
	(0.092)
Time	-0.078
	(0.11)
$Time^2$	0.004
	(0.005)
$Time^3$	0
	(0)
Constant	-3.738***
	(0.581)
Observations	2,068
Number of CCODE	36
Fixed Effects; Clustered Standard Errors	

* p<0.10, ** p>0.05, *** p>0.01

Table 3.9: Nuclear Weapons Activity, Leader Change, and Foreign Aid

Country	Start	Stop	Duration	New Leader	% Increase in Military Aid
Algeria	1983	1991	8		39.8
Argentina	1968	1990	22	Y; Menem	2634.7
Australia	1956	1973	17	Y; Whitlam	
Belarus	1991	1996	5	Y; Shushkevich	10337.8
Brazil	1955	1990	35		188.3
Canada	1944	1969	25	Y; Trudeau	
Chile	1974	1995	21		424.1
China	*1955*	*Present*			
Egypt	1955	1980	25		819779.2
France	*1946*	*Present*			
W. Germany	1957	1958	1		13262.9
India	*1948*	*Present*			
Indonesia	1965	1967	2	Y; Suharto	1917.7
Iran	*1974*	*2013*		*Y; Rouhani*	
Iraq	1976	1995	19		
Israel	*1949*	*Present*			
Italy	1955	1958	3	Y; Zoli	385.7
Japan	1945	1970	25		
Kazakhstan	1991	1995	4	Y; Nazarbaev	9416.9
Libya	1970	2003	33		
North Korea	*1965*	*Present*			
Norway	1949	1962	13		34.9
Pakistan	*1972*	*Present*			
Romania	1985	1993	8	Y; Vacariou	1437.6
Russia	*1945*	*Present*			
South Africa	1969	1993	24	Y; deKlerk	2788
South Korea	1959	1978	19		168.7
Spain	1974	1988	14		
Sweden	1954	1969	15	Y; Palme	
Switzerland	1946	1969	23	Y; van Moos	
Syria	1976	2007	31		
Taiwan	1967	1988	21	Y; Lee Teng-Hui	
Ukraine	1991	1996	5	Y; Yuschenko	12338.4
United Kingdom	*1945*	*Present*			
United States	*1945*	*Present*			
Yugoslavia	1954	1988	34	Y; Dizarevic	

CHAPTER 4: ARCHETYPES OF REVERSAL: A SURVEY OF THE HISTORICAL RECORD

Introduction

While the general consensus thus far has been that nuclear dismantlement is a rare event —the most common example being South Africa—in reality, deproliferation accounts for a significant portion of total nuclear activity. Of the thirty-six states that have engaged in some form of nuclear weapons activity, twenty-six have actively dismantled, returned, or reversed their programs.[24] The process by which deproliferation occurs is varied and complex and, though some general patterns can be isolated, the story of the former Soviet satellites, such as Kazakhstan or Ukraine is, no doubt, markedly different from that of Brazil or Sweden. These variations are important to advancing understanding of how nuclear reversal has evolved over time and to helping to understand how these processes may look in the future.

To get a sense of this phenomenon over time – essentially, potential trends of when states start and stop their nuclear programs - I begin with a brief description of nuclear weapons activity over time. Table 4.1 in Appendix 4 presents the start and stop patterns of global nuclear weapons activity – both proliferation and deproliferation – from 1945 to 2010. Table 4.1 reveals a few interesting implications regarding nuclear weapons activity over time. First, a significant portion of activity occurred in the early 1950s in the early days of the Cold War, and most likely, as a result of civilian nuclear assistance from the United States and other Western nuclear states through Eisenhower's

[24] Appendix A presents a full summary of the cases and their coding.

Atoms for Peace Initiative (Fuhrmann 2009, 2012). Additionally, a second 'wave' of proliferation occurred soon after the NPT went into full force in 1970. This analysis also suggests that many proliferators opted to dismantle their nuclear weapons programs or stop their nuclear pursuit near the end of the Cold War, that deproliferation may be part of a broader international political trend. Lastly, these data also reveal the surprising fact that nuclear deproliferation is much more likely than nuclear proliferation.

Next, I discuss the set of cases in this study, nuclear reversers compared to current proliferators, how they differ and in what ways from states that have successfully acquired or those that have never explored nuclear weapons. Using data on nuclear weapons activity from 1945-2007 collected from existing studies and re-coded, I present a few general patterns regarding the states that engage in nuclear weapons activity and *stop*. Specifically, I examine the set of nuclear reversers over time to reveal some interesting dynamics. First, and perhaps unsurprisingly, nuclear reversers have a relatively high nuclear latent capacity ex ante. By examining a measure of latent nuclear capacity that incorporates a series of technical and production capabilities, domestic nuclear deposits, metallurgists, chemical engineers, nuclear engineers, electronic/explosive specialists, nitric acid production capabilities, and electricity production capabilities. This variable is then a composite of these component parts, whereby each additional capability increases the measure by 1, resulting in a possible total of 7. Analysis of nuclear reversers reveals that their mean latent nuclear capability is just below 6 – indicating that on average, states that started and stopped their programs could feasibly have proliferated.

Second, the data on nuclear deproliferators suggests that these states have a lower than average risk for pursing nuclear weapons, confirming that these states have, for the most part, abandoned their interest in nuclear weapons. This variable assesses if a state is 'at risk' for acquiring nuclear weapons – specifically, if it moves from a general interest to active exploration and pursuit of nuclear weapons, it has left the risk pool and has become a proliferator (Singh and Way 2004). Given the set of cases in this analysis – those that made the decision to actively pursue nuclear weapons and then renounce that decision, their nuclear risk is generally considered to be low. Lastly, on average, nuclear reversers tend to be wealthy. Many of these states are OECD countries with high GDP per capita and economic growth rates. No doubt there are some critical outliers, such as Libya, but in general, proliferators often require vast economic resources to fund their lengthy nuclear weapons programs.

On the other hand, and potentially contrary to expectations, these states are generally lack significant conventional military capabilities, a variable that might have helped predict a propensity for proliferation. If potential proliferators are concerned with external security threats that their conventional militaries are less able to combat, they may turn instead to the acquisition of nuclear weapons as a substitutive deterrent against foreign aggressors. In contrast, some of the more recent literature on vertical nuclear proliferation and force structure suggests that strong conventional capabilities are a critical component of a diversified and effective nuclear deterrent – indicating that these two elements may indeed be more complementary than substitutive (Gartzke, Kaplow, and Mehta 2013). These data generally seem to coincide with some of the extant literature that outlines the theoretical motivation and empirical 'determinants' of nuclear

weapons proliferation over time (Sagan 1996/1997; Jo and Gartzke 2007; Bleek 2009; Singh and Way 2004; Meyer 1984).

Exploring the Phenomenon of Deproliferation

As discussed previously, the process of deproliferation can take on a variety of forms. To model existing studies of reversal, I adopt as a basis for selection into my population of interest, a definition suggested by Ariel Levite: "the phenomenon in which states embark on a path leading to nuclear weapons acquisition but subsequently reverse course, though not necessarily abandoning altogether their nuclear ambitions…. including a governmental decision to slow or stop altogether an officially sanctioned nuclear weapons program" (Levite 2002; Mueller and Schmidt 2008). This definition provides a crucial theoretical and empirical condition—a state is required to have begun active pursuit of a nuclear weapon, and subsequently abandoned or discontinued its proliferation activity, to be considered in this study. Deproliferation is then defined as observation of the process of reversing a state's decision to pursue nuclear weapons activity. This can take on one of the following forms: permanent abandonment of active nuclear development, returning full weapons systems to another state or non-governmental organization, or the voluntary dismantlement of an operational nuclear arsenal.

In this chapter, I overview this variation by presenting some of the broad archetypes of deproliferated states and examining how and why they embarked on acquiring a nuclear weapon and how they ultimately opted to renounce these nuclear ambitions. I present these cases to illustrate the primary equilibria or outcomes derived

from the main theoretical framework of this dissertation – differentiating between dove states that had low values for acquiring nuclear weapons and were relatively easy to persuade to deproliferate compared to hawk states that were eager to persist in their nuclear weapons programs despite receiving pressure from the international community to stop their nuclear pursuits. I begin by briefly describing the process of deproliferation and the forms it has taken historically. I then present six descriptive case study analyses as examples of the theoretical outcomes, paying careful attention to the structure of the interaction between the proliferator and international community, i.e. whether the use of force was possible, the state's value for acquiring nuclear weapons along the dove-hawk spectrum, and lastly, the role of inducements in their path to deproliferation or successful nuclearization. Specifically, these cases were selected to generally examine the wide variety of deproliferated states while still providing some implications for how pressure from the international community can help identify which states are easy to convince to stop their nuclear pursuit (dove states) compared to those that have a higher value for nuclear weapons and are much more resilient in their pursuits (hawk states). Lastly, I examine how international pressure, specifically positive inducements or rewards offered by the international community, can play a significant role in helping to reveal the type of the proliferator and identify the best strategy for bargaining. While these states only represent a few of the instances of nuclear reversal, they may be able to provide valuable insight into the commonalities among proliferators and their experiences dismantling their nuclear weapons programs and help better understand the empirical patterns established in the large-n empirical analysis presented in the prior chapter.

In addition to examining how the equilibrium outcomes derived from the theory occur within the historical record, these case study analyses, and the more in-depth case analyses in Chapter 5, provide a useful opportunity to explore the analytical nuances in coding and operationalization from the broader quantitative analysis. Given the limited availability and precision of observational data as proxies for the primary theoretical constructs examined in this project, it is necessary to employ case study analyses to more thoroughly and deeply explore the variables and measures to establish the validity of these coding decisions. Thus, each archetypal case study presented here and the Egyptian and Indian case studies presented in the following chapter will delve into the measures used and how they manifest in each of these instances of proliferation. For example, what evidence can be used to justify Canada's designation as a 'dove' proliferator and Libya's as a 'hawk' state with a high value for acquiring nuclear weapons? Furthermore, how best can we understand the specific package of positive and negative inducements offered and/or threatened to a particular proliferator or how those instruments may vary in a given interaction? To further understand the implications and expectations derived from the theoretical framework presented earlier, it is critical to see how key parameters of interest in the model manifest in a particular set of cases. Thus, the remainder of this chapter examines these various forms of reversal in six case studies that highlight the role of inducements in states' decisions to renounce their nuclear ambitions within the historical context. Table 4.2 in the Appendix outlines the states that I examine in this chapter.

Drivers of Reversal

In this chapter, I provide detailed, illustrative examples of various deproliferation cases and the types of inducements that were used to encourage nuclear reversal. These mini-case studies serve to delve deeper into the deproliferation processes to get a better understanding for how states embark on and end the pursuit of nuclear weapons. In this chapter, I present archetypal cases that best depict the primary theoretical equilibria derived from the formal model presented previously. Specifically, I provide an in-depth examination of six specific cases, how previously they are coded in both the large- and medium-n context, how their nuclear trajectory can be applied to the strategic interaction described in the formal model, and lastly, how the outcome of the proliferation instance relates back to the key equilibria that resulted from analysis of the theoretical model (i.e. deproliferation or proliferation as a result of rewards or coercion). Canada, for example, began its nuclear weapons program in conjunction with the United States and Great Britain as an integral member of the Manhattan Project and remains a key ally of the United States. However, Canada soon opted to stop its nuclear program; given its low value for becoming a nuclear weapons state, Canada more readily yielded to nominal US pressure to give up their nascent nuclear program and return to a non-nuclear status. On the other hand, despite being a relatively low priority with regard to ensuring their security and survival, China ultimately acquired a nuclear deterrent, due partly to little pressure or action, either positive or negative, from the international community.

Second, I examine the variation among hawk states or those with a significantly higher value for pursuing nuclear weapons. After nearly thirty years of consistent and costly investment, Libya ultimately decided to give up its nuclear weapons without

having successfully acquired one. Despite having a high value for a nuclear deterrent, Libya positively responded to offers by the international community, particularly Great Britain and the United States, and stopped its weapons pursuit. On the other hand, some, though interestingly not all, hawk states can be exceedingly difficult to satisfy or appease with positive, or negative, inducements. Recent evidence suggests that North Korea may be one such hawk state: given its perceived high need for a nuclear deterrent against South Korean and American aggression, North Korea has been resistant to most attempts at nuclear reversal and thus remains a nuclear weapons state.

Lastly, I conclude with two case study analyses that examine how bargaining with the international community helped to reveal information about the preferences and the type of proliferators that helped facilitate, or not, the path to deproliferation. In one instance, repeated bargaining with Taiwan helped disclose its preferences for an extended deterrent, rather than an indigenous nuclear program, to protect itself from foreign aggressors. In a similar vein, repeated interactions with the United States, specifically the offer of positive inducements to stop its nuclear program, revealed Pakistan's increasingly high value for nuclear weapons. Despite the US's desire to intervene and prevent further development of Pakistan's program, it was not willing to use military force to acquire that outcome; ultimately, Pakistan persisted in its efforts and acquired nuclear weapons.

In sum, these analyses reveal some interesting patterns across deproliferators, including the important and often defining role that the United States plays in encouraging nuclear reversal. By examining these cases in light of the primary theoretical outcomes presented previously, we are able to gain more insight in how the

causal relationship between international pressure, whether positive or negative, and the conditions under which states are willing to deproliferate. Furthermore, these analyses reveal that state-specific characteristics, such as regime type, reputation, and past behavior as a pariah or ally, may shape how the international community, especially the United States, tailors its reaction and forms of pressure, such as the ability to use force against the state. Lastly, these case studies also suggest that the path to deproliferation is long and that efforts to induce nuclear reversal may not always be successful: for some states, successful nuclearization is a foregone conclusion.

Canada (1940-1969)

Introduction

Perhaps surprisingly, Canada's nuclear weapons program represents a considerable portion of the early nuclear weapons proliferators – after embarking on a nuclear weapons program that was of low value to them, they ultimately opted to renounce their nuclear ambitions and return to a non-nuclear weapons status. While Canada's initial foray into nuclear weapons was initially motivated by desire to assist the United States, and other allies, during World War II, the Canadians, themselves, had no real need for a nuclear weapons program: they faced no external threat of consequence and did not demand the status of nuclear weapons for prestige. Canada's proliferation was primarily the result of opportunity and convenience, making her a dove proliferator that was relatively easy to convince to reverse the nuclear weapons program. What then were the options for doing so?

The use of military force, for example, against Canada was practically impossible: Canada remained a close ally and neighbor of the United States, their preferences with regard to the international system were similar, especially during the transition from World War II to the start of the Cold War, and lastly, membership in the nuclear club was far from determined such that any state, including a highly-capable state like Canada, could join without resistance. Given these factors, what would the theory of deproliferation presented previously predict for Canada's nuclear outcome? According to the theoretical model presented previously, Canada's status as a dove state with a low value for acquiring nuclear weapons, where the use of military force was significantly unlikely, should result in the United States offering a reward to induce Canada to stop its weapons program.

Indeed, analysis of the Canadian case confirms the extent to which the United States played a role in persuading the Canadians to deproliferate, despite the latter having a relatively advanced nuclear weapons capability. While the threat and/or use of military force against their ally and neighbor was unlikely, the United States opted to ease Canada's transition from nuclear proliferator to non-nuclear weapons state by offering a useful and costly reward – a security guarantee that protected Canada from current or future foreign aggressors – that resulted in the Canadians deciding to permanently dismantle its nuclear weapons infrastructure.

Manhattan Project Beginnings

Canadian policy towards nuclear weapons evolved considerably during the first three decades of the post World War II/Cold War era. As a member of the Manhattan Project that took part in the initial development of the atomic bomb, Canada is often

considered to be among the first group of states that could have acquired the bomb but surprisingly stopped its pursuit after only a short time. Canada also is in the small group of states that likely would have been accepted as a de jure nuclear state, with the other members of the permanent-5 nuclear weapons states, if it had chosen to remain on its nuclear path. Why then did Canada choose to reverse its nuclear weapons program and revert to non-nuclear status?

In partnership with the British government, Canada began its work on the Manhattan project in conjunction with the United States in the midst of World War II. Historical analyses from the US and Canada indicate the importance of Canada's influence in building the first bomb (Lentner 1976). Canada was instrumental in providing expertise on uranium mining, milling, refining and conversion, and on heavy water production, all necessary for the completion of the first bomb. By the end of World War II, Canada had successfully built a pressurized heavy water reactor and a pilot plant from which to extract plutonium (Canada Nuclear Safety Commission 2012; Blanc 2008). Senior Canadian officials later announced the decision to pursue nuclear weapons on August 13, 1945, in part, revealing Canada's role in the Manhattan project.

After reaching full power in late 1948, the plutonium plant processed a significant amount of plutonium for transfer to the US, while demand for Canadian uranium had begun to slow down. Simultaneously, the Canadian government proceeded to procure delivery vehicle systems capable of deploying US tactical and strategic weapons, ultimately equipping many Canadian units in NATO with US nuclear warheads. Canada's prominent position in the Manhattan Project had placed her in a select group, known as the "ABC Powers"—America, Britain, Canada—that were capable of

producing a nuclear arsenal if desired. Canadian politicians shared this perspective: the Canadian ambassador to the United States stated "any industrial state with the knowledge of atomic technology could manufacture it, resulting in the 'most bitter and disastrous armament race ever run'" (Paul 2000). For example, Canada began development of an indigenous nuclear-capable aircraft system, the Avro Arrow, but canceled it due to high production costs. Indeed, nuclear policy issues continued to dominate the Canadian defense policy debates for the next two decades, specifically regarding the acquisition of nuclear weapons systems (including short-range ground-to-air Bomarc B missile and Honest John artillery rockets) from the United States as part of the institutionalization of US-Canadian cooperation with the establishment of NORAD, North American Aerospace Defense Command (Paul 2000; Lentner 1976). By the end of World War II, Canada was well on its way to becoming a leader in the development of nuclear weapons infrastructure and was in the process of acquiring the necessary second phase of a nuclear weapons program, a viable delivery system.

Path to Deproliferation

The evidence suggests that the Canadians had the opportunity, resources, and material necessary to pursue a relatively successful nuclear weapons program, probably within a short period of time. According to the historical records, the Canadians considered several nuclear options, including building an indigenous capability where Canadian forces would have exclusive control over the nuclear weapons or allowing the transfer of American weapons to Canadian forces in Europe to provide security against a growing Soviet threat. Canada ultimately opted to reverse its nuclear trajectory and pursue the 'NATO strategy' whereby the Canadian forces stationed in Europe would

have American nuclear weapons operated under dual US-Canadian control (Paul 2000; Blanc 2008).

Yet, it is critical to note Canada's relative reluctance and lack of desire to fully transition to a nuclear weapons state. Canadian officials saw no need to develop their own nuclear deterrent, especially given their relationship with the United States and NATO. Indeed, the majority of nuclear research conducted in Canada exclusively dedicated to bringing the peaceful applications of nuclear energy to fruition (Edwards 1983). However, for nearly twenty years after the start of the Manhattan Project, Canada sold uranium and plutonium for use in American and British nuclear weapons programs, arguably out of a sense of loyalty and a desire to maintain close ties with the American and British nuclear establishments.

Over the course of the next two decades, the Canadians continued their deproliferation process. By 1969, the Canadian government ratified the Nonproliferation Treaty, and Canadian government insisted on the removal of the US nuclear arsenal deployed with Canadian forces in Europe, and dismantled the Bomarc missile sites in Canada (Paul 2000). In 1971, a foreign policy review called for the complete transfer of nuclear weapons to the United States and a reduction in troop commitment to NATO, though Canada would remain both in the alliance and in NORAD (Canadian Nuclear Safety Commission 2012; Paul 2000). The Canadians then began the process of transforming its heavy-water production plant and uranium refinery for peaceful purposes, in compliance with an IAEA safeguard agreement and the NPT's Additional Protocol. Canada, an active proponent of peaceful nuclear energy around the world, continues to operate the CANDU (Canada Deuterium Uranium) reactors and assist other

states in pursuing nuclear energy. Canadian leaders, such as Prime Minister Jean Chretien, have often stood at the forefront of efforts to reduce the appeal of nuclear weapons globally, including the call of disarmament, no first use policies, and de-alerting nuclear weapons. Canada has also taken on a critical role in calling for the eventual elimination of nuclear weapons, required under Article VI of the Nonproliferation Treaty, arguing that the "nuclear deterrent was valid only against a potential nuclear attack and not aggression in some other form" (Paul 2000).

Canada had access to enriched uranium and plutonium-processing reactors, scientists, and an alliance with United States that would have resulted in the swift transition from a latent nuclear weapons state to a de jure nuclear weapons state. Yet, in 1965, the Canadians decided that all exports of uranium and other nuclear materials would be designated for peaceful purposes only, essentially closing the door on a nuclear weapons program. What explains the decision to reverse this progress and terminate their nuclear weapons program?

Based on historical analyses of the Canadian nuclear weapons program, it appears as though Canada may be among the first few states with significant nuclear capability to reject nuclear weapons, and one of the few for which the international community took no significant action, either through sanctions, coercion, or tangible inducements, to incentivize reversal. However, the promise of security with US hegemony and its broader security guarantee made the development of nuclear weapons increasingly less attractive and provided Canada with the necessary push to give up its nuclear weapons infrastructure and transition to a non-nuclear status. Given the benign security environment in North America, the Canadians had no significant foreign threat to counter

and the potential threat that the Soviets may have posed was alleviated both through Canada's active conventional force, US security guarantees, and the strength of NATO. These rewards, particularly the commitment by the United States and NATO, provided Canada with a critical incentive to stop its indigenous program.

Thus, though an independent nuclear capability may have increased Canada's influence and power within the alliance and the international system, Canada ultimately opted to renounce nuclear weapons because the expected utility of acquisition was not significant enough to outweigh the costs of developing and maintaining a separate arsenal, especially given a security commitment from the United States to defend Canadian territory and interests from foreign aggressors. Under these conditions, Canada ultimately decided to stop its nuclear weapons pursuit and revert permanently to a non-nuclear weapons status. Indeed, since deproliferating, Canada has become a global proponent of nonproliferation and has worked to uphold the commitments of the Nonproliferation Treaty.

China (1955-Present)

Introduction

China's path to proliferation is seemingly more rare than Canada's or other proliferators within the nuclear club. After beginning a nuclear weapons program, primarily due to the influence and support of the USSR, the Chinese opted to continue, despite waning Soviet support, because of security concerns of a tense region - a mild motivation to continue down the nuclear path. Interestingly, the Chinese faced very little pronounced obstruction in their nuclear trajectory: while the use of military force was briefly considered by the United States as a means to inhibit China's successful

proliferation, the US did not believe that they could coerce the Chinese with the support of the Soviets, an alliance that was both improbable and potentially costly. Given these conditions – no viable option for the use of military force against a state with a moderate value for acquiring nuclear weapons but could have been persuaded – the theoretical model would predict that the international community could potentially have influenced Chinese nuclear policy and prevented their proliferation. Why then did we see China's advancement into the nuclear club?

Analysis of the historical record suggests that this outcome may in part be the result of limitations in US nuclear policy. Indeed, after months of ambivalence and indecision, and no coherent counter-proliferation strategy, the United States reached the conclusion that China's proliferation was inevitable and opted ostensibly to do nothing to affect China's nuclear trajectory: China became the fifth, and final, de jure member of the nuclear club with almost no international interference. The remainder of this section attempts to explain how this occurred.

Opportunity and Limited 'Willingness'

The People's Republic of China first publicly announced its decision to pursue nuclear weapons in 1955 under the guidance and direction of the Soviet Union. There is some evidence to suggest that the Sino-Soviet nuclear relationship actually began in 1951 when the two states signed an agreement in which China provided uranium ore in exchange for Soviet assistance in pursuing a nuclear weapons program. Yet, most attribute the start of the program to the Chinese decision to develop a strategic nuclear force under the guise of pursuing peaceful uses of nuclear energy (Federation of American Scientists 2006; Nuclear Threats Initiative 2013). The program was to be

included in a Twelve-Year Science Plan that would establish the Ministry of Nuclear Industry to immediately begin construction on a gas-diffusion uranium enrichment plant for producing weapons-grade uranium. Indeed, the evidence suggests that at the outset of the Chinese program, successfully acquiring a nuclear weapons deterrent was not the highest priority: as it pursued nuclear weapons without significant obstruction from the international community, the Chinese did not necessarily see the initial development of the nuclear arsenal as integral to their security and survival.

Given that China's initial desire to acquire nuclear weapons was due in part to augment their conventional capability and to protect against the unknown possibility of a US strike during the Korean War, a natural removal of these security concerns could have persuaded China to focus their resources and energy on strengthening their conventional capabilities and abandon their nuclear program. Despite their status as a growing regional power, Chinese officials saw nuclear weapons primarily as a means to a strategic end. While Mao believed that nuclear weapons could help China's international status, analysis of the historical records reveals that China has seen other advancements, particularly in military modernization and power projection in space, as contributing to Chinese prestige (O'Neill 1992). Thus, evidence suggests that China's proliferation is due primarily to 'opportunity,' rather than willingness alone: without the initial phase of technical assistance and guidance, it is unclear if the Chinese would have embarked on a nuclear weapons program on their own. In this regard, it is possible to consider China to be a dove proliferator – a state for whom a nuclear capability was desired but not necessary and, additionally, could have been persuaded to stop their nuclear pursuit under the right conditions.

Unobstructed Trajectory

Indeed, the Chinese program began because of offers of assistance and guidance from the Soviets as part of the growing relationship between the two Communist states. In 1957, the Chinese and Soviets signed an agreement to provide the Chinese with new technology and a guarantee of Soviet nuclear assistance in designing and manufacturing nuclear weapons, in addition to supplying a sample atomic bomb (FAS 2006, NTI 2013). While historically the overwhelming Soviet support for the Chinese has been attributed to "Nikita Khrushchev's romantic belief in world socialist revolution, and the strength of the Sino-Soviet alliance," recent evidence suggests that the Soviets, though initially hesitant to help Chinese proliferation attempts, were persuaded by the post-Stalin power struggle that required support from Mao (Shen and Xia 2012). As a result, the Soviets helped construct a research reactor and cyclotron, assisted in cooperative uranium prospecting and mining, and helped establish the Eastern Atomic Energy Institute in nuclear technological training (Shen and Xia 2012). This type of support continued through 1957 where the Soviet supplied the Chinese with a host of sensitive nuclear assistance—uranium enrichment, plutonium reprocessing, warhead design and production, and missile development—in exchange for Mao's continued support for Khrushchev.

By late 1958, the surprise PRC bombardment of Jinmen Island off the coast of Taiwan, and China's refusal to deliver a captured US-made missile to the Soviets for analysis, marked the decline of Soviet assistance to the Chinese. This shift became even more obvious as Khrushchev's position as leader of the USSR became more secure; as he relied less on Chinese support, the flow of Soviet aid substantially decreased. Perhaps

the clearest indicator of the deterioration of Soviet-Sino relations was the Soviet decision in 1959 to violate the terms of an agreement to send to China an atomic bomb teaching model and technical information integral to successful manufacture of nuclear weapons (Shen and Xia 2012; FAS 2006).

Sino-Soviet relations continued to cool during the next few years, eventually resulting in the withdrawal of Soviet advisors and the compete termination of nuclear assistance in the early 1960s (Shen and Xia 2012; FAS 2006). China, still determined to pursue nuclear weapons, relied on domestic know-how and the indigenous development of facilities and acquisition of materials to build a viable weapon. China successfully exploded its first atomic bomb in 1964 and launched its first nuclear missile in 1966. For the past half-century, the Chinese have proceeded to develop a highly advanced nuclear weapons program. And despite an initial slow-down in production during the Cultural Revolution, the Chinese have recently invested more capital into modernizing their arsenal, including the implementation of a sea-based force and the miniaturization of warheads (FAS 2006; NTI 2013).

Ambivalence in Counter-Proliferation

Recently declassified documents from the Kennedy and Johnson administrations, acquired from the National Security Archives, reveal the ambivalence and course of non-action that the United States chose in addressing the increasingly likely Chinese acquisition of nuclear weapons. The evidence suggests that although US intelligence was relatively confident that China would successfully conduct a nuclear test in the early 1960s, it was much less certain about the appropriate course of action to contain or neutralize a Chinese nuclear capability (Burr and Richelson 2001). In January 1963,

advisors to President Kennedy suggested that the US cooperate with Moscow to 'compel China to stop nuclear development,' where concern of a nuclear China, and the potential threat of a nuclear Germany, would form the basis for an anti-China alliance. For a state like China, for whom nuclear weapons were desired but not required, the use of military force would have promptly and permanently shut down the program. Yet, for the United States, the leader in counter/non-proliferation at the time, this was clearly not an option: without support, ideally from the Soviets, the US could not undertake a strategy that would involve a military strike on Chinese nuclear facilities. This option was deemed to be too costly.

After months of inaction and ambivalence about how to manage the Chinese threat (whether to use military force or enter into a tenuous political alliance with the Soviets), the administration began to consider the possibility that a nuclear China may not act as recklessly or belligerently as predicted (Burr and Richelson 2001). By 1964, the United States had ostensibly run out of time to prevent Chinese proliferation and had "fully anticipated the possibility of Peiking's entry into the nuclear weapons field and had taken it into full account in determining our military posture" (Burr and Richelson 2001).

What accounts for the US's non-response to the threat of a Chinese proliferation? First, it is likely that the US delayed acting to stop China's acquisition of nuclear weapons because it lacked a strong ally in the Soviets and did not want to engage China without assistance from the Soviets (who at the time of China's proliferation would have preferred to close the nuclear club). Evidence also suggests that, although the US was concerned about the prospect of a nuclear-armed China, they were also worried about the proliferation repercussions throughout Asia. Would a nuclear China provoke India to

seek out the bomb itself (as turned out to be the case a decade later in 1974) or would the presence of a nuclear weapons state help provide order and peace to the region? Unfortunately, the emergence of China as a de jure nuclear weapons state and a leader in the international community prompted other states to balance China's power by acquiring nuclear weapons, sparking an arms race in East and South Asia. Indeed, intelligence documents indicate that United States Air Force planners advocated dispersing nuclear weapons to US allies and other potential cooperators in the region, including India, in contravention to the Johnson administration's growing policy preference for global nonproliferation (Burr and Richelson 2001). This inherent policy tension, and the lack of other viable partners with whom to cooperate to incentivize reversal, may have stunted and ultimately prevented the US and other members of the international community from effectively responding to the increasing likelihood of a nuclear China. Specifically, the United States failed to address the other side of the inducement spectrum by analyzing whether some form of reward or benefit, potentially a way to reduce Chinese security concerns, could have influenced their decision to continue their nuclear weapons program. Though an unknown counterfactual, the theoretical model would predict that it may have been possible that a commitment by the United States to help strengthen conventional forces or address regional tensions could have slowed Chinese proliferation or potentially stopped it all together. Instead, it is possible that the US inadvertently fueled these security concerns by extending their nuclear umbrella to some of China's regional opponents – strengthening Chinese claims that their need for nuclear weapons was incredibly motivated by hostile neighbors and all but ensuring China's continuation as a nuclear weapons state.

Libya (1969/70-2003/04)

Introduction

Libya's proliferation story is no doubt markedly different from other deproliferators: during his tenure, Qaddafi placed Libya on the map as a pariah state that sponsored terrorism, while secretly pursuing weapons of mass destruction through foreign assistance. Interestingly, it is this characteristic, Libya's status as a revisionist state whose preferences for the international system differed dramatically from those of the United States and other members of the international system, that made the use of military force against the Libyans a viable option. Indeed, because of its behavior and reputation in the international system, the regime "became afraid that Libya would become the main target of the Middle East region for the United States" (Braut-Hegghammer 2007).

In the same vein, it was Libya's nearly three-decade long pursuit of nuclear weapons that revealed the extent to which nuclear weapons were a national priority. Regional security concerns, specifically Israel's nuclear weapons programs, and the belief that a nuclear deterrent would elevate Libya both regionally and internationally provided a strong foundation for an incredibly costly and lengthy nuclear pursuit. Indeed, according to Qaddafi, "in 1969 and early 1970s we did not reflect on where or against whom we could use the nuclear bomb. Such issues were not considered. All that was important was to build the bomb" (Braut-Hegghammer 2007). Libya's exceedingly high value for acquiring nuclear weapons was relatively clear, fueling their status as a hawk state that would be difficult to dissuade from successfully proliferating.

Yet, after decades of effort and numerous attempts to indigenously build or externally purchase a nuclear weapon, Libya finally yielded to international pressure and action, and began the process of nuclear reversal (Bowen 2010; Braut-Hegghammer 2007; Blakely 2010). Despite this seemingly exceptional nuclear experience, the Libyan proliferation story shares similarities with other states that received pressure from the international community. In this section, I overview the Libya nuclear program, the manner in which it was revealed that they were a hawk proliferator, and the rewards and punishments used to induce nuclear reversal.

Commitment and Determination

Libya's remarkable attempt at procuring a nuclear weapon began similarly to many states in the region—with the signing and ratification of the Nonproliferation Treaty in 1969. By the beginning of the 1970s, however, Libya had already begun its nuclear pursuit, when President Muammar Qaddafi contacted China to purchase a nuclear weapon (Bowen 2010). Determined to focus its energy overseas rather than indigenous production, Libya continued to approach nuclear technology suppliers, hoping to acquire anything ostensibly considered part of a civilian nuclear energy program, ranging from uranium mining and enrichment and research reactors to plutonium reprocessing capability. During this initial period, Libya's progress was thwarted by the reluctance of many states (including Argentina, France, and Egypt) to supply sensitive technology or equipment, thus forcing Qaddafi to turn to the Soviet Union and Pakistan for assistance (Bowen 2010; Braut-Hegghammer 2007).

The limited progress made during the 1980s, with the assistance of the Soviets and Pakistanis, came to a halt in the early 1990s. The secret work conducted during this

time on plutonium separation, uranium conversion, and gas centrifuges exemplify the difficulties of Libya's reliance on acquiring nuclear technology and training from reluctant nuclear-suppliers (Bowen 2010). Despite their significant efforts, the Qaddafi regime remained relatively frustrated by lack of progress.

The second phase of the Libyan nuclear program began in the 1990s with the establishment of the Tajoura Nuclear Research Center and its IRT-1 reactor, a 10MW light-water research reactor (Bowen 2010). From here, the Libyans began their long-term clandestine effort to build a nuclear weapon by working on uranium conversion, gas-centrifuge enrichment, and plutonium separation. While beginning experiments on plutonium separation at TNRC, Libya also continued its efforts at uranium enrichment abroad, receiving only limited help in conversion from an Eastern European country, most likely Yugoslavia (Bowen 2010; Braut-Hegghammer 2007; Blakely 2010).

However, two observations emerge: first, states were generally unwilling to work with Qaddafi because of concerns of nuclear pursuit and potential terrorist activity; and second, hawk proliferators committed to acquiring a nuclear weapon are difficult to deter even with tight restrictions on nuclear materials and technology for civilian purposes. The final phase of the Libyan nuclear program began in 1995 when Qaddafi focused efforts on uranium enrichment, leading to the reduced role of the TNRC research reactor. This one last push at acquisition also marked the beginning of Libya's collaboration with AQ Khan and his associates in Europe (Bowen 2010; Braut-Hegghammer 2007). This network provided Qaddafi with assistance on developing a gas centrifuge uranium enrichment capability, overseas training for Libyan nuclear personnel, acquisition of sensitive materials and equipment, and supplier contacts. With this system, the Qaddafi

regime placed orders with Khan who, as a middleman, contacted suppliers to produce the components requested before shipping them to Libya. By 2002, Libya had also successfully acquired design and manufacturing instructions for a 10-kiloton implosion device (based on a 1960s Chinese design), designed for delivery by aircraft or ballistic missile (Bowen 2010; Braut-Hegghammer 2007). This resurgence of nuclear ambitions, from the late 1990s onwards, cost somewhere between $100-$500 million ((Bowen 2010; Braut-Hegghammer 2007; Blakely 2010). With this investment, it was becoming increasingly clear that Libya had a high value for nuclear weapons and was willing to incur great costs to acquire a nuclear deterrent, despite the costs of economic sanctions and international reprobation imposed by the United Nations and United States.

Yet, at the time that Libya ultimately gave up its nuclear weapons program, the country had most of the technical pieces required for successful weaponization. There are a few technological factors that help explain why Libya didn't reach this point, including, the absence of a high-technology industrial and scientific base that resulted in a lack of qualified expertise to actually run and operate nuclear technology. Yet, the question remains—why did Qaddafi ultimately decide to stop this decades-long pursuit after such high sunk costs and with a low likelihood that the international community would use force to stop Libya's nuclear pursuit?

Reversal After Three Decades

The theoretical model would predict that the threat and/or imposition of sanctions should have limited impact on a hawk state that is willing to incur multiple rounds of coercion because they are truly committed to acquiring a nuclear weapons. This is especially likely to be the case when the threat of military force is a viable option for the

international community, especially a state like the United States that has the technological capability to launch a military strike against a proliferator. According to the model, if military force were an option, the US would prefer to permanently dismantle the program with a strike than use economic sanctions where the likelihood of success is uncertain.

In the Libyan case, however, the US and other members of the international community opted to try to coerce Libya to abandon its nuclear program through bilateral and multilateral sanctions. It appears, however, as though sanctions had limited negative impact on Libya's proliferation process. While, Qaddafi ultimately opted to end the program in exchange for improved relations with the international community and the end of US and UN sanctions, Libya's nuclear program seemingly blossomed under sanctions—providing no observable financial impediment to the country's decades-long acquisition attempt. Libya was able to compensate for the cost of sanctions by turning to state and non-state allies for economic and technological assistance, which only seemed to grow in the midst of international sanctions. The cohort of 'rogue' actors, including AQ Khan and North Korea, rallied together to help Qaddafi acquire nuclear weapons, seemingly undeterred by multilateral efforts to impose heavy, and hopefully prohibitive, costs on Libya. This evidence suggests that while some forms of negative inducements, such as coercive force, may have worked well for some states, like Syria, the effect of other forms of negative inducements, like sanctions, are more ambiguous and less likely to be effective against truly persistent and committed hawk proliferators.

Indeed, the theoretical model reveals an interesting and counter-intuitive outcome that seems to work well in explaining Libya's ultimate reversal of its nuclear weapons

program. The model suggests that the offer of rewards, especially when war or military force is a viable option, can be effective in inducing hawk states, such as Libya, to deproliferate. These types of states, despite the high value they hold for acquiring nuclear weapons, would prefer not to incur the costs of a military strike that decimates their nuclear program. If offered a reward from the US, they would prefer to accept the offer rather than reject it and face the very real likelihood of a military strike in response. In this way, rewards can work coercively to persuade even the most committed and hardened of nuclear proliferators to cede to the demands of the international community and stop their nuclear pursuit. Indeed, it was in the midst of the Iraq War where the US argued that use of military force was justified to stop the development of weapons of mass destruction, that Libya ultimately reversed its nuclear program. According to Qaddafi, a military strike against Libya was becoming a very real possibility – one that conditioned how both Libya and the United States approached negotiations for nuclear reversal.

Libya's nuclear reversal is primarily attributed to international pressure on Qaddafi to 'reenter' the international community. Qaddafi was faced with a critical choice: rather than continue to invest in a desired but unsuccessful nuclear program that produced opportunity costs for domestic economic development, he could stop the program and receive the resulting political and economic rewards that were associated with nuclear reversal. This ultimately prompted Qaddafi to reassess his nuclear ambitions and instead respond to international pressure to roll back Libya's nuclear weapons program, primarily through negotiations with the United State and the United Kingdom on how to settle the Lockerbie bombing issue. Trilateral bargaining provided

Libya with the opportunity both to rehabilitate its international image and to address the proliferation issue more concretely. According to the agreement, Libya was to admit responsibility for the Lockerbie bombings and pay compensation to the families of the victims. In exchange, the US cancelled sanctions against Libya, announced the resumption of full diplomatic relations with Libya, and removed it from a list of states that supported terrorism (Bowen 2010; Braut-Hegghammer 2007; Blakely 2010). Perhaps most importantly, however, the agreement provided the perfect context for negotiating Libya's deproliferation: Libya's promise to abandon its nuclear pursuit and surrender nuclear-related equipment and ballistic missiles with ranges greater than 300 km to the US facilitated the initial Lockerbie negotiations, resulting in Libya's reemergence into the international community (Braut-Hegghammer 2007; Bowen 2010). Indeed, the promise of economic assistance, international recognition, and re-entrance into the international system helped to prompt Qaddafi to renounce his nuclear ambitions and deproliferate.

What role, then, did negative inducements play in Libya's nuclear reversal? The theoretical model would predict that for a hawk state like Libya, for whom the use of force was a viable though less-desirable option, economic sanctions would have little effect. Hawk proliferators are willing to endure the 'cost of sanctions' with the belief that the ultimate acquisition of nuclear weapons will compensate for any potential political or economic loss associated with the imposition of sanctions. Indeed, in this case, it appears as though sanctions had a different, and counter-intuitive, impact on Libya's proliferation process. While, Qaddafi ultimately opted to end the program in exchange for improved relations with the international community and the end of US and UN sanctions, Libya's

nuclear program seemingly blossomed under sanctions—providing no observable financial impediment to the country's decades-long acquisition attempt. Libya was able to compensate for the cost of sanctions by turning to state and non-state allies for economic and technological assistance, which only seemed to grow in the midst of international sanctions (Braut-Hegghammer 2007). The cohort of 'rogue' actors, including AQ Khan and North Korea, rallied together to help Qaddafi acquire nuclear weapons, seemingly undeterred by multilateral efforts to impose heavy, and hopefully prohibitive, costs on Libya. In accord with the theoretical model, this evidence suggests that while some forms of negative inducements, such as coercive force, may have worked sufficiently well for some states, such as Syria and potentially Iraq if the United States had opted to follow that strategy, the effect of sanctions is more ambiguous. For example, if the international community opts to impose sanctions on proliferators, they must either be targeted at proliferators that are not intensely committed and persistent proliferators and are willing to change their nuclear policy if induced to do so. Libya ultimately reversed its nuclear program when offered a significant and desired reward for deproliferating.

Despite the high value Qaddafi initially placed on acquiring nuclear weapons, he ultimately decided to accept the positive inducements offered by the United States and Great Britain, and permanently dismantle Libya's nuclear weapons program. This instance of deproliferation helps to illustrate a critical equilibrium from the theoretical model presented previously: hawk states with high values for nuclearization may still be susceptible to pressure or action by the international community to shift their strategy and reverse their nuclear course. Libya's nuclear deproliferation provides a useful example

of one of the most interesting and counter-intuitive outcomes from the theoretical model: with a looming threat of force, the offer of positive inducements can coerce even the most committed and determined of proliferators to abandon a lengthy nuclear program. Indeed, this is one of the most novel predictions of the theory of deproliferation: rewards can be differentiated from punishments as they serve a secondary purpose of coercively modifying the behavior of the opponent.

North Korea (1959-Present)

Introduction

North Korea's nuclear program is of growing international concern. Pyongyang's tradition of antagonistic behavior on the Korean peninsula and the recent rise in belligerence towards United States are increasingly troubling, especially in light of continued nuclear and missile testing. Despite continued efforts by the US and other key members of the international community to negotiate with Pyongyang, North Korea remains committed to its nuclear program. Given the concern raised by their nuclearization, especially on the Korean Peninsula, how best can we understand their nuclear trajectory and the role that the United States and other members of the international community have played?

The theoretical framework presented previously would suggest that North Korean proliferation was likely to be a significant challenge to international counter-proliferation efforts. Unlike many other proliferators in the international community, North Korea's commitment to and value for nuclear weapons is abundantly clear. As recently as 2013, a top North Korean decision-making body issued a statement, calling its nuclear weapons "the nation's life" and saying they will not be traded even for "billions of

dollars."[25] North Korea's position as a hawk proliferator with a significant commitment to the development of nuclear weapons as a deterrent against foreign aggressors and as a means of attempting to revise the status quo in their favor has become increasingly clear over the past two decades and has significantly shaped the interactions between the North Koreans and the international community. In this way, North Korea's high value for acquiring nuclear weapons represents a challenging case for the international community for any counter-proliferation policy.

However, it is not completely clear the extent to which North Korea's hawk status has influenced the US or international community's willingness to use military force against the North Koreans. While US political rhetoric, and prior counterproliferation strategies, has left open the option for a military attack against North Korean nuclear facilities to limit their initial and continued nuclear development, how plausible and likely this is relatively uncertain. While the North Koreans are similar to the Libyans and Syrians, a pariah state with divergent preferences for the status quo from those in the international community, a military attack on North Korea is likely to be prohibitively costly to the United States and its allies in East Asia. Indeed, President Obama, throughout his presidential campaign and in his inaugural address, indicated a desire to engage with "rogue" governments. Despite North Korea's recent belligerence, the Obama Administration maintains a policy of "strategic patience," waiting for North Korea to come back to the bargaining table.

Yet, an attack on the North Koreans is possible, and perhaps more importantly,

---

[25] "North Korea Calls Nuclear Weapons Nation's Life." *The Associated Press*. March 31, 2013. Accessed via: http://www.cbc.ca/news/world/north-korea-calls-nuclear-weapons-nation-s-life-1.1303455.

it is clear that the North Koreans believe it is possible. According to North Korean expert, Dae-Sook Suh, "the reason for the North Korean nuclear weapons program is based on its need to survive. It is not to improve its power position vis-a-vis South Korea or to use nuclear blackmail in its international relations. It is not the purpose of the North Korean nuclear weapons program to engage in nuclear arms trade.... North Korea thinks it needs such weapons for its survival" (Cha, 2002). Analysis of the North Korean case provides additional evidence to suggest that Pyongyang deeply fears a preemptive strike by the Americans and is primarily focused on existential deterrence to ensure the survival of the state. North Korean scholar, Bruce Cumings, states regarding Reagan's decision to sell F-16s to Korea which was seen as a threat to DPRK in the 1980s, "this scenario truly horrified the North Koreans, and during the remaining Reagan years they shouted themselves hoarse in opposition to U.S. policy" (Cha, 2002). Thus, despite the US's intentions, along with other members of the international community, to work with the North Koreans to stabilize relations in East Asia, and potentially negotiate the reversal of North Korea's nuclear proliferation, the regime in Pyongyang believes that a military strike by the United States is possible.

Thus, the North Korean case reveals that the international community is faced with negotiating with an extreme hawk proliferator for whom the use of force, though undesired, is possible. The theoretical model presented in Chapter 2 would predict that in this type of interaction, the United States would prefer to offer a reward to observe the response by the proliferator. If North Korea rejects a reward, this further reveals their determination to acquire nuclear weapons and may then require the use of military force against the proliferator to stop its weapons program. If North Korea accepts a reward, the

US has gotten their preferred outcome without resorting to a military strike. Regardless, economic sanctions will have no impact on North Korea's proliferation: hawk proliferators, like the DPRK, are willing to incur the costs of coercion, even multiple rounds of sanctions, to successfully acquire nuclear weapons.

In actuality, the international community's policy towards North Korea's proliferation has relied on the threat and/or use of economic sanctions to stop further proliferation. In 2013, the United Nations unanimously agreed to tougher sanctions, but questions remain regarding the efficacy of this strategy after decades of failed efforts to curb North Korea's nuclear endeavor with sanctions and offers of rewards for nuclear reversal. Given what the theoretical model would suggest for US and global counter-proliferation policy for highly determined hawk proliferators like North Korea, why has much of the negotiations with North Korea centered on ineffectual sanctions that seemingly impose higher costs on the sender than on the target? In this section, I briefly overview the North Korean case and the history of deproliferation deals offered by the international community, and then evaluate the most recent attempts to negotiate with Pyongyang. I conclude with a discussion on how the further attention to the role of positive inducements may help to restructure the tenuous relationship between North Korea and the global community.

North Korea's Transition from Nuclear Explorer to Possessor

North Korea's nuclear ambitions began in the aftermath of the Korean War and growing tension in the newly divided Korean peninsula. By 1959, Pyongyang had signed a nuclear cooperation agreement with the Soviets, wherein for the next thirty years Moscow agreed to supply the North Koreans with the necessary training and technology

for basic nuclear development. This agreement resembled others of the era: the Soviets (and the US with the Atoms for Peace program) supplied client states and allies with basic nuclear technology and training (Nitikin 2013). Though not specifically designed to assist in developing nuclear weapons, the agreement initiated a series of scientific project exchanges (including the construction of the Yongbyon Nuclear Research Center) and provided the basic technologies required to produce and separate plutonium (Nitikin 2013; Niksch 2010; Arms Control Association 2013). When it became operational in 1965, the Yongbyon facilities comprised of small research reactor, IRT-2000, that could conduct basic nuclear-related research, and a radiochemical laboratory that could produce small quantities of radioisotopes, both of which gave the North Koreans the ability to experiment with plutonium (Nitikin 2013; Niksch 2010). Though the Yongbyon complex was placed under IAEA inspection in 1977, these types of facilities were not subject to undue scrutiny (Niksch 2010; Arms Control Association 2013).

In the next decade, North Korea ramped up its nuclear ambitions by launching a national program aimed to build several industrial-scale facilities that could produce significant amounts of plutonium for the country's nuclear weapons and power industries. To do this, the North Koreans built three gas-cooled natural-uranium-fuelled reactors, uranium mine factories to process and refine uranium ore for fuel fabrication, and a radiochemical laboratory/reprocessing plant (with a second plant in production) that could extract plutonium from the spent reactor fuel. This indigenous approach to pursuing a nuclear weapons program was made easier from already-public reactor designs and easy access to significant quantities of raw materials, such as natural uranium (Nitikin 2013; Niksch 2010).

However, when North Korea acceded to the Nonproliferation Treaty in December 1985, all its nuclear facilities and materials were placed under international inspection. In exchange for allowing inspections of all of its nuclear facilities, the North Koreans demanded that the United States withdraw all of its naval and land-based tactical nuclear weapons deployed in South Korea (nearly 100 nuclear warheads), and that South Korea agree to the Declaration on the Denuclearization of the Korean Peninsula under which Seoul promised not to "produce, possess, store, deploy, or use nuclear weapons" (Nitikin 2013; Niksch 2010). In December 1991, both the DPRK and South Korea signed the Joint Declaration, agreeing to non-nuclearization and mutual inspections for verification. And although Pyongyang had only 18 months under the treaty to negotiate a comprehensive safeguard agreement with the IAEA, it did not sign this agreement until 1992 (Arms Control Association 2013; Niksch 2010). Simultaneously, the United States began to impose targeted sanctions on specific corporations for their missile proliferation activities (Arms Control Association; Nitikin 2013; Niksch 2010).

After six official inspection missions, the North Koreans denied inspectors access to potential nuclear waste storage facilities and threatened to withdraw from the NPT. These initial inspections, however, revealed discrepancies between Pyongyang's initial declarations to the IAEA and the analyzed samples taken from extracted plutonium, which, coupled with satellite imagery, indicated that the North Koreans had produced much more plutonium (between 2 and 4 kg) than authorized or disclosed (Nitikin 2013). By 1993, after repeated refusals for greater access (including a IAEA request for a 'special inspection of two alleged waste sites), and US assurances against the threat and use of force (including the use of nuclear weapons) and interference in

DPRK internal affairs, Pyongyang withdrew from the NPT. Thus began the 1993-1994 nuclear crisis. At the start of the crisis, the US assessed that the North Koreans had potentially produced enough plutonium for one to two nuclear weapons or 8-12kg of separated plutonium they had concealed throughout IAEA inspections (Nitikin 2013).

In 1994, the US and North Korea signed the Agreed Framework, that included various provisions, such as the freezing and replacement North Korea's indigenous nuclear power plant program with more proliferation-resistant light water reactor plants, the normalization of diplomatic relations between the two states, and US formal assurances that it would not threaten or use nuclear weapons against the North Koreans. To verify the freeze on plutonium production facilities, the IAEA placed seals on the key access points, installed monitoring devices and allowed a team of resident inspectors at Yongbyon, who were authorized to conduct inspections on short-notice. Pyongyang also agreed to a series of additional containment and surveillance measures to confirm the freeze on production, but resisted others that could possibly reveal the extent of progress before the arrested development. One recurring theme throughout the nuclear freeze was the high premium placed on food and economic assistance as a policy-changing reward. For example, Former President Jimmy Carter was able to negotiate a deal between the US and North Koreans regarding implementation of restrictions, points of access, and inspections, in exchange for US food assistance and the resumption of high-level talks with the United States (Niksch 2010).

This agreement represented a significant concession to North Korean demands: given the DPRK's fear of regime survival due to a preemptive strike by the United States, an assurance to not threaten to attack the North Koreans (even in defense of their allies in

the region) was a critical carrot to Pyongyang. This agreement, with a focus on benefits desired by the North Koreans, was a critical shift in how the international community, but especially the United States, approached negotiating with the North Koreans. Indeed, as the theoretical model would suggest, North Korea's response to this offer, and if accepted, their willingness to uphold a commitment to the deal, was likely to reveal information about the extent to which North Korea desired to remain a nuclear weapons states and the costs they would incur to keep their deterrent.

Deviation from the Agreed Framework

North Korea's proliferation attempt did not end with the signing of the Agreed Framework as hoped. To the extent that Pyongyang sought to maintain a nuclear hedge to protect itself, the regime had strong incentives to pursue alternative proliferation that would allow it to comply with international nonproliferation demands, while clandestinely preserving its nuclear ambitions. For example, although neither has publicly acknowledged their cooperation, it is suspected that the North Koreans provided Pakistan with missiles and production technology in exchange for sensitive nuclear assistance, such as gas centrifuge technology, which would allow the DPRK to produce weapons-grade fissile material. By 1996, the United States began re-imposing a series of sanctions on North Korea for missile technology-related transfers, missile-proliferation activities, and Pyongyang's transfer of missile technology and components to AQ Khan's Research Laboratory in Pakistan. The United States, in conjunction with South Korea and Japan, also continued diplomatic negotiations with North Korea to encourage the termination of its missile programs in exchange for relief from economic sanctions. This strategy resulted in some temporary successes. For example, Pyongyang agreed to a

moratorium on testing any long-range missiles for the duration of the bilateral talks with the US in exchange for a partial lifting of economic sanctions (Nitikin 2013; Niksch 2010). In addition, in response to the historic North-South summit regarding the question of reunification of the Korean Peninsula, the US temporarily relaxed sanctions, allowing a wider range of trade in commercial and consumer goods, easing restrictions on investment, and removing prohibitions on direct financial transactions. In 1999, North Korean policy coordinator William Perry recommended "a new, comprehensive and integrated approach to…negotiations with the DPRK, which would involve a coordinated reduction in isolation by the US and its allies in a 'step-by-step and reciprocal fashion'" (Arms Controls Association, 2013).

However, these advances were short-lived, despite continued efforts at diplomacy by the US and other members of the international community. By 2002, US intelligence had discovered Pyongyang's suspected attempts to acquire technology and materials, such as high-strength aluminum tubes, for a centrifuge program. Less than two years later, the US concluded that the North Koreans had reneged on their commitment to curb proliferation and had instead, initiated a secret production-scale centrifuge facility to produce enough weapons-grade uranium for two or more nuclear weapons per year when fully operational (Nitikin 2013). This revelation resulted in the collapse of the Agreed Framework in late 2002, when North Korea disabled the IAEA monitoring equipment at its reactor and reprocessing facility, restarted plutonium production, and expelled inspectors from Yongbyon.[26] In January 2003, the IAEA Board of Governors adopted a

[26] Without inspections it is obviously difficult to ascertain the exact status of plutonium production and the extent to which DPRK re-ignited its nuclear weapons pursuit.

resolution that condemned Pyongyang's decision to restart its reactor and resume its nuclear activities. Less than five days later, North Korea withdrew from NPT, ostensibly confirming that they had re-embarked on their nuclear ambitions and were determined to maintain their nuclear deterrent (Arms Control Association 2013).

North Korea's decision to renege on their commitments attached to the offer of significant political and economic rewards signifies an important turning in the interactions between the Pyongyang and Washington: with this move, the North Koreans revealed their determination to remain a nuclear weapons state whereby neither the use of economic sanctions (imposed prior) or the offer of rewards would persuade them to abandon their nuclear program. After years of ineffective economic sanctions and a seemingly reasonable offer of political and economic benefits, North Korea revealed they had little intention of ever abandoning their nuclear program. The collapse of the Agreed Framework represents a key implication of the theoretical model: there are some states for which successful nuclearization is a foregone conclusion.

Aftermath of the Agreed Framework

The unprecedented withdrawal of the DPRK from the NPT and indications that it may lift its moratorium on long-range missile testing prompted a series of attempts at multilateral negotiations, to no avail. The negotiations, however, highlight the iterative nature of bargaining between the North Koreans and the international community, and the wide range of inducements offered (and rejected) by both parties. For example, in 2003, North Korea proposed a solution whereby the US would conclude a non-aggression treaty that normalized bilateral diplomatic relations, refrain from interfering in North Korean economic affairs with other states, complete the reactors promised under the

Agreed Framework, and increase food aid, in exchange for the dismantlement of the 'nuclear facility,' the termination of missile-testing, and export of missile-technology (Niksch 2010; Arms Control Association 2013). The North Korean delegation, however, also threatened to test nuclear weapons or demonstrate that they have the capability to deliver them. Unsurprisingly, the US did not agree to this proposal. Hostilities, interspersed with occasional attempts at negotiation and ongoing sanctions, have continued for more than a decade.

In the past year, tensions between the North Koreans, their immediate neighbors, and the broader international community have intensified as Pyongyang, now under the leadership of Kim Jong-Un, has continued to conduct missile and nuclear tests in contravention of UN Security Resolutions aimed to deter these tests. The result of these actions has been increasing bellicose rhetoric out of Pyongyang that has suggested imminent aggression against Seoul, US military bases in the Pacific, and the Western coast of the United States. And despite evidence that indicates that the North Koreans do not yet have the capability to target the mainland of the United States, North Korea's threats have presented significant challenges to continued efforts to talk with Pyongyang on issues of nonproliferation and arms control.

Nevertheless, the international community continues to negotiate with North Korea by threatening/imposing financial sanctions. As recently as February 12, 2013, the UN Security Council passed a unanimous resolution to strengthen existing sanctions (by expanding the scope of materials covered) and to add financial sanctions (including the blocking of large cash transfers and targeting specific individuals and entities for asset freezes) (Nitikin 2013; Arms Control Association 2013). Recent evidence suggests that

these sanctions have been relatively ineffective (Nanto and Maynin 2010; Haggard 2012). For example, Hufbauer et.al., estimate the projected cost of sanctions to be approximately 1.2% of North Korea's GNP in a given year. But, in the years when the international community imposed sanctions, China provided compensatory economic, military and food aid to offset those sanctions (Hufbauer et.al. 2006; Nanto and Maynin 2010; Haggard 2012).

Analysis of North Korea's proliferation history, particularly in the context of the theoretical model presented previously, provides evidence of two interesting and unexpected implications and equilibrium outcomes: coercive instruments may not always be effective with proliferators like North Korea, and, potentially more importantly, there may be some highly-resolved states that are unlikely to reverse their nuclear course, even when offered valuable and desired rewards, i.e. proliferation breakout may occur regardless of the international community's best efforts otherwise. Despite ongoing efforts the international community, including more recently the Chinese, to work with the North Koreans to discuss the nuclear issue, these negotiations continue to be unsuccessful and inadvertently prolong Pyongyang's nuclear course. This evidence confirms the predictions derived from the theoretical model of deproliferation: that it may be increasingly challenging, potentially even impossible, to induce deproliferation in North Korea or similar determined proliferators. In these instances, the threat or use of economic sanctions are not likely to change the outcome – breakout will occur.

Taiwan (1956- 1988)

Introduction

Taiwan, like other states in her immediate neighborhood, pursued a nuclear weapons program due to the increasingly dangerous security environment of East Asia. However, unlike most other states in the region, Taiwan was at the epicenter of proliferation in the Cold War era—with the emergence of China as a growing regional threat, now with a nuclear weapons arsenal. Like other states fearful of foreign aggressors, Taiwan desired the protection that accompanied a nuclear deterrent – whether outsourced to a nuclear weapons patron like the United States or through indigenous development. Analysis of the Taiwanese case reveals that in some ways, Taiwan pursued both routes: while under the protection of the US nuclear umbrella, Taiwan also opted to secretly pursue a nuclear weapon. What then explains their decision to stop their nuclear pursuit after nearly thirty years? How does the Taiwanese case differ from that of the Libyans?

First, Taiwan's desire for a nuclear deterrent, and the lengths they were willing to go to procure one was uncertain – this was increasingly evident when they clandestinely pursued an indigenous nuclear program, despite the extended deterrent guaranteed by the United States. Indeed, it was only after a second phase of bargaining with the United States, who offered to strengthen their security guarantee and renew their commitment to protect their client state, that Taiwan ultimately revealed their type: though they had an unsurprisingly high value for nuclear weapons as a form of 'existential deterrent,' Taiwan was unwilling to incur additional political, economic, or military costs to acquire an independent arsenal. Taiwan ultimately successfully revealed information about their

type as a dove proliferator that was not willing to endure the costs of coercion by continuing their nuclear program.

Second, the Taiwanese instance differs from others where the proliferator pursues a lengthy nuclear program, such as the case in Libya, because the use of force as a means of inducing reversal was a non-option. Aside from its stated responsibility to ensure the survival and protection of Taiwan against foreign aggressors, the United States was also hesitant to impose significant coercive costs on an ally, especially in a complicated and tense region. Taiwan represented an opportunity, though somewhat costly, for the US to extend its sphere of influence in East Asia. With their client states, the use of military force as a means of inducing nuclear deproliferation was all but impossible.

Taiwan's pursuit of nuclear weapons lasted about thirty years before Taiwan opted to dismantle its nuclear technology, return nuclear material to the United States, and permanently renounce any weapons-related nuclear research. At the time of its reversal, Taiwan was considered to have modest weapons potential, indicating, essentially, that it could have relatively easily transitioned from a latent nuclear state to a de facto nuclear weapons state. What then explains its decision to renounce its nuclear ambitions?

Clandestine Independent Nuclear Program

The postwar partition between mainland China in 1949, China's overwhelming military superiority, and the ability to suddenly strike nationalist forces on the small island drove Taiwan to seek protection elsewhere—namely the United States. These concerns precipitated the US and Taiwan to sign the Mutual Defense Treaty of 1954 that obligated the US to defend the island. This de facto US security guarantee included the

placement of nuclear-capable weapons on Taiwanese territory in the 1950s. The 1964 Chinese nuclear detonation further shook the Taiwanese leadership, who immediately turned to the United States to take preemptive action against an encroaching and nascent Chinese nuclear program that could easily strike and annihilate the small island. The US's refusal to engage the Chinese and neutralize their arsenal, coupled with their focus on Vietnam, prompted the Taiwanese to begin to secretly develop their own nuclear arsenal at an enormous cost (approximately $140 million) for the still-developing island (Hersman and Peters 2006; Reiss 1988). This resulted in the creation of the weapons project, "Hsin Chu," put under the authority of the Taiwanese Institute of Nuclear Energy Research (INER). INER's close ties to the military and its proximity to other research centers in the nuclear power industry provided the necessary cloak for the nuclear weapons program to remain clandestine for several years. In fact, the nuclear project was managed by both civilian personnel, from the Atomic Energy Council and military officers, from the Chungsan Institute Military Research and Development Center, further blurring the line between Taiwan's civilian and military nuclear aims (Hersman and Peters 2006; Blanc 2008). This nexus coupled with the lack of transparency inherent in authoritarian regimes perpetuated the clandestine nature of the nuclear program (Albright and Gay 1988; Hersman and Peters 2006; Levite 2002/2003).

Throughout this time, however, Taiwan maintained the auspices of a member of the nonproliferation regime. In 1968, Taiwan joined the Nonproliferation Treaty (NPT) as a non-nuclear weapon state and signed a safeguards agreement with the IAEA. Only three years later, Taiwan was expelled from the UN (due to the UN's recognition of the PRC as the only legitimate regime in China) and lost its IAEA membership (leading to

the establishment of a trilateral agreement between Taiwan, the US and the IAEA that ostensibly gave the US de facto responsibility over Taiwan's non-nuclear status) (Albright and Gay 1988; Hersman and Peters 2006; Levite 2002/2003).

This pattern of interaction, where the US's attention would shift away from its security guarantees in the region which Taiwan used to justify its covert pursuit of nuclear weapons, ensued for decades. When President Nixon embarked on a new relationship with China, Taiwan responded by purchasing light water reactors (and other forms of nuclear technologies) from West Germany, Canada, South Africa, France, and even the US as the defense ministry secretly pursued a plutonium separation capability, successfully separating 30 kilograms of plutonium by 1978 (Hersman and Peters 2006; Blanc 2008). The US embassy in Taipei began to notice large purchases in fuel to operate its reactors, nuclear technology and uranium, finally leading the CIA to conclude in 1974 that Taiwan had begun a 'small nuclear weapons program.'

Revelation of Type and Renewed Reliance on the US Nuclear Umbrella

Taiwan's clandestine nuclear program, confirmed by specialists at Los Alamos National Laboratory who had visited Taiwan, ultimately caught the attention of the US government who began to pressure the Taiwanese to stop pursuit of nuclear weapons and dismantle their existing nuclear technologies. Upon realizing that the Taiwanese had violated the terms of the security guarantee, the United States aimed to reinstate negotiations to stop further nuclear development. After President Chiang Ching-kuo, a long proponent of nuclear weapons, publicly announced that Taiwan could produce nuclear weapons if they desired, the US significantly increased public and private pressure on Taiwan to end all nuclear-related activities (Albright and Gay 1988; Hersman

and Peters 2006; Levite 2002/2003). This pressure took various forms, such as the threat of changing or revoking existing positive inducements and the promise of new forms of positive inducements. The US, for example, hinted that further actions by Taipei to continue down their nuclear path would threaten and weaken the US security guarantee in place and could actually result in future sanctions against the regime, including a ban on exporting fuel supplies for research reactors. Ultimately, however, the United States opted to pursue a primarily rewards-based strategy whereby if Taiwan agreed to dismantle its reactor labs and processing facilities, return the US-supplied plutonium, and convert the country's main reactor to use low-enriched and natural uranium exclusively (not for weapons), the US would agree to strengthen, and more credibly signal, its promise to guarantee Taiwanese security. This new 1979 Taiwan Relations Act (TRA) aimed to codify the role of the US as a security guarantor against 'grave concerns,' leaving the exact nature of that relationship ambiguous (Hersman and Peter 2006).

The United States offered this reward to the Taiwanese as a way of relieving some of their concerns about security, especially whether the US could be relied upon to protect Taiwan in the event of foreign aggression. Given that regime survival was the primary aim of the Taiwan's indigenous nuclear development, Taipei was willing to abandon its own nuclear weapons program and effectively reveal its type as a dove proliferator that, though desirous of an effective nuclear deterrent, did not place a high enough value on nuclear weapons such that they were willing to incur the costs of acquiring on their own. Indeed, as is predicted by the theoretical model presented earlier, the offer of rewards can help reveal the preferences and type of the proliferator such that dove proliferators like Taiwan that seek nuclear weapons would still prefer to accept a

reward, especially an offer of military assistance or security guarantees, than risk the costs of coercion, namely economic sanctions (as the use of force with an ally like Taiwan is incredibly unlikely). In revealing the type of the proliferator, the United States, is better able to identify the most effective policy instrument to induce permanent deproliferation.

With the promise of a US military commitment to provide security against foreign aggressors such as China, Taiwan ultimately relented and began to dismantle its nuclear program, including allowing close inspections of nuclear facilities and returning nearly 80 kilograms of spent plutonium to the United States (Hersman and Peters 2006; Albright and Gay 1988; Levite 2002/2003). Taiwan did briefly reconsider a nuclear program in the late-1980s, but again, the US was able to quickly pressure Taipei to re-abandon any weapons-related activities. Indeed, it was ultimately Taiwan's response to the reinstatement of the Taiwan Relations Act, a reward that ensured continued US protection that helped distinguish Taiwan from other proliferators.

How then do we describe Taiwan's path to deproliferation? While there is a long-standing debate in the literature regarding the nature of inducements—whether the revocation, adaption, or renewal of an inducement still considered to be a positive inducement, rather than a negative inducement—Taiwan's proliferation case is certainly a useful example of a key equilibrium outcome from the theoretical model where the United States offers a reward, the proliferator's behavior in either accepting or rejecting the reward helps to reveal its type, and the United States updates its prior beliefs about the proliferator by either guaranteeing the reward or switching to a coercive strategy. For Taiwan, nuclear decision-making was closely tied to the perception of US assistance and

protection that the promise of this carrot alone was enough to convince Taiwan it couldn't afford to lose the US as a guarantor. Indeed, some scholars have argued that Taiwan's survival, especially in the context of China's development as a regional nuclear power, was entirely dependent on security assistance and the provision of political and economic aid from the United States (Reiss 1988; Albright and Gay 1988; Hersman and Peter 2006; Levite 2002/2003). Lastly, contrary to some early predictions regarding proliferators that stress the role of security threats in proliferation decisions, Taiwan instead opted to commit to the protection of an extended nuclear umbrella, dismantle its nuclear technology/stop pursuit of an indigenous nuclear capability, and receive the benefits offered by the United States in exchange for abandoning an independent nuclear deterrent.

Taiwan's decision to rollback its nuclear program suggests that positive inducements may be sufficient to persuade some types of proliferators, especially states with low or medium valuations for nuclear weapons programs, without the threat or use of punishments to alter state behavior. For these types of states, the offer of rewards (or the promise to resume rewards) works first to reveal the state's intentions (whether they have strong or weak value for acquiring nuclear weapons). Indeed, continued bargaining and negotiation with Taiwan helped to uncover Taiwan's preference for guaranteed protection under the American security umbrella rather than a previously-held belief that Taiwan wanted to pursue an indigenous and separate nuclear deterrent. Upon this revelation of Taiwan's type as a dove proliferator, the United States was able to provide the reward best suited to ensure Taiwan's nuclear reversal and return it to a non-nuclear weapons status.

Pakistan (1957-Present)

Introduction

Pakistan, with India, was among the first to develop a nuclear capability outside the confines of the Nonproliferation Treaty (NPT) that helped open the door for other states to pursue nuclear weapons as a de facto nuclear state. Despite the international community, especially the United States' attempts to curb the tide of proliferation globally – the Pakistanis were able to relatively clandestinely acquire nuclear weapons with some external assistance.

The reaction to Islamabad's announcement of the new nuclear program suggests that while the exact timing of the tests was surprising, the fact that the Pakistanis were determined to acquire a nuclear deterrent against foreign aggressors was not. Indeed, Pakistan's high value for acquiring nuclear weapons became increasingly clear over the course of its interactions with the United States and other members of the international community. Pakistan's two-fold motivation for nuclear weapons – India's nuclear development and Pakistan's desire for international prestige - incited its high desire for a nuclear deterrent. According to Pakistan scholar, Samina Ahmed, "from its inception, Pakistan's nuclear policy has been India-centric, revolving around perceptions of threat from and hostility toward India. The issue of prestige, evident in Pakistan's desire to acquire equal standing with India in nuclear weapons development, also looms large."[27] Yet, it was not until Washington began to approach Islamabad for negotiations on their nuclear development that it became incontrovertibly clear that Pakistan was a hawk

[27] Samina Ahmed. "Pakistan's Nuclear Weapons Program." *International Security*, Vol. 23, No. 4 (Spring, 1999).

proliferator that was determined to acquire nuclear weapons despite the costs of doing so.

In spite of growing evidence that the Pakistanis were committed to their nuclear weapons program as a means of deterring, a potential conflict with India, the United States was not keen to use aggressive coercive tactics to stop their proliferation attempt. For much of the early part of Pakistan's nuclear program, its geostrategic position – neighboring China and located near the Soviet Union – and non-Communist bent, made Islamabad a natural ally of the United States. In addition to serving as a reliable donor of conventional arms and some of Pakistan's earliest sensitive nuclear assistance, US military and economic assistance allowed for the expansion and development of Pakistani standing, especially relative to its neighbors and adversaries. For the US, the use of force against Pakistan was not a viable option.

How then can we understand Pakistan's transition from secret proliferator to de facto nuclear weapons state? The theoretical model of deproliferation would predict that in an interaction with a hawk proliferator for whom the use of military force is not a viable option, like Pakistan,, the international community and/or the United States should focus their pressure on offering positive inducements rather than imposing sanctions that won't have a significant impact on a persistent and determined proliferator. Yet, analysis of the Pakistani nuclear case suggests that the US's inconsistent, arbitrary, and often self-serving policy decisions may help explain why the international community was ultimately unsuccessful in incentivizing Pakistan to reverse its program. Upon negotiating with the Pakistanis, the United States ultimately learned their type as a hawk proliferator that was committed to acquiring nuclear weapons. Instead of focusing their counter-proliferation policy on offering positive inducements that addressed Pakistan's

motivations for pursuing a nuclear deterrent in the first place, the United States centered its policy towards Pakistan on threatening the revocation of its economic and military assistance and imposing sanctions to induce nuclear reversal. In this section, I review Pakistan's path to proliferation, highlighting the US's policy path that ultimately failed to prevent Islamabad's acquisition of nuclear weapons.

Partition to Proliferation

The 1947 division of the subcontinent resulted in the creation of two independent states and almost immediate regional tension. To counter potential external aggression from each other and neighboring adversaries, both India and Pakistan sought to secure an effective deterrent and initially relied on conventional forces to do so. Unsurprisingly, both India and Pakistan first expressed interest in nuclear weapons with the introduction of the Atoms for Peace program. In a speech to the United Nations General Assembly in 1953, President Dwight Eisenhower announced a plan that encouraged nuclear suppliers to share civilian nuclear technology and materials in a broader effort to advance international peace and prosperity while limiting entrants into the nuclear weapons club (Fuhrmann 2009). Since then, nearly 2000 bilateral civilian nuclear cooperation agreements (NCAs) have been signed to regulate the transfer of related nuclear technology, nuclear materials, and technical know-how for peaceful or civilian purposes, in exchange for agreeing not to pursue the bomb (Furhmann 2009). Pakistan was one such recipient of an NCA: in August 1955, Pakistan and the United States signed an agreement that led to the construction of a small research reactor at the Pakistan Institute of Nuclear Science and Technology (PINSTECH) and a small supply of highly enriched uranium to operate the reactor (Furhmann 2009; Samira 1999). In the 1960s, the

Pakistanis signed a similar agreement with the Canadians to establish the Karachi Nuclear Power Plant and supply the necessary heavy water and uranium to run the reactor. Similar agreements were reached with the United Kingdom, Belgium, and France. Within the next decade, not only had Pakistan received the necessary materials and technology for a nascent, potentially dual-use, nuclear program, but Pakistani scientists were also being trained to both design and build nuclear reactors and in chemistry and metallurgy to safely operate dangerous radioactive materials (Furhmann 2009). By the conclusion of the Indo-Pakistani War in 1971, where India had soundly defeated the Pakistanis, Islamabad initiated a nuclear weapons program. Pakistan quickly redoubled its efforts at acquisition after India's 1974 'Peaceful Nuclear Explosion,' made significantly easier by the previous two decades of technology transfers and scientific training that actually equaled those of India's in the wake of the 1974 test.

Indeed, the Atoms for Peace program is generally viewed as a critical moment in US foreign policy that effectively aided the acquisition of nuclear weapons by lowering the costs of developing a program if the country chose to do so. With this assistance, many, including Pakistan, did. Prime Minister Zulfikar Ali Bhutto and Munir Ahmad Khan, chairman of the Pakistan Atomic Energy Commission who had only recently finished training at Argonne National Laboratory, believed they could use the existing facilities, built through Atoms for Peace, to develop nuclear weapons (Fuhrmann 2009; Samira 1999). While they eventually followed the uranium path to the bomb, with the assistance of the clandestine AQ Khan network, Pakistan was only able to master the sophisticated enrichment technology to produce the highly enriched uranium necessary for weaponization because of the assistance it had received through the Atoms for Peace

program.[28]

The evidence suggests that without the technology, know-how, and materials it procured through foreign assistance, Pakistan's path to proliferation would have been more tenuous and costly. According to the core tenets of Eisenhower's speech in 1953, which was later codified in Articles III and IV of the NPT, the United Nations sought to establish a 'grand bargain' that would ensure that the nuclear club remained at five states: offering peaceful nuclear technology in exchange for foregoing nuclear weapons. Atoms for Peace was meant as a consolation prize for states that agreed to stop any existing pursuit of the bomb and to prevent states from starting or restarting a nuclear weapons program. The program began as a series of bilateral agreements for peaceful nuclear technology that helped Pakistan develop a civilian energy program while maintaining an explicit nonproliferation agreement.

Constraining Development: The Initial Use of Sanctions

Yet, the question remains, how did the United States fail to effectively use its political pressure to induce Pakistan to stop its nuclear weapons program once it became clear that they had transitioned from a civilian to military program and were determined to acquire nuclear weapons? The answer suggests that incentives to misrepresent intentions and seemingly contradictory policy preferences play a significant role in our understanding of how Pakistan was able to successfully acquire nuclear weapons despite international pressure and constraints.

Perhaps unsurprisingly, Pakistan's rhetoric regarding its nuclear weapons

[28] George Perkovich, "Nuclear Power and Nuclear Weapons in India, Pakistan, and Iran," in Paul Leventhal, Sharon Tanzer, and Steven Dolley, eds., Nuclear Power and the Spread of Nuclear Weapons: Can We Have One without the Other? (Washington, D.C.: Brassey's, 2002), p. 194. Samar Mubarakmand, Capital Talk Special, Geo-TV, May 3, 2004, http://www.pakdef.info/forum/showthread.php?t_9214.

program varied based on the audience and thus presented conflicting information about its preferences and desire for nuclear weapons. To the international community, Pakistan remained committed to global nonproliferation goals and the introduction of a nuclear weapons-free zone in South Asia. Indeed, Pakistan soon became a regional and global leader in encouraging disarmament and limit the spread of nuclear weapons materials beyond the nuclear club. Yet, to its domestic audiences, especially the powerful military-industrial complex, Pakistani leadership stressed the importance of a nuclear deterrent as a means of survival. Zulfikar Ali Bhutto famously stated in 1966 that if India acquired nuclear weapons, "even if Pakistanis have to eat grass, we will make the bomb" (Ahmed 1999).

With this contradiction in intent, it was initially difficult to assess Pakistan's true value for acquiring nuclear weapons and the lengths it would go to for successful weaponization. Even as late as 1985, a National Intelligence Council report suggested that though Pakistan probably had a workable design for a nuclear explosive device, it was unclear how far they were from being able to produce enough enriched uranium to produce one bomb (Kerr 2011). This ever-present ambiguity in technical capability and willingness to endure the costs of development could have presented an opportunity for the United States to leverage an offer of rewards that would have exceeded the benefits Pakistan could derive from their nuclear program, in exchange for permanently abandoning their program. In accord with the theoretical model, the United States is more likely to permanently induce nuclear reversal in all types of proliferators, including those where the initial evidence indicates that the proliferator could be a hawk with a high value for nuclear weapons. For these types, however, the value of the reward must

be sufficiently high to make the proliferator indifferent between stopping and continuing the program. The model also suggests that the use of coercion, specifically economic sanctions, may work on some proliferators but is less likely to deter the most determined of opponents.

Unfortunately, the international community's policy on attempting to curb Pakistan's nuclear development followed a coercive path. The United States, after first learning of the transition from a purely peaceful to military program in the late 1970s (September 1977 and April 1979), imposed a set of military and economic sanctions that were designed to slow or stop Pakistan's nuclear development. Additionally, the United States cut off economic and military aid under amendments to the Foreign Assistant Act that had previously codified the United States' role as a large contributor of foreign aid to the Pakistanis.

Despite the attempt to constrain Pakistan's ability to purchase the necessary fissile materials or infrastructure for the weapons program, Islamabad created a widespread covert network throughout Western Europe to acquire uranium enrichment technology that capitalized on existing loopholes in international legislations and circumvented the sanctions imposed by the United States and other members of the international community. Simultaneously, Pakistan also began turning to other nuclear weapons states, like China, for assistance in purchasing materials, hardware, and nuclear expertise to continue its indigenous program. Chinese assistance consisted of weapons-grade uranium, information on uranium enrichment, and help in establishing the Kahuta ultracentrifuge uranium enrichment plant (Ahmed 1999). Indeed, Pakistan's reaction to the sanctions, ostensibly a redoubling of its efforts to acquire a nuclear deterrent, helped

to reveal information about its high determination to acquire nuclear weapons despite the ensuing political and economic costs.

According to the model, the US, upon receiving this information, has an opportunity to update its beliefs about Pakistan's value for nuclear weapons and realize that a second phase of coercion would be ineffective, especially given that they would not be able to use military force against their sometimes ally. Instead, the model would suggest that the United States turn to the offer of positive inducements to persuade even the most committed of proliferators to reverse their nuclear weapons.

Unfortunately, the US's strategy towards the Pakistan centered on continuing the imposition of economic sanctions and dramatically reducing military and economic assistance to the Pakistanis (their second-largest recipient of foreign aid). There were, however, brief moments in Washington's relationship with Islamabad that emphasized that positive inducements may work better to induce a change in Pakistan's nuclear policy. The U.S. undersecretary of state for security assistance, science, and technology, James Buckley, for example, stated, "in place of the ineffective sanctions on Pakistan's nuclear program imposed by the past administration, we hope to address, through conventional means, the sources of insecurity that prompt a nation like Pakistan to seek a nuclear capability in the first place" (Ahmed 1999). Indeed, in the 1980s, to ensure Pakistan's allegiance to the Americans during the Cold War, President Reagan opted to ignore Pakistan's continued nuclear development and further extend its economic and military aid commitments to Islamabad.

However, the post Cold War environment again shifted the dynamics between the United States and Pakistan: with less need for the strategic support of the Pakistanis

against the Soviets, Washington returned to its broader disarmament goals by reinstating sanctions against Islamabad under the Pressler Amendment and halting all US economic and military assistance (Ahmed 1999). Perhaps unsurprising for a hawk proliferator like Pakistan, that was sufficiently determined to acquire a nuclear deterrent, these policy instruments have did little effect on Pakistan's nuclear policy. First, according to some Pakistani scholars, Islamabad expected US foreign aid to wane after the end of the Cold War, as Pakistan was no longer strategically important to the Americans. Additionally, Pakistan believed that continued sanctions would have minimal impact on their economy, as US-imposed sanctions were not tied to loans or grants given by the International Monetary Fund, the Asian Development Bank, or the World Bank. Pakistani officials also stated that the state's legitimate security needs required a nuclear deterrent and that these unfair sanctions served only to reduce Washington's leverage in dealing with Islamabad (Ahmed 1999).

Indeed, soon after the United States opted to refocus its policy on negative inducements, the Pakistanis publicly declared its intent to build nuclear weapons. The next half decade saw an oscillation in the strategic dynamic between the Pakistanis and the United States whereby the latter would suggest negotiations emphasizing positive engagement and the offering of positive political and military incentives, including under the Brown amendment to the 1996 Foreign Assistance Act, a onetime waiver of the Pressler amendment and the selling of $368 million worth of military hardware to Pakistan. Yet, the United States could not provide the key inducement that the Pakistanis

sought – a promise by New Delhi to reverse their nuclear course and halt proliferation.[29] Because of the United States' policy objective to remain allies with the Indians and continue to develop their relationship, especially in the aftermath of the Cold War, the United States was unwilling to apply additional pressure to the Indians to dismantle their nuclear program. As the BJP shifted from a policy of nuclear ambiguity to a policy of overt weaponization, the United States sent mixed signals about its tolerance for weaponization on the subcontinent: while Pakistan faced increasing sanctions for their nuclear pursuit, the Indians faced little or no international pressure to abandon their nuclear program. This self-serving policy decision by the United States factored in to dynamics with these rivaling proliferators, leading to relatively different strategies for counterproliferation between the two and ultimately provided incentives for both to continue to proliferate.

Until the subsequent nuclear tests in 1998, the United States approached bargaining with the Pakistanis with both carrots and sticks – offering the reinstatement of military assistance while threatening additional sanctions. Yet, according to most Pakistani scholars, the path to proliferation for Pakistan had already been set: given the high value that Islamabad placed on acquiring nuclear weapons, especially in light of India's simultaneous pursuit, there was little that could be done to dissuade them from weaponization. Despite the US's efforts to induce a change in Pakistan's nuclear behavior, the specific incentive that the Pakistanis sought was too costly for the United States to offer and guarantee. Indeed, Pakistan's proliferation trajectory provides an

[29] The case study on the Indian nuclear program delves, in the next chapter, into the strategic interaction between the New Delhi and Washington and the impact this had on Pakistan.

appropriate example of a key finding from the theoretical model presented earlier: as negotiations reveal information about the type of the proliferator, it is possible that there are some actors for whom successful proliferation is a foregone conclusion, despite the best efforts of the international community to change their nuclear course.

Concluding Remarks

It is no surprise that the paths to pursue and relinquish nuclear weapons are varied and somewhat idiosyncratic. However, by examining several archetypes of nuclear reversal and failures, we may begin to see a broader picture of the role of the international community in incentivizing states to renounce their nuclear ambitions. In this chapter, I presented six descriptive case studies explore how rewards and coercive punishments have shaped the states' proliferation and reversal histories. Using the outcomes from the theoretical framework presented in a previous chapter, I examine cases in which dove states, those that are especially easy to persuade to modify their nuclear policy, chose to deproliferate or maintain a nuclear pursuit. Additionally, I analyze the other side of the spectrum at hawk states that are often resistant to pressures from the international community to abandon their weapons program. Lastly, I look at how negotiating with proliferators can be useful to the international community in differentiating between doves and hawks and then allow them to update their bargaining strategy.

With this analysis, some interesting implications emerge. First, there is wide variance in the types of states that deproliferate—they each have different motivations for their initial proliferation decisions and their valuations for nuclear weapons. Surveying

the historical trends reveals that the international community often requires information gleaned from the negotiations – such as the type of the proliferator - as they decide to tailor their inducements to account for these variations and to more efficiently encourage a state to reverse its nuclear program. Indeed, examination of these cases with regard to the outcomes derived from the theoretical framework suggests an interesting dynamic: if the offer of rewards is rejected, the international community may be able to update its beliefs about the value that the proliferator holds for nuclear weapons and thus, alter its negotiating strategy. If a proliferator, such as North Korea or Pakistan is willing to turn down positive inducements, they have effectively revealed to the international community the high value they hold for acquiring nuclear weapons. This, in turn, can shape the strategic dynamic between these types of hawk proliferators and the international community – potentially making the use of negative inducements more likely. In this regard, rewards can be seen as coercive bargaining instruments.

Second, and perhaps more importantly, theses trends highlight the differential effects of rewards and punishments in these interactions. Carrots may work better for 'dove-type' or weakly resolved states, such as Canada, that do not have a high valuation or expected utility from acquiring nuclear weapons. On the other hand, sticks may be less effective at encouraging nuclear reversal than expected. The current proliferation case in North Korea seems to imply that sanctions have not yet worked in certain cases they have been applied. Yet, it is necessary to acknowledge the selection problem in these analyses: we cannot conclude that coercive instruments could never work because it is possible that they have mainly been applied in very tough cases where it is possible no amount of positive inducements or threats of negative inducements will affect the

actions of these highly resolved, 'hawk-type' states. It is possible that threat or use of coercive instruments could be successful on easier cases (though they are less likely to be used), and rewards, in turn, may be less effective for truly committed states. Lastly, these case studies also suggest that it is possible that no amount of rewards or threats of punishment can convince some states to renounce their nuclear ambitions and that some additions to the nuclear club may be inevitable. The following chapters examine these dynamics in greater detail with in-depth case study analyses of the Egyptian and Indian nuclear weapons programs over time.

Appendix 4

Table 4.1: Nuclear Weapons Activity 1945-2010

Period	Start (Cumulative # States)	Stop (Cumulative # States)	Total Nuclear Weapons Activity
1945	4	0	4
1945-1950	2 (6)	1 (1)	5
1951-1955	7 (13)	0 (1)	12
1956-1960	5 (18)	0 (1)	17
1961-1965	3 (21)	1 (2)	19
1966-1970	3 (24)	4 (6)	18
1971-1975	4 (28)	2 (8)	20
1976-1980	2 (30)	2 (10)	20
1981-1985	2 (32)	0 (10)	22
1986-1990	1 (33)	5 (15)	18
1991-1995	3 (36)	9 (24)	12
1996-2000	0 (36)	1 (25)	11
2001-2005	0 (36)	1 (26)	10
2005-2010	0 (36)	1 (26)	9/10

Table 4.2: Models of Deproliferation

	Stop Program	**Continue Program**
Dove/Easy to Persuade	Canada	China
Hawk/Difficult to Persuade	Libya	North Korea
Offer of Rewards Revealed Type	Taiwan	Pakistan

Table 4.3: Detailed Case Coding

State (Years of Program)	Proliferation Evidence	Reversal Evidence
Algeria (1969-1995)	Uranium exploration began; Intention to launch program was announced (in 1981)	Acceded to the NPT
Argentina (1950-1994)	Established National Atomic Energy Commission (CNEA); mining and processing uranium core; began production of research reactor	Gaseous diffusion enrichment facility shut-down; ratified Treaty of Ttatelolco; ratifies NPT
Australia (1956-1973)	Australian Defense Committee recommended that the government approach UK about purchasing nuclear weapons from them; Prime Minister asked British Air Chief and Foreign Secretary whether UK could 'supply' Australia with atomic weapons.	Ratified the NPT
Belarus (1991-1996)	Inherited 800 nuclear warheads after collapse of the USSR	Concluded withdrawal of nuclear warheads to Russia; approved safeguards agreement with the IAEA
Brazil (1954-1994)	Established National Nuclear Energy Commission (CNEN); began production of first nuclear research reactor (5000 KW)	Ratified Treaty of Ttatelolco and IAEA Safeguards; Spent fuel reprocessing facility decommissioned.
Canada (1940-1969)	Participated in Manhattan Project (provided expertise on uranium mining, refining, and conversion on heavy water production); began to develop a pressurized heavy water nuclear reactor (basis for CANDU reactor system)	Ratified NPT; began removal of US nuclear weapons from Canadian bases.
Chile (1974-1995)	1st research reactor operational	Ratified NPT
China (1955-Present)	Publicly announced decision to pursue nuclear weapons, with assistance from USSR; established Ministry of Nuclear Industry to begin construction of uranium enrichment plant.	

Table 4.3: Detailed Case Coding, Continued

State (Years of Program)	Proliferation Evidence	Reversal Evidence
Egypt (1955-1980)	Creation of Egyptian Atomic Energy Authority; began development of first research reactor	Ratified NPT and IAEA Safeguards Agreement
France (1945 – Present)	First research reactor went critical; began to extract small amounts of plutonium	
India (1945-Present)	Established Institute for Fundamental Research by Dr. Homi Bhabha; Statement by Nehru calling for development of 'atomic force for constructive purposes.'	
Indonesia (1954-1967)	Established Commission of Radioactivity and Atomic Energy; began construction of first nuclear research facility	Suharto's government formally agreed to international safeguards for sensitive nuclear materials and equipment.
Iran (1967-Present)	First research reactor at Tehran Nuclear Research Center (TNRC) went critical – produced small amounts of plutonium	
Iraq (1956-1992)	Established Iraqi Atomic Energy Commission; begin developing 1st research reactor	Destruction of Al Atheer, Al Tarmiya, and Tuwaitha facilities
Israel (1952-Present)	Secretly established Israeli Atomic Energy Commission under control of Defense Ministry; perfected uranium extracted and developed procedure for making heavy water	
Italy (1957-1975)	Began exploration of possible joint nuclear development activities with France and West Germany; began development of first research reactor	Ratified NPT; ratified comprehensive safeguards agreement with the IAEA

Table 4.3: Detailed Case Coding, Continued

State (Years of Program)	Proliferation Evidence	Reversal Evidence
Kazakhstan (1991-1994)	Inherited 1410 nuclear warheads and Semipalatinsk nuclear weapons test site after collapse of USSR	In partnership with US (under Project Sapphire), transferred highly-enriched uranium to US and began transfer of all nuclear warheads to Russia
Libya (1969/70-2003/04)	Qaddafi publicly announced desire for nuclear weapons; unsuccessfully attempted to purchase a weapon from China	Qadaffi renounced unconventional weapons and surrendered all nuclear-related equipment and long-range ballistic missiles
Japan (1959-1976)	Began development of uranium enrichment technology; began development of first nuclear research reactor	Ratified NPT
North Korea (1959-Present)	North Korea and USSR signed nuclear cooperation agreement; began production of Yongbyon Nuclear Scientific Research Center	
Norway	Created Norwegian Defense Research Establishment and directed to do nuclear research for defensive purposes; began development of experimental heavy water research reactor.	NPT ratified
Pakistan (1957-Present)	Established Pakistan Atomic Energy Commission under direct military control; began development of first research reactor	
Romania (1952-1989)	Began uranium mining activities; beginning of covert nuclear weapons program	Ceausescu overthrown and nuclear weapons program abandoned; agreed to full-scale IAEA inspections and command of facilities.

Table 4.3 Detailed Case Coding, Continued

State (Years of Program)	Proliferation Evidence	Reversal Evidence
South Africa (1952-1990)	Established first uranium mining plant; began large-scale research and development of uranium processing plant and indigenous power reactor production	President F.W. de Klerk ordered termination of nuclear weapons program; acceded to NPT
South Korea (1959-1988)	Established Office of Atomic Energy; began development of first nuclear research reactor	New democratically-elected government came to power, stifled military's involvement in nuclear program.
Soviet Union/Russia (1942-Present)	Stalin launched Soviet program to develop an atomic bomb, headed by Igor Kurchatov	
Spain (1959-1975)	First nuclear research reactor (Coral-1) went critical; Suspicions arose that military dictatorship had begun to develop nuclear weapons facilities	Franco's death led to abandonment of nuclear weapons program.
Sweden (1949-1968)	Created nuclear authority, Atomenergi, with intent to exploit uranium deposits for civilian and military purposes; Defense Research Establishment (FOA) began research on nuclear weapons	Leaders officially renounced nuclear weapons; ratified NPT.
Switzerland (1945-1969)	Atomic Energy Committee given mandate to investigate defensive protective measures for country and determine requirements to develop nuclear weapons.	Ratified NPT
Syria (1976-2007)	Established Syrian Atomic Energy Commission	Destruction of nuclear facility (suspected of containing partially-constructed nuclear reactor of North Korean design) in Deir ez-Zor region; full-scope IAEA safeguards in place

Table 4.3 Detailed Case Coding, Continued

State (Years of Program)	Proliferation Evidence	Reversal Evidence
Taiwan (1956- 1988)	First nuclear research reactor went critical	Agreed to return all spent fuel from research reactor to US; began to shut down nuclear-related facilities and return remaining heavy water to US and ban any nuclear weapons-related nuclear research
Ukraine (1991-1996)	Inherited 4500-6000 nuclear weapons with collapse of USSR	Ratified NPT; transfer of nuclear weapons to Russia concluded
United Kingdom (1940-Present)	Began Manhattan Project (in conjunction with US) to develop atomic weapons	
USA (1940-Present)	Began Manhattan Project (in conjunction with UK) to develop atomic weapons	
West Germany (1957-1975)	Defense Minister Strauss began diplomatic initiative to acquire nuclear arms in joint project with France and Italy	Ratified NPT; began comprehensive safeguards agreement with the IAEA
Yugoslavia (1948-1995)	Established 1st research reactor center (Vinca Institute of Nuclear Sciences); Tito decided to development capability to produce nuclear weapons	Staggered reversal in newly-formed states after breakup of Yugoslavia; Macedonia acceded to NPT in 1995; Serbia approved for ratification of Additional Protocol in ’04.

CHAPTER 5: THE WOULD-BE PROLIFERATOR AND THE SURPRISING SUCCESS: CASE STUDY ANALYSES OF THE EGYPTIAN AND INDIAN NUCLEAR PROGRAMS

Introduction

Thus far, the analysis in this dissertation has centered on examining broader patterns among the universe of states that have pursued nuclear weapons programs and the inducements, if any, they received when choosing to reverse their nuclear course. In this chapter, I delve into two specific cases, the Egyptian and Indian nuclear programs, to examine these processes in depth. These case studies provide detailed accounts of the Indian and Egyptian nuclear programs from their inceptions and discuss the factors that led one state to choose to abandon its nuclear intentions, Egypt, and the other to continue down its nuclear path, India. Through these historical narratives, we are better able to identify the specific mechanisms at play that best describe how the international community has provided inducements to persuade proliferators to give up their nuclear weapons and why certain types of inducements may work better than others.

I begin by describing the case selection method used, a most similar systems design approach, and the virtues of this selection method for this type of analysis. Specifically, I discuss how Egypt and India match on several important observable parameters of interest – thus providing an effective match for comparison in this analysis. This type of analysis offers several important benefits: by allowing me to compare very similar cases which differ only in their dependent variable, deproliferation or no deproliferation, it helps reduce the likelihood of confounding or irrelevant variables from biasing the estimated effect of the independent variable, here, the role of the international

community in inducing a change in proliferation behavior, on the dependent variable of interest. By keeping other potential factors 'constant,' I am able to better identify the direct effects and the specific mechanisms at play in these interactions between the international community and proliferators.

Additionally, a most similar systems design approach allows me to more thoroughly examine the process by which these states embark on and then choose to stop their nuclear programs in a more nuanced manner. How did the United States choose to approach Egypt in contrast to India? What is the impact of these actions on the proliferators' nuclear policy-makers decisions? By examining in detail how the Egyptian and Indian nuclear programs received such different treatment from the international community regarding their nuclear programs, though being very similar states in key ways, I am able to derive a much better and clearer understanding of how these mechanisms play out in these specific instances. For example, case study analyses require a detailed historical account of the exact process by which Egypt and India went from potential proliferators to a non-nuclear weapons state and active nuclear weapons state, respectively. In addition to better understanding the link between technical and political stages in nuclear proliferation, this type of analysis more easily lends itself to causal exploration, beyond what is generally available with the observational data analyzed in other sections of this project, related to the theoretical outcomes discussed previously.

Lastly, case studies help elucidate information about the broader universe of cases (Seawright and Gerring 2008). Though limited in their applicability to other states, they allow an assessment of how, if at all, these patterns could apply to other similar states

(Seawright and Gerring 2008). For example, both Egypt and India considered themselves to be rising regional powers that, while facing external threats to their security, desired the stability and prestige associated with being in the nuclear weapons club. By examining, in a more fine-grained manner, their paths to proliferation and the role of the international community, especially the United States, in inhibiting or encouraging the acquisition of nuclear weapons, there are important implications for similar states that opt to pursue nuclear weapons in the future.

Upon discussing the case selection method and establishing this pair in accord with a most similar systems research design, I analyze each country's nuclear program, paying particular attention to the specific periods of interaction between the international community and proliferator, as the United States, or other key members of the international community, attempt to persuade the state to abandon its nuclear program. I begin by examining Egypt's nuclear program and the relatively surprising evolution from latent proliferator to permanent non-nuclear weapons state. In the second half of the chapter, I explore India's proliferation story, as it transitioned from a civilian nuclear power state to secretly pursuing an indigenous weapons program.

Case Selection: Egypt and India

To best examine variation from among the population of proliferation cases – both those that stopped and those that continued – I employ a most similar systems design (Lijphart 1971, 1975; Meckstroth 1975; Przeworski and Teune 1970; Skocpol and Somers 1980; Seawright and Gerring 2008). There are a couple of variations to this approach: in the first most basic form, a pair of cases are similar on all measured

independent variables, except the primary independent variable of interest. In the other, the one used in this analysis, the chosen pair of cases are similar across all background conditions that might be relevant to the outcome of interest, imagined as a vector of control variables X_2, but importantly, that the pair varies on the outcome of interest, Y (Seawright and Gerring 2008). With this type of design, it is presumed that the presence or absence of the independent variable of interest is what causes variation in the dependent variable, *Y*. Indeed, this type of design allows for a better attempt at causal inference with the chosen pair of cases than is usually attainable with the empirical analysis of observational data.

How then do we select two cases for comparison from among the universe of states that have engaged in nuclear weapons activity? To be able to employ the most similar systems approach, it is necessary to find two states that match on background conditions that might be relevant to the outcome, that are not connected to the independent variable of interest, and that vary on the dependent variable – here, whether or not a state has abandoned its nuclear weapons program (Seawright and Gerring 2008). A survey of the universe of cases in this project revealed an interesting avenue for investigation: among the potential pairs to examine, the Egyptian and Indian programs suggested a useful point for comparisons. Indeed, India and Egypt had similar backgrounds as rising regional powers, especially in the period during which they were pursuing nuclear weapons, and had similar proliferation paths with respect to interactions with the international community. Yet, importantly, while India continued down the path to proliferation and ultimately successfully acquired nuclear weapons by the late 1990s,

Egypt had instead opted to abandon its nuclear intentions and revert to a permanent non-nuclear weapons status.

To establish this pair of cases for analysis, I identify a set of parameters on which India and Egypt were similar. I examine the following dimensions of similarity between Egypt and India: origins of nuclear program, regional environment/position in the international system, latent capability/opportunity to nuclearize, preferences/value for acquiring nuclear weapons, and domestic political and economic characteristics such as economic and military capacity. By matching on these variables and determining that these factors, given that they are common between the states, were unlikely to contribute to the ultimate outcome of interest, deproliferation, I can better assess the role of the key independent variable introduced in this project - intervention from the US or other members of the international community - on this outcome.

First, both Egypt and India had similar proliferation trajectories, beginning with their initial foray and interest into nuclear and/or missile technology that arose in the late 1940s and early 1950s, after receiving inspiration and support from Eisenhower's Atoms for Peace Initiative. With initial assistance from the United States through the Atoms for Peace program, both Egypt and India began civilian nuclear programs that established domestic organizations that developed research programs for atomic energy exploration (Bahgat 2007). Soon after the initial delivery of materials and technology from the United States to develop a peaceful nuclear program, Egypt established the Egyptian Atomic Energy Authority while India created the Atomic Energy Commission that began to explore non-peaceful uses for nuclear power (Blanc 2008). Indeed, both Egypt and India had similar nuclear origins where, soon after the introduction of nuclear power,

both regimes began to explore non-peaceful avenues of nuclear technology with the Atoms of Peace Program working to reduce the costs of proliferation.

Because of this similar start and the early assistance given by the United States to pursue a civilian nuclear program, it is likely that both Egypt and India began with similar latent nuclear capabilities – thus, potentially yielding similar outcomes for success. Both countries quickly acquired research reactors that went critical in the late 1950s/1960s and developed plans to build a spent fuel reprocessing plant (Blanc 2008). Simultaneously, both Egypt and India attempted to purchase weapons technology and/or weapons from the USSR and China, in addition to continuing their sensitive nuclear assistance relationship with the United States (Blanc 2008; Fuhrmann 2009). Indeed, given that the US, and other nuclear weapons states, had provided technology, materials, and expertise to both the Indians and Egyptians in similar ways, their 'nuclear opportunity,' or the probability of their ultimate successes with regard to transitioning from a peaceful to weapons program was likely to be close, especially if Egypt had decided to continue down its nuclear path (Blanc 2008; Fuhrmann 2009).

On the other side of the spectrum, Egypt and India also had similar views on the necessity or desire to acquire nuclear weapons. First, both Egypt and India faced threatening security environments that made the acquisition of nuclear weapons, that would act as an effective deterrent, increasingly appealing (Sagan 1996/1997; Bahgat 2007; Shikaki 1985). Both states feared that nuclear proliferation, and ensuing arms races, would destabilize their regions and threaten their security and long-term survival. In this logic, the acquisition of nuclear weapons themselves would alleviate these threats and may work to prevent large-scale conflict with their adversaries. For example,

President Gamel Abdul Nasser firmly articulated Egypt's military policy for much of the 1960s, stating, "if Israel produced nuclear weapons, so would Egypt" (Shikaki 1985). Prime Minister Jawaharlal Nehru, and subsequent prime ministers, shared a similar perspective on the pursuit of nuclear weapons as a means of guaranteeing Indian security. He stated,

> We must develop this atomic energy quite apart from war – indeed I think we must develop it for the purpose of using it for peaceful purposes…of course, if we are compelled as a nation to use it for other purposes, possibly no pious sentiments of any of us will stop the nation from using it that way (Chengappa 2000).

Both states were similarly motivated to pursue a nuclear program to ensure their security in an increasingly threatening security environment, especially as their adversaries, namely Israel and China, developed their own nuclear capabilities.

However, as founders of the non-aligned movement (along with Marshall Josef Tito of Yugoslavia), both President Nasser and Prime Minister Nehru, shared visions of increasing Egyptian and Indian leadership, power, and prestige in the Middle East and South Asia, respectively (Bahgat 2007; Perkovich 1999). Nasser, for example, spoke often about Egypt's position as a regional and world leader because of its grand history, military might, cultural dominance, and political standing in the international community. In *The Philosophy of the Revolution*, Nasser discussed the important role that Egypt was bound to play in three major arenas – Arab, African, and Islamic, stating,

> For some reason it seems to me that within the Arab circle there is a role, wandering aimlessly in search of a hero. And I do not know why it seems to me that this role, exhausted by its wanderings, has at last settled down, tired and weary, near the borders of our country and is beckoning to us to move, to take up its lines, to put on its costume, since no one else is qualified to play it. We alone, by virtue of our place, can perform the role.

This vision of Egyptian leadership and prowess played a significant role in Egypt's perspectives on conventional and nuclear advancement and modernization in the Middle East, especially with regard to Israel's emergence as a de facto nuclear weapons state. For Nasser, the admission and acceptance of Egyptian inferiority in the nuclear realm would have resulted in a considerable political loss domestically, potentially threatening the stability of Nasser's regime, and within the international community more broadly (Bahgat 2007). Though Nasser and other Egyptian leaders remained hesitant about acquiring nuclear weapons, the desire to remain a regional and global leader, and guarantee protection against neighboring adversaries, provided a significant motivation to pursue the nuclear option. Egypt's desire for regional prestige grew with further proliferation in the region, particularly with Iran and Iraq's nuclear exploration (Bahgat 2007).

Similar dynamics arose in India with its emergence as a leader of the non-aligned movement in the midst of the Cold War. India's preferences for its standing in the international community was, no doubt, intimately tied to her desire to defeat adversaries, Pakistan and China, and guarantee her survival and stability if the threat from either adversary grew. Unsurprisingly, India believed that acquiring a nuclear deterrent would provide an effective means for preventing foreign aggression from both China and Pakistan and aimed to transition from a peaceful program to a weapons program, in part, for this purpose (Chellaney 1991; Perkovich 1999; Sagan 1996/1997).

Like Egypt, however, India also greatly desired the prestige granted to regional and global powers and pursued strategies that maximized the potential that India would be perceived that way by allies and adversaries alike. According to O'Neill's analysis of

the Indian nuclear program, "prestige is not the only motive for these weapons, of course, and in some cases of proliferation it may be absent, but it led India to acquire them even though the net consequence seems to have been a decrease in security" (O'Neill 2002). Indeed, similar to Egypt, prestige and the desire to solidify India's position in the international community as a regional leader was deeply connected to its motivations for acquiring and persistently pursuing nuclear weapons. India's value for acquiring nuclear weapons for the purposes of enhancing prestige and standing in the global community was also readily apparent to the United States. A recently-declassified State Department document suggests that,

> In India, and to some degree in other countries capable of initiating nuclear weapons programs, one pressure for proliferation is assumption that a nuclear weapons program automatically endows a state with a special prestige or status or enhances its voice in international councils. As a general rule, therefore, we should adopt a negative attitude toward proposals based on the assumption that the five countries, which have tested nuclear weapons, have in common either some special interest or some quality of power, prestige, or capability not shared by others (State Department, 1966).

Indeed, both Egypt and India had similar perspectives for their roles as regional powers and believed that nuclear weapons would help pave the path to doing so, in addition to providing a much needed deterrent against foreign aggression and intervention. On this 'willingness' or desire dimension, the cases of Egypt and India provide a useful comparison for analysis: both states started out with a similar preference for initiating a nuclear weapons program and while this preference may have evolved over time, it does not fully explain the difference in outcome.

Egypt and India also match on some other key dimensions that are necessary to include in the analysis to ensure that the effect we are observing, the difference between

continuing or stopping a nuclear program, is not due to characteristics intrinsic to the state, such as the economic or political capacity necessary to acquire nuclear weapons, but rather due to the independent variable of interest – the role of the international community, especially the United States, in inducing deproliferation. To ensure that this is the case, I identify potentially confounding variables, specifically domestic-level attributes that could be contributing to the effect we observe, including economic capacity and conventional military capability. While I focus on establishing a match comparison of these variables at the time of the initial proliferation attempt, in the 1950s for both countries, it is interesting to note that to this day India and Egypt remain similar in many ways.

At the time that both states were beginning their nuclear programs, both Egypt and India had sufficient economic capacity to invest in a costly nuclear program and actually develop a robust and viable nuclear arsenal. While neither Egypt nor India experienced the type of rapid economic growth of China or other states in the same cohort of developing, industrializing states, both saw modest increases in their GDP and economic growth. These outcomes may be due to their imitation of Soviet centralized policies and five-year plans that yielded moderate, though not spectacular, economic progress. Additionally, though both states had generally low levels of income, they experienced similar growth rates in GDP per capita, 3 % and 2.8% respectively, throughout their nuclear programs (Rublee 2006; Bhalia 2009; World Bank 2008). In this regard, Egypt and India had similar economic trajectories of nationalization and centralized planning in the early stages of their nuclear programs that provided a sufficient, though not robust, foundation for a costly nuclear program.

In Egypt, for example, in the aftermath of World War II from 1947-1952, the economy experienced a significant boost – with a growth rate of about five percent per annum. Though economic growth, and economic policy, varied greatly over the next decade, the strength of the Egyptian economy and the capacity for Egypt to undertake the costly investment of a civilian and/or nuclear weapons program remained consistent (Hansen and Nashashibi 1975). In the initial phases of the nuclear program during the 1950s, Nasser was primarily interested in developing Egypt's peaceful technological capabilities. This interest evolved from a purely civilian program to a weapons program in the 1960s when Egypt shifted gears and began to concentrate on investing in a nuclear weapons program – namely through the purchase of a heavy water reactor that would provide easier access to weapons-grade fissile material (Rublee 2006). Additionally, Egypt was interested in the purchase or transfer of a nuclear device from the Soviet Union or China. These attempts, mostly unsuccessful because of administrative or logistical obstacles, provide a valuable assessment of Egypt's economic capacity for a nuclear program: Egypt had the economic resources necessary to pursue and acquire a nuclear weapons program if they had chosen to continue down the nuclear path (Rublee 2006).

In the same vein, India had similar resources with which to invest in a costly nuclear program. During the initial phases of its program, immediately after independence and partition, India experienced a similar economic growth rate that, though paling in comparison to other states like China, provided the necessary economic opportunity to pursue a primarily indigenous nuclear program, with modest assistance from other nuclear weapons states. Indeed, many analysts agree that India's promising

trajectory was a necessary, though not sufficient, condition for India's continued pursuit of nuclear weapons (Perkovich 1999; Chellaney 1991). Strikingly, the US State Department also confirmed India's economic capacity to develop and test a nuclear device. In a recently declassified letter to the US Embassy in New Delhi, the State Department warned of India's impending nuclearization, since testing a first device would be "well within India's financial capabilities" (State Department, 1966).

Similarly, and just as critical to the ultimate success of a nuclear weapons program, both Egypt and India had comparable conventional military capabilities. According to a RAND study on economic and military trends on the latter half of the 20th century (1950-2000), Egypt and India had similar projected military trajectories. The report stated,

> Although the military capital stocks of middle regional powers (such as Korea, Taiwan, Turkey, India, Brazil and Egypt) are small relative to those of the larger powers, they will represent a formidable supply of weapons, very likely advanced systems, during the rest of the century and in the beginning of the 21st century. Furthermore, these middle regional powers will acquire a capacity to produce and to export a wide range of weapons, including all but the most sophisticated types (Wolf et.al., 1989).

Indeed, observable indicators suggest that Egypt and India were considered to be in the same cohort of militarily capable, regional powers that had the capacity to pursue a variety of military technologies – including nuclear weapons. During the initial phases of Egyptian and Indian nuclear exploration, the two states had nearly equivalent military capital stocks, a measure that includes both weapons and military infrastructure (Wolf et.al. 1989). It is interesting to note that all of the states included as middle regional powers, at one point or another, pursued a nuclear weapons program, yet India is the only

successful instance of proliferation. This may suggest the potential generalizability of these matched pair of cases: if the analysis establishes a pattern of behavior that distinguishes among strong, regional powers in regards to their ultimate success in nuclear proliferation, this may yield some interesting implications for US and/or global nonproliferation policy.

Thus, analysis of the Egyptian and Indian nuclear program reveal that they provide a useful point of comparison for a most similar system case study design. Given the number of dimensions on which Egypt and India have similar values, we can be more confident of the impact of the key independent variable, pressure from the international community, especially the US, in inducing deproliferation. In the following section, I analyze the Egyptian case.

The Would-Be Proliferator: The Egyptian Nuclear Weapons Program

Opportunity

Egypt began its nuclear path in 1955 with the establishment of the Egyptian Atomic Energy Authority and, like many other states that have explored the nuclear option, Egypt's interest in nuclear weapons continued to develop through guidance and sensitive assistance from the United States with Eisenhower's Atoms for Peace Initiative (Fuhrmann 2012; Blanc 2008; Rublee 2006). During the initial stages of Egypt's nascent nuclear program, Cairo focused primarily on the pursuit of a civilian nuclear energy program, especially if they were receiving assistance and materials from the United States. Indeed, one senior bureaucrat stated about the origins of the program,

> In the 1950s, after the establishment of the IAEA [International Atomic Energy Agency] and Eisenhower's Atoms for Peace, many developing countries began talking about the peaceful uses of nuclear power. It was like joining the scientific elite, and countries thought, 'why don't we jump in?' Whether they needed it or not, they just wanted to get on board. That's why Egypt did it.

With the burgeoning relationship with the United States, who was eager to fulfill the promises of the Atoms for Peace program by extending nuclear power to new states, especially potential allies such as Gamel Abdul Nasser, Egypt had a great opportunity to develop a peaceful nuclear program with significant help and guidance from the United States and other Western nuclear powers. Indeed, by the early 1960s, Egypt had built its first reactor at Inshas, a 2-megawatt research reactor facility that went critical in 1961 and that was later intended to provide Egyptian scientists with easier access to weapons-grade plutonium. Within the next five years, the Egyptian Atomic Energy Authority (AEE) also had projects including the production of a power reactor, desalinator, and a fuel

fabrication facility (Rublee 2006). During the height of its nuclear program, Egypt was a major civilian nuclear energy producer with a high latent capacity to further develop its program (Blanc 2008).

Indeed, it was also at this time, that Egypt also began to express interest in technology that was ostensibly dual-use: though officially for use in a power program, the desire for heavy water reactor was primarily so that Egyptian scientists could have easier access to weapons-grade fissile material. According to senior military officials, "the reactors were designed to be a plutonium route to nuclear weapons" (Rublee 2006). In the hopes of pursuing this technology without necessarily alerting its primary nuclear donor, the United States, Egypt turned to European countries, such as Germany with whom a contract for a natural uranium-fueled heavy water reactor fell through, and the Soviet Union, who were ultimately unwilling to transfer this type of critical technology to the Egyptians, to purchase the reactor (Rublee 2006).

Despite these setbacks in acquiring sensitive nuclear materials and technology for indigenous nuclear production, Egypt persisted in its nuclear weapons efforts by attempting to purchase or transfer a nuclear device from other nuclear-capable or weapons states, primarily the Soviet Union and China (Rublee 2006). Soon after China's first nuclear test in October 1964, Nasser sent a delegation to Beijing to approach the Chinese about buying a nuclear weapon from them or with further assistance on Egypt's nuclear program. A former AEE official stated, "I knew people in the delegation that went to China after their detonation. The team went and inquired about prospects for a nuclear device. The Chinese took them to various facilities, but then told them, 'you have to build your own infrastructure'" (Rublee 2006). Indeed, both Moscow and Beijing

urged Nasser to reconsider his nuclear intentions and if he persisted in them, to pursue them without external assistance from other nuclear weapons states. This, no doubt, played well into Nasser's, and Egypt's, attitude of self-reliance, national and regional pride, and as a leader of the non-aligned movement and potentially, a leader in the broader global community; indeed, when Mubarak was later offered external nuclear assistance, he declined. In June 1998, President Mubarak stated, "it is easy to buy nuclear weapons. After the fall of the Soviet bloc, I could have bought a bomb. I was offered one, and I refused" (Einhorn et.al. 2004).

This evidence suggests that while Egypt initially had some trouble with its nuclear program, especially with foreign assistance, Egypt had the technological opportunity – materials, knowledge, assistance - to transform its nuclear program from a purely civilian program intended to produce nuclear energy for peaceful purposes, to one that was aimed at producing nuclear weapons. Strikingly, analysis of the historical record reveals that a large portion of this latent nuclear capability (ostensibly the time it would take to move from a purely civilian program to a weapons program) could have been the result of early US assistance through Eisenhower's program (Fuhrmann 2012). Yet, what were Egypt's motivations for pursuing a weapons program? What value, if any, did they hold for acquiring a nuclear deterrent? In the next section, I discuss Egypt's political transition from nuclear exploration to nuclear pursuit.

Willingness

Like many other nuclear proliferators, including India, Egypt's reasoning to pursue nuclear weapons was multi-fold: while due mostly to security concerns raised by nuclear ambitions or actual proliferation in the region, Egypt also initially pursued

nuclear weapons because of the belief that joining the limited nuclear club would bestow prestige and grandeur to the state. Indeed, Egypt soon made clear their nuclear intentions with Nasser's 1961 public declaration that Israeli nuclear proliferation would spark similar behavior in the region, including in Egypt. Nasser stated, [if Israel acquired such weapons] "we will secure atomic weapons at any costs" (NTI 2014; Solingen 2007). Unsurprisingly, Nasser issued his public statements about Egypt's nuclear intentions when he instructed the AEE to pursue a weapons program. Analysis of the historical record suggests that the threat from Israel, especially with the development of the nuclear reactor at Negev Nuclear Research Center in Dimona in 1964, was a significant motivation for Nasser to announce Egypt's pursuit of nuclear weapons and a transition of Egypt's program (Rublee 2006).

According to some evidence on the start of the Egyptian nuclear program, Nasser's decision to officially announce the start of the program was in direct response to Israel's nuclear proliferation. Rublee states, "while Nasser eventually may have directed the AEE to explore military options later on, the revelations about Dimona made Egypt's reaction almost a foregone conclusion" (Rublee 2006). While Egypt's nuclear stance had previously been purposefully ambiguous, Israel's production of a peaceful nuclear reactor prompted the shift in posture, intentions, and effort. According to Walsh, "...it is fair to say that Egypt's most intensive efforts to acquire nuclear weapons (or the capability to produce them) occurred during this phase—that is, just after the disclosure of the Dimona reactor, but before the 1967 Arab-Israeli war" (Walsh 2001). It was during this time and in reaction to the threat from an Israeli nuclear program that Egypt increased their costly investment in the nuclear program by pursing both indigenous and

external routes to developing, procuring, and/or purchasing dual-use technologies for a weapons program, ultimately to no avail (Rublee 2006; Solingen 2007; Walsh 2001; Einhorn et.al. 2004).

Given Egypt's history and attitude towards the international community, perhaps it is unsurprising that Cairo persisted down the nuclear path for nearly thirty years before ultimately abandoning its nuclear intentions, as part of a grander plan to establish itself as a regional, and potentially, global leader. Israel's emergence as a de facto nuclear weapons state prompted a shift in the Egyptian mentality about its place as a regional, and pan-Arab, leader. According to Amre Moussa, a former Egyptian foreign minister, Israeli nuclearization sparked an emotional response among many countries that motivated them to also proliferate. He stated, " 'it would change the entire equation in the region.' Israel would be saying, 'I am the dominant power.' Membership in the NPT for Arabs would be humiliating" (Einhorn et.al. 2004). Indeed, Israel's nuclear proliferation prompted the question of leadership in the region and perhaps more importantly in Egypt, raised questions about Cairo's prestige, dominance, and strength in the area. Moussa later commented, "Egypt will never accept playing second fiddle. It will do whatever it takes to maintain its position in the Middle East and in the Arab world" (Einhorn et.al. 2004). Existing scholarship on nuclear proliferation suggests that desire for prestige in the international community with entrance into the exclusive nuclear club can be a significant motivation for actively pursuing nuclear weapons (Sagan 1996/1997). No doubt, there is mixed feelings about this issue – while some including Foreign Minister Moussa believe that Egypt's attitudes towards glory and grandeur play a key role in its relations with adversaries and allies in geo-political dynamics, others,

including Ambassador Nabil Fahmy argue that decisions on the nuclear weapons option would be the result of external security threats, such as nuclear proliferation in Israel, Iran or Iraq (Einhorn et.al. 2004).

The consensus, however, in Egypt and nuclear literatures is that both factors, an increasingly threatening security environment and the demand for increased power and prestige in the region, heavily contributed to Egypt's initial decision to pursue nuclear weapons (Einhorn et.al. 2004; Solingen 2007; Rublee 2006; Bahgat 2007). Given these factors and the perceived benefits of nuclear weapons in easing Cairo's security concerns, it is relatively unsurprising that Egypt chose to make the costly decision to pursue nuclear weapons after initially beginning a civilian nuclear program. Yet, less than thirty years later, after incurring the financial and political costs associated with nuclear weapons pursuit, Egypt shifted from a latent nuclear weapons state, with the capacity to relatively quickly nuclearize, to a permanent non-nuclear weapons state and a staunch supporter of the nuclear nonproliferation regime. What explains this decision to reverse their nuclear course and deproliferate?

International Pressure to Deproliferate: Nasser, Sadat, and Mubarak

President Nasser

From the start of Egypt's nuclear program, there had been some uncertainty about whether Egypt would ultimately succeed in acquiring nuclear weapons. Would Egypt purchase a nuclear device from another nuclear weapons state? Was there sufficient political will and capital to build an indigenous nuclear program? Or, would there be some amount of pressure from the international community that would effectively persuade the Egyptians to abandon their program and return to a non-nuclear status? In

this section, I analyze the strategic interaction between the Egyptians and the international community, primarily the United States, throughout the course of Egypt's nuclear program. Specifically, I examine the key opportunities for bargaining with each Egyptian regime during this time – the Nasser, Sadat, and Mubarak governments. Evidence from this in-depth evaluation of the program suggests that pressure from the United States, especially through the offer and acceptance of a variety of incentives, played a decisive role in inducing Egyptian's nuclear reversal. No doubt, there are other factors, including changes in Egypt's security environment and domestic attitudes towards nuclearization, which contributed to Cairo's ultimate decision to stop pursuing nuclear weapons. Yet, by focusing on this alternative level of analysis, the bargaining dynamic between a proliferator and the key members of the international community, a slightly different picture emerges about how deproliferation may occur as a result of pressure from the international community, especially the United States.

Egypt's relationship with the United States, with regards to its nuclear program, emerged as a result of the Atoms for Peace Initiative that sought to prevent the spread of nuclear weapons by providing interested states with access to nuclear energy for peaceful purposes (Fuhrmann 2012). The aim of this program, and the ensuing relationship that saw the transfer of civilian nuclear technology to Egypt and other participants of the program, was to satisfy the desire for nuclear technology while establishing a precedent whereby these recipients of the assistance gave up the option to pursue nuclear weapons in the future (Fuhrmann 2012). Perhaps unsurprisingly, in retrospect, this tactic failed with many of the states that received assistance through Eisenhower's program. Indeed, many, if not most, of the participants in Atoms for Peace pursued a nuclear weapons

program at some point, and often as a result of the initial guidance and support they received from the United States. The Atoms for Peace program worked, ostensibly, to reduce the costs of nuclear weapons to states that were interested in transitioning to the acquisition of nuclear weapons. Egypt was no different: despite initially agreeing to not pursue nuclear weapons in exchange for civilian nuclear technology, Nasser began to more heavily invest in acquiring a nuclear deterrent capability.

How then can we explain why, despite the costs of a nuclear weapons program, Egypt decided to continue down the nuclear path at the outset? In accord with this project's overarching theoretical framework, we can better understand Egypt's initial decision to persist in its nuclear efforts, despite incentives not to, by examining its desire to reveal information about its preferences, both to regional adversaries like Israel that was also pursing a nuclear capability, and the broader international community. By defecting from the original agreement whereby Egypt would have surrendered the option to acquire nuclear weapons, Egypt was able to reveal information about its preferences, specifically, the value that it held for nuclear weapons. This, not surprisingly, impacted both its relationship with the US, and other nuclear weapons states (i.e. China, the Soviet Union, and the developing proliferator, India) that were hesitant to continue to help a potential proliferator and concerned about continued proliferation in the region, and with other states in their neighborhood that were either on the cusp of nuclearization (Israel) or were also considering going nuclear (Iran and Iraq). By announcing itself as a state interested in entering the nuclear club, Egypt may have been able to reveal information about its type – a strong regional actor with an ongoing nuclear weapons program that

could result in nuclearization if and when Cairo so desired – that would hopefully alter Egypt's bargaining leverage regionally and globally (JCR Special Issue 2009).

With this revelation, the United States and other nuclear weapons states or technology donors, like West Germany, opted to impose a negative inducement on Egypt by limiting their transfers of peaceful nuclear technology, materials, and support, to the Egyptians after Nasser first announced Egypt's intention to go nuclear (Rublee 2006; Walsh 2001). Indeed, though most nuclear proliferators attempt to purchase and often receive significant amounts of assistance and materials for indigenous development, they often pursue a complimentary strategy of procuring completely constructed and fully operational weapons from other nuclear weapons states or suppliers to ensure successful proliferation. While this may appear to suggest a potentially low subjective probability in the likelihood of successful indigenous development, it may better serve to indicate the high willingness of some hawk states to use any means necessary to acquire nuclear weapons. Indeed, Egypt, Pakistan, and South Africa – all hawk proliferators with high values for nuclear weapons including two successful, indigenous proliferators – pursued both an indigenous capability and foreign procurement (Albright 2001). Indeed, some scholars argue that engaging in both tactics can work to significantly increase the likelihood of nuclear development while working to reduce unnecessary investment costs in the interim (Albright 2001).

In the case of Egypt, this attempt at technology denial, especially the preclusion from purchasing a complete nuclear device or reprocessing facilities from a nuclear weapons state, such as the Soviet Union, had an interesting and counter-productive effect of strongly motivating Egypt to pursue a primarily indigenous program. While some

analysts, including Egypt expert Jim Walsh, argue that the negative inducement of technology denial actively prevented Egypt from acquiring a nuclear deterrent, it is important to note that after initial rebuffs from the Chinese, Soviets, and Indians for sensitive technology or materials, Nasser proceeded to redouble domestic efforts to produce a nuclear weapons program (Rublee 2006; Gregory 1995). In this instance, the international community's decision to impose a negative inducement, technology denial, led to Egypt's continued proliferation attempt.

Despite this delay, and costs, to the development of the Egyptian nuclear program, Nasser continued to invest in Egyptian nuclearization. In part due to changing regional dynamics, especially with Egypt's loss of the Sinai Peninsula after the Six-Day or Arab-Israeli War, the acquisition of nuclear weapons remained an important political issue – Nasser again approached nuclear weapons states to purchase a nuclear device (Rublee 2006). It was this last failed attempt to acquire nuclear weapons and a fundamental shift in Cairo's relationship with the United States and the international community that led to a change in Egypt's approach towards nuclear weapons. Indeed, Nasser began to see Egypt's developing nuclear weapons program as an opportunity to leverage changes to its relationship with the United States, especially with regard to its security concerns in the region. During the final years of Nasser's regime before his death in 1970, he used his decision to end the program and sign the Nonproliferation Treaty, after continued pressure from the Soviet Union, as a diplomatic tool with the international community, to renegotiate the status quo with the US and Israel (Rublee 2006).

President Sadat

Egypt's nuclear issue was yet to be 'solved' before Nasser's death in 1970 and President Anwar Sadat proceeded to work to reestablish better Egyptian relations with the international community, especially the United States, by revealing Cairo's new approach to acquiring nuclear weapons. Indeed, it was Sadat that took the primary steps to Egypt's road to deproliferation: by working to reveal Cairo's evolving preferences, the international community and Egypt were able to reach an agreement that was preferable to a nuclear Egypt.

After watching nearly two decades of unproductive effort, Sadat sought to change Egypt's nuclear course and refocus energy and attention on raising the country's stature in the international community – even without the prestige associated with having successfully acquired nuclear weapons. Instead, Sadat decided to pursue a strategy that would help to reveal Cairo's updated preference for pursuing nuclear proliferation – ostensibly hoping that this new declaration of Egypt's decreasing value for nuclear weapons would work to restructure their interactions with the international community, especially the United States, and renew Egypt's ambitions for regional leadership, especially in the Arab world (Rublee 2006). Sadat, for example, stated that Egypt would only acquire nuclear weapons if their opponent, Israel, did. Most scholars view this as an attempt to dissuade Israel from acquiring nuclear weapons, not a clear representation of Egyptian nuclear policy preferences. To Sadat, the clear objective was recovering lost territory and he did not believe that nuclear weapons could assist in completing this aim (Reiss 1998). Thus, Sadat began a re-evaluation of Egyptian security policy that worked to distance Egypt from its role in the Non-Aligned Movement, its appeals to the Soviet

Union for nuclear assistance, and its history of conflict with the Israelis. Essentially, Egypt sought to influence the status quo and improve Egypt's chances of emerging as a regional power. Strikingly, Sadat believed that leveraging their nuclear ambitions would be one way of accomplishing this aim.

Unlike Nasser who was committed to investing in a nuclear program mostly as a means to achieve this aim, Sadat believed that giving up the nuclear program and reverting to a non-nuclear status would move Egypt closer to these objectives. This was especially likely to be the case if Egypt could leverage its nuclear renunciation in exchange for some benefits offered by the international community, or its primary donor, the United States. As one former senior Egyptian military officer noted,

> Sadat knew that the United States would not come to Egypt without incentives. The nuclear issue was one of those issues we were ready to abandon. It was a tool, something we could give to the United States as a present, even though Sadat knew that the nuclear program was already closed and it wasn't really much of a present (Rublee 2006).

The revelation of the marked shift in Egypt's value for acquiring a nuclear program facilitated a new round of discussions with the international community and provided the relevant background for coming to an agreement about Egypt's pursuit of nuclear weapons. Indeed, this declaration suggests that Sadat had reexamined Egypt's value for acquiring nuclear weapons and was newly determined to use this change to Cairo's advantage. After years of costly investment and split attention between pursuing a nuclear deterrent and engaging an adversarial neighbor in four conventional conflicts, Sadat believed that the best way to ensure Egypt's long-term survival and security in a tense region was by allying with the United States and seeking military and economic

assistance, and potentially, some degree of protection in future regional conflicts. Despite having a high latent capacity to transform the civilian nuclear program into a weapons program, without prohibitively high costs, Egypt was beginning to shift its perspective on what exactly continued proliferation would accomplish. Dr. 'Ali al-Sa'idi, former president of the Nuclear Power Plants Authority stated, 'we used to have an Egyptian nuclear program, but now we do not have any vision...with regard to this vital issue" (Gregory 1995). As Egypt's value for acquiring nuclear weapons decreased, mostly due to Sadat's diminishing belief that a nuclear deterrent would help with the regional tensions, Cairo was more willing than ever to come to the bargaining table and permanently give up their nuclear program in exchange for some tangible benefits.

Indeed, this evidence from the historical record aptly describes one of the most important implications from the theoretical model: new leaders that come to power in the middle of nuclear weapons pursuit may be interested in using negotiations with the international community, especially the United States, to reveal their updated value and preferences for nuclear weapons. The model suggests that new leaders who are less interested in nuclear acquisition are often able to use the opportunity to come to the bargaining table to reveal to the US that, while their predecessor may have been willing to endure the heavy costs of nuclear pursuit, they are not. Analysis of the Egyptian nuclear case reveals that Sadat's rise to power, in the aftermath of Nasser and his public declarations of Egypt's high motivation for nuclear weapons, ultimately worked to reveal Cairo's diminishing value for a nuclear deterrent.

In seeing a great opportunity to influence the nuclear outcome in Egypt and achieve its preferred outcome – a non-nuclear Egypt that would not spark further

proliferation in the region – the United States was strongly, and singularly, motivated to negotiate with the Egyptians and determine the specific rewards that would induce them to stop their nuclear pursuit. And unlike interactions with other proliferators for whom the US had mixed preferences - deciding between maintaining the support and commitment of a potential proliferator in the midst of the Cold War against the Soviets versus adhering to the principles of nonproliferation/counterproliferation – the objective for Egypt was clear: identify and support efforts necessary to best ensure Egypt's transition to a deproliferated, non-nuclear weapons status. This consistent focus and message facilitated the bargaining dynamic between the United States and Egypt and led the way to Egypt's nuclear deproliferation.

By 1980, nearly thirty years after the start of the Egyptian nuclear program, Egypt ultimately agreed to dismantle its nuclear weapons program and return to a non-nuclear weapons status, while still maintaining a strictly civilian nuclear program under IAEA regulations and safeguards. Indeed, the deproliferation deal that resulted from the negotiations between the United States and Egypt had several component parts, including the demand that Egypt retain the option to continue a peaceful nuclear energy program, specifically the transfer of nuclear power reactors from the United States, if they were in compliance with IAEA Comprehensive Safeguards Agreement (INFCIRC 302) and if Egypt's facilities were brought into the verification and inspection mechanisms of the nonproliferation regime (NTI, 2013). As part of this agreement, Egypt's Inchas reactor, for example, does not produce enough plutonium to make its spent fuel a proliferation threat (Gregory, 1995).

President Sadat also took steps to transition Egypt from its former status as a potential proliferator to a leader in the nonproliferation regime. First, Sadat agreed to ratify the Nonproliferation Treaty (which Nasser had only signed before his death), acquire parliamentary support for it, and officially join the nonproliferation regime and push for a nuclear-free zone in the Middle East (NTI, 2013). Egypt agreed to alter its stance on nonproliferation by moving from a prior position of ambiguity and opacity to full transparency about its peaceful nuclear intentions under the IAEA system, in conjunction with the United States and other nuclear weapons states (NTI, 2013).

What then did Egypt get in exchange for agreeing to change its nuclear course? When Sadat came to the decision to stop Egypt's nuclear pursuit and become a declared non-nuclear weapons state, he did so under the assumption that he would get some type of compensation or reward, from the United States or the international community, more broadly, for doing so. Indeed, Sadat had originally planned (and succeeded) to use the reversal of its nuclear weapons pursuit to acquire more technology, especially power reactors, to further develop Egypt's civilian/nuclear power program. In an interview with ABC on November 6, 1975, Sadat stated, in response to a question about recent Egyptian demands to purchase a set of nuclear power reactors from the US, "this, in fact, is the reason I asked for this reactor which is only concerned with the desalination of the water…Exactly, and it has no relation whatsoever with any other activity concerning atomic energy and all the technicians know this quite well" (ABC, 1975).

In addition to securing a stable nuclear power program (with renewed assistance from the United States after a failed reactor deal), the Egyptians also sought to improve their position with regard to regional adversaries, such as Israel, especially in the

aftermath of the 1973 Yom Kippur/Arab–Israeli War. To ward against or win a future conflict with the Israelis, or other neighbors in the region, the Egyptians believed they needed to improve their now solely conventional military capabilities. In an effort to do this, Egypt centered its efforts on acquiring/purchasing military assistance on the United States and other western states, such as France and Great Britain; specifically, the Egyptians refused to turn to the Soviets for this help so as not to endanger Cairo's relationship with Washington. As Sadat believed that Egypt's survival rested in normalizing relations with the US, he ended the once-close relationship that Egypt shared with the Soviets, stating that he had never trusted them, and focused on negotiating with the US for increased military assistance in exchange for deproliferating (Bahgat, 2004).

This turned out to be an effective strategy: in exchange for agreeing to stop their nuclear weapons program, revert to a strictly civilian nuclear program under IAEA safeguards, and officially abide by the nonproliferation regime, the United States provided a significant reward to the Egyptians. At the time of Egypt's decision to reverse its nuclear course and deproliferate, annual foreign assistance, specifically military assistance or military loans, nearly tripled from approximately $940 million to over $2.5 billion (CRS 2005; USAID 2013). It is important to note, however, that this agreement was at the same time as the decision by the United States to encourage a stronger bilateral relationship with the Egyptians in the aftermath of their latest crisis with the Israelis and to help facilitate an agreement between the Israelis and Egyptians. The ensuing 1978-1979 peace negotiations included the US as a key player and de facto guarantor of the resulting agreement (Einhorn 1998). Indeed, an important component of the 'peace package' was to provide substantial foreign assistance to the Egyptians, to compensate

for their losses from the conflict and for whatever subsequent reductions in foreign aid would result from a peace deal with the Israelis. Specifically, the United States became Egypt's largest and primary donor of military equipment that also expanded the military relationship between the two states to include joint military exercises, engagement in the military-industrial complex, and broadly, strengthening the ties between the two states. Indeed, a significant component of the peace deal included military assistance as a means of reducing the potential threat posed by future conflict with the Israelis and promoting peace in the region. By providing Sadat with a significant reward, and helping to mitigate Egypt's concerns about its security in the wake of a nuclear Israel, Sadat was willing to come to the negotiating table and renounce nuclear weapons. As Einhorn points out, "taken together, Sadat's decisions between 1977 and 1981 constituted a fundamental strategic choice for Egypt – in favor of peace with Israel, stability in the Middle East, economic development for Egypt, close relationship with the United States, *and* the renunciation of nuclear weapons" (Einhorn 1998). A senior Egyptian official pointed out, in retrospect, "Nuclear weapons weren't part of the future as we saw it, with Arabs and Israelis living together. Why would you need the ultimate weapon when you are living peacefully with your neighbors?" (Rublee 2006)

In sum, strengthening of the relationship with the United States and its significant contribution of military assistance provided Sadat with the necessary incentive to abandon its nuclear program permanently: the rewards, offered in exchange for stopping a nuclear program outweighed the potential benefits to acquiring nuclear weapons, especially in an environment where Egypt's strongest adversary, Israel, was in the process of proliferating itself. In turn, by offering these specific rewards, military

assistance and continued access to peaceful nuclear technology and aid that was integral to Egypt's security in an increasingly threatening environment, the international community ultimately achieved their desired aim – Egypt's commitment to reverse its nuclear program and commit to global nonproliferation aims. Sadat's strategy of revealing Cairo's updated value for acquiring nuclear weapons as a means of encouraging bargaining with the United States, who was singularly motivated in preventing continued proliferation in the region and thought that renouncing nuclear weapons would help achieve that aim, was instrumental to Egypt's ultimate deproliferation.

President Mubarak

The early years of the Mubarak regime, after Sadat's assassination in the early 1980s, aimed to maintain Egypt's evolution from a nuclear proliferator to a fervent non-nuclear weapons state and ostensible leader of the nonproliferation movement/nuclear free zone in the Middle East. Upon taking office, Mubarak confirmed motivations for adhering to Egypt's nuclear weapons free course: alternative sources of energy and the substantial costs associated with acquiring a nuclear weapons arsenal (Bahgat 2007). He stated, "frankly, I would be leaving a debt for the citizens, a burden on the people. I cannot do this . . . I do not want to add more burdens than the people can endure" (Bahgat 2007). Regardless of the veracity of Mubarak's intentions with regards to saddling the state with the heavy costs of nuclear weapons, he was consistent in his commitment to maintaining Egypt's non-nuclear status, and using this as a point of leverage for negotiating with Israel to similarly dismantle its nuclear weapons program, join the NPT, and officially make the Middle East free of nuclear weapons.

Although unsuccessful in these efforts, Mubarak remained an ardent supporter of Egypt's permanent deproliferated status, especially with regards to retaining military and economic assistance from the United States as part of the agreement. Mubarak continued Sadat's steps toward economic liberalization and was committed to ensuring Egypt's economic integration into the international system by inviting Western capital and technology (Bahgat 2007). Specifically, Mubarak aimed to maintain the newly established relationship between Cairo and Washington, in particular, the US's significant (the second largest after Israel) foreign aid contribution. According to Mubarak, one good way to do this was to uphold the agreement to not pursue nuclear weapons and to remain committed to international and regional goals of nonproliferation and disarmament. Indeed, in the late 1990s, non-state parties from a former Soviet republic are rumored to have approached Mubarak with an offer of nuclear materials and technology (Rublee 2006). Mubarak declined the offer and instead chose to rely on the US's contribution of aid and political and military support rather than pursue a nuclear deterrent against Israel (Rublee 2006). This has been Egypt's policy ever since.

Under Mubarak's regime, Cairo has opted to maintain its non-nuclear status and permanently abandon any of its prior nuclear intentions. Though it remains a latent nuclear weapons state under IAEA safeguards, Egypt does have the technical capacity to transition from a civilian nuclear program to weapons program in the event that they are willing to once again undertake the costly and uncertain process of nuclearization and *forego* the significant political and military benefits it has received, primarily from the United Sates, for deproliferating in the 1980s. Despite the persistence of security concerns in the region, especially with varying array of potential proliferators in the

neighborhood – Iraq, Syria, Iran - Egypt has opted to dedicate itself to preventing further proliferation by strongly supporting the nonproliferation regime in the Middle East and working toward the long-term goal of raising Egypt's prestige in the international community (Bahgat 2007, Rublee 2006).

With regard to the nuclear issue, Egypt has, for the most part, been successful in garnering the support and respect of regional and global allies by taking an active and public stance on nonproliferation and disarmament debates within the NPT regime (Rublee 2006). Yet, like many other states, Egypt is hesitant to foreswear the possibility that it will never pursue nuclear weapons in the future. As recently as 2010, Egyptian Ambassador to the United Nations, Maged Abdel Aziz, stated in an interview on the last day of the 2010 NPT Review Conference, "we in Egypt are against even the presence of nuclear weapons in our region. But if others will acquire nuclear weapons -- and if others are going to use these nuclear weapons to acquire status in the region of the Middle East -- let me tell you, we are not going to accept to be second-class citizens in the region of the Middle East" (NTI, 2010). It is likely that the US's best chance for ensuring that Egypt remains a declared non-nuclear weapons state and fervent supporter of the nonproliferation regime, is to continue to provide the set of positive inducements that best outweigh the potential benefits of nuclearization.

Concluding Remarks

The first part of this chapter begins with a discussion of the case selection method that results in the in-depth case study analyses of the Egyptian and Indian nuclear weapons program included in this chapter. By examining some of the key constructs and

variables presented in previous empirical chapters in a more detailed manner, we are able to get a much better understanding of how the measures are coded and how the phenomenon in question, international pressure to deproliferate, actually occurs in accord with our theoretical expectations. This dual aim, explication of coding and measurement and process tracing, is best accomplished by a thorough examination of how specific cases evolve over time. In this vein, this chapter attempts to discuss the conditions under which states are willing to deproliferate and how nuclear trajectories can vary as a result of pressure or influence from the international community, by specifically examining two particular instances of nuclear weapons pursuit, the Egyptian and Indian nuclear weapons programs.

Analysis of the Egyptian nuclear case begins by describing some of the key coding decisions discussed in prior chapters of the dissertation project, especially in the context of the theoretical framework presented in Chapter 2. Egypt's nuclear story presents a more complicated, yet surprisingly more common, outcome of nuclear deproliferation in the international system. Like many other states, indeed the majority of nuclear proliferators over time, Egypt embarked on a nuclear weapons program in part due to concerns over long-term survival and security in an increasingly threatening neighborhood, and out of a desire to enhance stature and prestige in the global community (Sagan 1996/1997). After nearly thirty years of exploration, costly investment, internal and external pressures to both continue and abandon their effort, Cairo decided to end its nuclear pursuit and return to a non-nuclear status.

Specifically, I examined the conditions under which Egypt arrived at this decision by arguing that Egypt's deproliferation was heavily influenced by pressure from the

United States, primarily in the form of positive inducements such as economic and military aid if Cairo would credibly to reverse its nuclear program. Analysis of the Egyptian case reveals that Egypt's ultimate decision was at least, in part, a result of these inducements by the international community, especially the United States: upon deproliferating and committing to revert existing nuclear facilities and place them under IAEA safeguards, the Egyptians received triple the amount of military and economic assistance it had received in the year prior to its decision to deproliferate. This striking case illustrates the great role that the United States as proxy of the international community can play in incentivizing potential proliferators to stop their nuclear pursuits.

Yet, as evident by the historical record and in line with some of the key findings from the theoretical model, it is not always the case that the United States or other key members of the international system are successful in inducing deproliferation. There are several instances in which, despite external pressure from the international community to stop their nuclear weapons programs, states succeed in acquiring the bomb. Indeed, the main research question of this dissertation asks, how can we explain why some states are willing to stop their nuclear pursuits while others are not? To help answer this question, as part of the larger empirical strategy in this project, this chapter lays the last phase of the research design and introduces the case study analyses. The narrative begins by describing the process in which I choose the cases for examination, Egypt and India, and the reasoning behind this particular case selection design. This first section begins with an examination of the trajectory of the Egyptian nuclear program, exemplifying an example of a proliferator that chooses to end its nuclear program after receiving a significant amount of positive inducements, namely economic and military assistance

from the United States. Egypt's nuclear story, from which we can potentially derive patterns about the behavior of some similar proliferators for the purposes of generalizability (discussed in more detail in the Conclusion), is certainly the more common one – states that have embarked on a nuclear program and have stopped account for nearly two-thirds of states in this sample.

However, the Egyptian nuclear case stands in contrast to that of other states, including India that despite similar motivations, constraints, and basic characteristics, was ultimately successful in acquiring a nuclear arsenal. In the following section, I expand on this case and examine, in detail, the trajectory of India's path to proliferation and what can help explain the variation in the dependent variable– ostensibly why Egypt was successfully incentivized to deproliferate while India was not.

The Surprising Success: The Indian Nuclear Weapons Program

Introduction

India's seemingly sudden shift to de facto nuclear status in 1998 prompted concerns in the international community about the spread of nuclear weapons beyond the original nuclear club. How did India manage to rather clandestinely acquire the bomb within the confines of the nonproliferation regime? What would be the ramifications for the region – would India's nuclearization incite Pakistan or other neighboring states to also pursue the bomb? Lastly, were their opportunities along the way to change India's nuclear course? Much of the existing scholarship on India's path to proliferation has centered on the causes and consequences of New Delhi's acquisition of nuclear weapons (Perkovich 2002; Sagan et.al. 2008). Less attention, however, has been paid to what, if any, opportunities the international community had to delay or prevent India from getting the bomb. There is, however, growing evidence to suggest that the global community, especially the United States, may have had some chances throughout India's nuclear development – from its participation in the Atoms for Peace program to the unofficial announcement of its shifting nuclear intentions with the Peaceful Nuclear Explosion in 1974 – to change the course of nuclearization on the subcontinent.

This chapter explores India's acquisition of nuclear weapons and its relationship with the international community, primarily the United States, during its rise to nuclear status. In particular, I examine how the United States may have applied pressure to the Indians to help alter their nuclear intentions through the offer of rewards and/or the threat of punishments. These inducements, while not ultimately affecting whether the Indians acquired the bomb, may have altered India's path to proliferation and structured its future

interactions with the international community as a de facto, not de jure, nuclear state. This case study analysis also provides an in-depth, nuanced analysis of the potential mechanisms at play in the international community's application of pressure during India's pursuit of nuclear weapons.

India's Nuclear Rise

Causes of Proliferation 1948-1974

India's ultimate acquisition of a nuclear weapon came as a surprise to the international community; after decades of relatively clandestinely pursuing the bomb, India finally announced its successful weaponization with 1998 nuclear tests. There had been indications that India was interested in acquiring a nuclear capability when it conducted a peaceful nuclear explosion (PNE) in 1974 after decades of pursuing a primarily civilian nuclear program. Despite the relatively unexpected pronouncement of India's shifting intent on nuclear weapons, the international community still attempted to persuade the state to stop its pursuit and dismantle its program. When the international community was unsuccessful in doing so, India developed a nuclear capability that seemingly opened the door for other states to pursue nuclear weapons outside the confines of the Nonproliferation Treaty (NPT) as a de facto nuclear state. Analysis of US counter-/deproliferation attempts in South Asia suggests that the US's inconsistent, arbitrary, and often self-serving policy decisions may help explain why the international community was ultimately unsuccessful in persuading India to reverse their program.

India's nuclearization was the result of both exogenous conditions and domestic pressures to build an effective nuclear deterrent against foreign aggressors. As a new nation with rivalries on borders with China and Pakistan, India's decision to pursue

nuclear weapons seemed unsurprising: the scholarship on the causes of nuclear proliferation suggests that states searching to maintain their security and survival might pursue nuclear weapons to ward against the potential for foreign aggression or assist in the event of conflict with an adversary, especially if they have the latent capacity to do so (Sagan 1996/1997; Jo and Gartzke 2007; Singh and Way 2004, 2009). India's ultimate decision to acquire nuclear weapons, no, doubt was fueled in part by a desire to protect its sovereign territory from potential incursions by China and Pakistan, with whom it had a history of tension and conflict (Sagan 1996/1997; Tellis et.al. 2001).

These threats from India's neighbors played a key role in the decision to move from a strictly civilian to a weapons program. Analysis of Indian nuclear decision-making reveals that New Delhi's decision to proliferate and pursue nuclear weapons was clearly influenced by China's rise as a regional nuclear power in East Asia. Indeed, it was also during this time that the growing threat from China (especially in the wake of the Indo-Chinese border war of 1962) prompted the Indians to reexamine their decision to remain a solely civilian nuclear power and seriously, though secretly, embark on a nuclear weapons program. According to Brahma Chellaney, one of the authors of India's nuclear doctrine, "the humiliating rout in the 1962 war with China is deeply embedded in the Indian psyche. No other event in independent India has cast so much influence on national planning or on the shape of long-term goals and strategies" (Chellaney 1991). China's growing territorial threat and its rapid military advancement and modernization in the nuclear era sparked urgency among Indian military planners to accelerate its work on a nuclear program to better counter Chinese capabilities (Chellaney 1991).

However, Pakistan's presence as a risk to Indian survival is not to be underestimated. Islamabad no doubt represented an equally proximate threat to India's security, especially given its history of rivalry and militarized disputes and Pakistan's political and military instability. India's desire to deter continued aggression, that could have potentially devastating consequences for the subcontinent, also prompted the move from a civilian nuclear energy program to one that sought to develop nuclear weapons to prevent territorial threats from its neighbors. Thus, after making this decision to transition to a weapons program, India established the nuclear explosive design group, Study of Nuclear Explosions for Peaceful Purposes (SNEPP), an Indian-based organization that dedicated to developing an explosive device that would use plutonium from a newly-constructed separating and reprocessing plant (Blanc 2008).

Externally, there may have been other determining factors that helped the Indians in their pursuit, and eventual acquisition of nuclear weapons. In addition to a strong infrastructure that facilitated the quick and sustained development of a civilian, and then weapons, program, the Indians had early assistance from the international community, primarily existing nuclear weapons states like the United States, the United Kingdom, and France. The origins of India's nuclear weapons program began with the establishment of the Tata Institute for Fundamental Research (TIFR) in December 1945 and the Atomic Energy Act of 1948.

This domestic initiative was heavily influenced and supported by Eisenhower's Atoms for Peace Plan. Atoms for Peace began as a bold endeavor to "hasten the day when fear of the atom will begin to disappear from the minds of people" by encouraging the peaceful spread of nuclear technology and fissionable materials to build nuclear

reactors under adequate IAEA safeguards (ACA, 2003). Indeed, South Asia became Washington's top priority in curbing the spread of weaponization through the promotion of peaceful technology, in part due to two policy directives, NSC 5409 (US Policy Toward South Asia) and NSC 5507/2 (Peaceful Uses of Atomic Energy) that aimed to simultaneously support strong stable governments in a key Cold War battleground, the South Asian subcontinent, that would be instrumental in promoting international and regional interests of the United States. With this, India became one of the first recipients of nuclear technology within the Atoms for Peace plan with the purchase of ten tons of heavy water for use in CIRUS reactor (Fuhrmann 2012). The United States remained eager to please the Indians as, "the USSR and Communist China will focus increasing attention on India in an effort to insure [sic] at least its continued neutralism, and if possible to bring it closer to the Communist Bloc" (ACA, 2003). Despite Prime Minister Nehru's role as a leader of the nuclear disarmament movement, he refused to foreclose on the nuclear option and instead moved the nascent nuclear program in the direction that would ultimately lead to the development of a nuclear arsenal with the desired assistance of the United States.

By 1955, India had two research reactors, after additional assistance from the British and Canadians. The CIRUS reactor, purchased from the Canadians, marked a turning point in India's nuclear program and international proliferation more broadly: though it was meant for peaceful purposes, the transaction took place before the establishment of any international policies to regulate technology transfers or to set provisions for inspections. To ensure independence, India created a program to

manufacture natural uranium fuel for the CIRUS reactor indigenously to maintain complete control of the production cycle.

Over the next decade, the United States remained India's leading supplier of technology and materials – over $93 million in loans and grants through Atoms for Peace – after persistent lobbying by Homi Bhabha, the father of the Indian nuclear program (ACA 2003). Yet, this relationship was not without its challenges: Bhabha often rejected US assistance in order to bargain for more advanced technologies from the US (or other nuclear suppliers). Requests for sensitive nuclear assistance, including the joint development of uranium resources, became more frequent until the United States ultimately declared that it was "emphatically not interested" in helping the Indians expand into a weapons program (ACA 2003). Indeed, during the early era of sensitive nuclear assistance, the US never suspected that the Indians were trying to produce nuclear weapons or that they were well on their way to being able to do so by 1974.

Rise of the Nuclear State: 1974-1998

Despite early ambivalence about the value of nuclear weapons (and delays in production during the Lal Bahadur Shastri administration), growing tensions with Pakistan, especially after the war with West Pakistan in 1965 and the Indo-Pakistani War of 1971, and the new Indira Gandhi regime, led to resurgence in India's desire to proliferate (Sagan et.al. 2009; Narang 2010). Ultimately, after more than thirty years of changing regimes and nuclear exploration – with the establishment of the Tata Institute for Fundamental Research in 1944 that began to conduct scientific research on nuclear weapons to the creation of the Trombay Atomic Energy Establishment in 1954 that began to examine weapons design and production to the introduction of the Bhabha Atomic

Research Centre tasked with manufacturing and testing a nuclear device – India finally entered the nuclear weapons club with a Peaceful Nuclear Explosion, named "Smiling Buddha" (Perkovich 1999; Blanc 2008). On May 18, 1974, the Indian Department of Atomic Energy secretly detonated a nuclear device underground. The device was indigenously created – it was manufactured by Indian scientists using facilities and materials in India, outside of international safeguards. According to the Indian government led by Indira Gandhi, it was also completely peaceful – it had no military or political implications for Pakistan or the international community more broadly (Jaipal 1977).

Indeed, Indian diplomat, Rikhi Jaipal, argued soon after the test that despite evidence to the contrary with the nuclear test, there was no reason to believe that India would seek to acquire nuclear weapons or would become a threat to any other country in the international community. He stated, "every Prime Minister of India since independence has reaffirmed India's opposition to the manufacture and use of nuclear weapons, and has reiterated that India has no intention of manufacturing them. This is an important, well-established and consistent policy of the Indian Government, and it should be taken seriously" (Jaipal 1977). The immediate response from New Delhi was that the international community should not fear the introduction of India as a new nuclear weapons state – but rather to take it in good faith that this declaration would not result in the production of nuclear weapons. They further argued that while the test may be surprising to the international community, it was actually not in violation of any international law or safeguards agreement: while the Indians had been consistent recipients and beneficiaries of civilian nuclear technology within the nonproliferation

regime, they had not signed or ratified the 1972 Nonproliferation Treaty that prohibited the development of nuclear weapons (Jaipal 1977). Because of this legal technicality that seemingly inoculated India from international reproach and punishment and New Delhi's public declaration of its peaceful intentions, regardless of the credibility of the sentiment, India was not deemed to be a de factor nuclear weapons state in 1974. Rather, it had shifted from a purely peaceful, civilian nuclear power to a state that was exploring a nuclear military option.

Unsurprisingly, the international community did not perceive India's intentions to be quite so pure. The Smiling Buddha test had done little to instill confidence among the Pakistanis, Chinese, or the international community more broadly that India was not well on its way to becoming a full-fledged nuclear state with a growing arsenal and the capacity to deliver warheads against adversaries. Islamabad, for example, did not view the test as peaceful and canceled a series of talks planned to discuss the normalization of relations between the two states. According to Prime Minister Zulfikar Ali Bhutto, "India's so-called Peaceful Nuclear Explosion (PNE) is tested and designed to intimidate and establish 'Indian hegemony in the subcontinent,' most particularly Pakistan."[30] The test appeared to heighten tensions on the subcontinent and threaten Pakistan's sense of survival. Furthermore, members of the Pakistani military-industrial complex, including Pakistan Atomic Energy Commission Chairman Munir Ahmed Khan and Pakistan's leading nuclear physicist, Pervez Hoodbhoy, argued that Smiling Buddha clearly and

[30] Bhutto, Zulfikar Ali. "Prime minister Secretariat Press Release," *Associated Press of Pakistan (APP) and Pakistan Television (PTV),* May 18, 1974. Accessed via: NTI.org.

definitively moved Pakistan into the nuclear arena, prompting Islamabad to develop and test its own nuclear bomb.[31]

Indira Gandhi's positive response from the Indian populace and from within the regime, encouraged New Delhi to continue down this nuclear path with a plan to develop hydrogen bombs (NTI, 2013). During Indira Gandhi's time out of office in the late 1970s, India's nuclear program flagged; after her return to power in the 1980s, New Dehli expanded the scope of the nuclear program, ultimately confirming its nuclear intentions in 1986, with Prime Minister Rajiv Gandhi's formal authorization of India's nuclear capability in the wake of the 1986-1987 Brasstacks crisis (which included advances in Pakistan's efforts to acquire nuclear weapons and Islamabad's veiled nuclear threats). This formal announcement of India's burgeoning nuclear program finally moved India from a nuclear explorer to a nuclear proliferator with the capability to produce a small, operational nuclear arsenal.

India became a declared, de facto nuclear weapons state with a second series of nuclear tests in May 1998. Again, India had managed to conduct a second round of testing under absolute secrecy: subsequent geospatial analysis helped to identify a time and place for the tests (NTI, 2013). The first of the Pokhran-II tests, or *Operation Shakti,* consisted of detonations of one fusion and three fission bombs; two days later on May 13, 1998, India detonated an additional two fission devices. Shortly after the tests, Prime Minister Atal Bihari Vajpayee made a statement announcing India's entrance into the nuclear club, stating,

---

[31] Khan, Munir Ahmad (18 May 1974). "India's nuclear explosion: Challenge and Response," *International Atomic Energy Agency and Pakistan Atomic Energy Commission*. Hoodbhoy, Pervez Amerali, "Pakistan's Nuclear Bayonet." *The Herald*, September 9, 2011.

> Today, at 15:45 hours, India conducted three underground nuclear tests in the Pokhran range. The tests conducted today were with a fission device, a low yield device and a thermonuclear device. The measured yields are in line with expected values. Measurements have also confirmed that there was no release of radioactivity into the atmosphere. These were contained explosions like the experiment conducted in May 1974. I warmly congratulate the scientists and engineers who have carried out these successful tests. (FAS, 2013)[32]

By 1998, India had become only the sixth country to test nuclear weapons and enter the relatively elite club of nuclear weapons possessors; Indian society was delighted with this new status and associated prestige (Perkovich 1999; INSA 2008).

International Reactions

While the reaction in India was mixed but predominately supportive of the country's new nuclear status, the response from the international community was decidedly less positive. Almost immediately, less than ten days later, the Pakistanis conducted their own underground nuclear tests, *Chagai-I*, in the Balochistan Province. It is without question that these first public nuclear tests were in direct response to Operation Shakti. Prime Minister Nawaz Sharif stated, "today, we have settled a score and have carried out six successful nuclear tests."[33] The Pakistani Atomic Energy Commission (PAEC) carried out five or six nuclear tests using fission devices, at the Chagai test site on May 28, 1998. The Pakistani scientists responsible for the tests earned national renown and helped launch the state into the selective nuclear club as its seventh member.

The United Nations condemned both states' nuclear tests with UN Security Council Resolution 1172. The resolution began by denouncing the proliferation of

---

[32] "Prime Minister's announcement of India's three underground nuclear tests". FAS.org. January 31, 2013.
[33] Sublette, Carey. "Pakistan's Nuclear Weapons Program: 1998: The Year of Testing. " Accessed via: nuclearweaponarchive.org. Retrieved November 1, 2011.

nuclear weapons to the subcontinent and stating that increases in nuclear weapons in the international system posed a threat to international security and peace and would, at the minimum, spark an arms race in South Asia. The UNSC Resolution also demanded that both India and Pakistan immediately cease their nuclear tests and demanded that the two states show restraint, refrain from provocative moves, and resume dialogue.[34] In addition, both countries were to stop their proliferation and reverse their nuclear programs, and cease development of fissile materials.[35] While neither country opted to end its nuclear program then or subsequently, this proliferation process raises questions about the options that members of the international community, especially the US, may have in regards to countering or reversing nuclear proliferation. Were there missed opportunities where the United States or other states in the international system could have influenced India's transition from potential proliferator to nuclear weapons state?

International Pressure to Deproliferate

In this section, I delve into the evolving options to encourage or incentivize nuclear reversal that the international community, including the United States, had during India's (and Pakistan's) paths to proliferation. Were there distinct opportunities to change the course of nuclearization on the subcontinent? What would have been the best avenues for achieving this aim - the imposition of sanctions, the action actually taken by the US and broader international community, or the offer of positive rewards? To examine these mechanisms, I provide a detailed account of the international community's, specifically the United States' role, during India's nuclear program and the

[34] UN Security Council Resolution 1172. "http://www.mofa.go.jp/mofaj/gaiko/naruhodo/data/pdf/data6-1.pdf."
[35] Incidentally, both countries agreed in their reactions to Resolution 1172, deeming it coercive and unhelpful.

particular points in time where they applied pressure, through positive or negative inducements, in an effort to alter India's preferences for acquiring nuclear weapons. This in-depth analysis provides compelling evidence in support of this dissertation's overarching theoretical framework by suggesting that the US's policy of punishing potential proliferators, through economic sanctions or the threat/use of force, may have been counter-productive for arresting India's nuclear development.

Atoms for Peace to Bhabha Atomic Research Center (BARC)

As discussed earlier, the United States' involvement with India's nascent nuclear program began with the Atoms for Peace program that allowed for the transfer of sensitive nuclear materials to states interested in pursuing nuclear power solely for civilian purposes. Though this program predated the "grand bargain" of the Nonproliferation Treaty, it aimed to fulfill the same promise: if states could forswear the pursuit and acquisition of nuclear weapons, they would receive nuclear power technology, materials, and assistance from the international community, especially the existing nuclear weapons powers, such as the United States and United Kingdom. Eisenhower stated,

> The more important responsibility of this Atomic Energy Agency would be to devise methods whereby this fissionable material would be allocated to serve the peaceful pursuits of mankind. Experts would be mobilized to apply atomic energy to the needs of agriculture, medicine, and other peaceful activities. A special purpose would be to provide abundant electrical energy in the power-starved areas of the world. Thus the contributing powers would be dedicating some of their strength to serve the needs rather than the fears of mankind (University of Maryland).

The exchange of materials, technology, and expertise between the US and India was specifically designed to prevent the spread of nuclear weapons technology to potential

proliferators but as is often argued, it actually worked to reduce the costs of proliferation to recipients of the Atoms for Peace program. In the case of India and the United States, the agreement to help develop a civilian nuclear program in exchange for not pursuing nuclear weapons was first challenged when India sought to purchase nuclear materials from other suppliers by circumventing the assistance arrangement with the United States. While this was not taken as an indication at the time of India's potential interest in acquiring dual-use technology for the purpose of acquiring nuclear weapons, India, from amongst the cohort of other recipients of Atoms for Peace, may have set itself apart by revealing information about its preferences for proliferation and its value for acquiring nuclear weapons. In the midst of the Cold War and Nehru's public stance on remaining non-aligned, the US was, perhaps unsurprisingly, primarily focused on maintaining India's support: while publically denying that they would assist in pursuing a weapons program, i.e. the Gilpatric Committee on Nuclear Proliferation's report that advised an uncompromising stance on nonproliferation, even to strategic allies, to President Johnson in 1965 (Gavin, 2003). While nonproliferation had been a key aspect of US foreign policy, it came distinctly second to strengthening the defenses of key non-communist nations (through, for example, a Multi-Lateral Force proposal to share nuclear weapons with NATO allies). The US's, and broader international community's dual and perhaps conflicting preferences (nonproliferation and winning over the non-aligned) indeed may have contributed to India's decision to begin an indigenous weapons program with limited assistance from the French and Canadians (Perkovich 1999; Blanc 2008).

This evidence suggests that the US nuclear policy decision to reduce or limit civilian nuclear assistance by more strictly controlling the transfer of civilian nuclear

power may have instead helped to reduce the associated costs of proliferation and ultimately contributed to the less-desired outcome of nuclear proliferation (Kroenig 2009; Fuhrmann 2012). While this counterfactual scenario is unknowable, it raises questions about the efficacy of international nuclear policy that focuses on technology denial and export limits as a punishing strategy for controlling the path to proliferation.

BARC to Smiling Buddha

India's first public intimation of its nuclear intentions, with the 1974 Peaceful Nuclear Explosion, came at an unfortunate time for international nonproliferation – only four years after the Nonproliferation Treaty went into effect. Though India had opted not to sign or ratify the treaty, perhaps another sign of India's less than peaceful intentions, India's transition from a civilian nuclear state to a nuclear explorer, announced with the 1974 Peaceful Nuclear Explosion, sparked concerns within the international community about the continued proliferation of nuclear weapons to non-nuclear states within the confines of the nonproliferation regime, and surprisingly, with assistance from key nuclear suppliers (Fuhrmann 2012; Kroenig 2009).

Following in the path of the Atoms for Peace program, the Nonproliferation Treaty was designed to provide incentives for continued nonproliferation among non-nuclear weapons states. In particular, the 'grand bargain' of the Nonproliferation Treaty had been designed to prevent against this: in exchange for non-nuclear weapons states agreeing to forgo the acquisition of nuclear weapons and placing their facilities under international safeguards, they would receive limited assistance from nuclear weapons states for peaceful purposes. Article III Section 2 of the Nonproliferation Treaty, specifies,

> The safeguards required by this article shall be implemented in a manner designed to comply with article IV of this Treaty, and to avoid hampering the economic or technological development of the Parties or international cooperation in the field of peaceful nuclear activities, including the international exchange of nuclear material and equipment for the processing, use or production of nuclear material for peaceful purposes in accordance with the provisions of this article and the principle of safeguarding set forth in the Preamble of the Treaty (NPT 1969; ACA 2003).

The regime, namely the existing nuclear club, felt assured that if non-nuclear weapons states, such as India, Pakistan, Israel among others, were given the opportunity to develop a civilian nuclear energy program with significant assistance from members of the nuclear club, they would be disinclined to pursue nuclear weapons indigenously and clandestinely. Within half a decade of the introduction of the NPT into the international system, the belief that technology and materials control and the denial of weapons-grade supplies would not only deter the spread of weapons capability but also work to satisfy even the most interested and capable of potential proliferators was challenged by India's acquisition and successful test of nuclear weapons.

Though India had not signed the treaty for what it claimed were political reasons – New Delhi argued that the treaty, by construction, created nuclear 'haves' and 'have-nots' – the surprise and suddenness of Smiling Buddha suggested the possibility that the Grand Bargain may not actually effectively deter states from proliferating from even within the regime. Indeed, analysis of the empirical records reveals this to be the case: of the successful and permanent proliferators after the United States and Soviet Union, all of them received some form of legal (or illegal) sensitive nuclear assistance on their paths to nuclear proliferation (Fuhrmann 2009; Kroenig 2009).

Smiling Buddha to Operation Shakti

After its sudden announcement of nuclear intentions, India quickly moved to further develop its program through advances in technology and acquisition of materials and supplies necessary to build a larger nuclear arsenal. Less than two decades later, India had, with limited obstruction, worked to develop its nuclear weapons program. Yet, Smiling Buddha had some unintended, albeit, interesting consequences for India's relationship with the international community, especially the United States. Indeed, the 1974 PNE was India's public hint that it had moved from being a civilian nuclear power consumer to a committed explorer with an increasing value for acquiring nuclear weapons. This, and other revelations provided useful information to the international community about India's preferences for acquiring nuclear weapons and the costs they would be willing to endure to successfully weaponize. It also provided a key foundation from which the international community, especially the US, could potentially apply pressure or offer incentives to modify India's nuclear behavior. The transition from Smiling Buddha to Operation Shakti marked a second critical moment in the US's strategic interaction with New Delhi. While the US, and the broader international community, was ultimately unsuccessful in altering India's path to proliferation, analyzing their strategy and policy tools can provide important information about effective ways of inducing nuclear reversal.

In the twenty-five years between Smiling Buddha and Operation Shakti, the international community, with the United States at the helm, adopted various means in an effort to stop further nuclear proliferation in South Asia. Primarily, however, the strategy was motivated by growing concerns that New Delhi's continuing nuclear program would

not only dramatically expand and increase the overarching number of nuclear weapons in the international system but that it would stoke Pakistan's desire to match the Indians with their own nuclear deterrent. Thus, the US's deproliferation strategy was motivated by these dual concerns: first, continue to provide aid and assurances, potentially even security guarantees, to Islamabad to prevent further nuclearization in South Asia and second, deter the Indians from continuing to develop their nuclear program though punishing disincentives for violating the spirit of the nonproliferation regime (though not the legal restrictions) and for potentially establishing a precedent for future proliferation outside the confines of the nonproliferation regime.[36]

The first of these approaches was a consistent part of US foreign policy. While the alliances between Pakistan and the US and Pakistan and China had developed, in large part, prior to the 1974 PNE, Washington's clear "tilt" towards the Pakistanis could no longer be ignored (K.Bajpai 2009; Perkovich 1999). The US, for example, had secretly supplied military equipment to the Pakistanis despite Congressional objections. Declassified CIA documents suggest that the US's interest in assisting Pakistan came from a concern that "India intended to dismember Pakistan and destroy its armed forces, a possible loss of U.S. ally in the Cold war that United States cannot afford to lose."[37] This Western pivot towards Pakistan, plus the growing alliance between the Chinese and Pakistanis, renewed Indian security concerns that made the development of nuclear weapons even more attractive, Indian strategists argued in defense of further nuclearization, "all in all, the broader geopolitical situation had deteriorated for India."

[36] This situation was made more difficult given that the Chinese were also allying with Pakistan and providing them with arms during Indo-Pakistan wars in the 1970s and 1980s.
[37] "Nixon/Kissinger Saw India as "Soviet Stooge" in 1971 South Asia Crisis." National Security Archives, http://www2.gwu.edu/~nsarchiv/news/20050629/index.htm.

This ambivalent strategy, maintaining some alliances while pitting regional rivals against one another, reflected the US's ambiguous preferences and potentially signaled to India a weak preference for inducing deproliferation on the subcontinent. The US's relationship with Pakistan was seen as threatening: by following a strategy that encouraged India's concerns about its security against foreign aggressors that now had the support and military assistance of a nuclear state, the United States' behavior potentially persuaded New Delhi to continue its nuclear weapons program for its own security and stability. India, facing a threatening regional security environment actively supported by a global superpower, may indeed have seen the decision to pursue a nuclear program as a necessity to protect itself against potential aggressors, both regional adversaries and their superpower allies.

However, the situation was made more complicated by efforts adopted by the international community, especially the United States, to manage India's nascent nuclear program. In addition to strengthening India's regional security concerns, the US also took more direct action to slow India's nuclear program through the use of negative inducements. After the conclusion of Smiling Buddha in 1974, the international community, especially key nuclear states responded negatively – imposing and/or enforcing strict regulations that ruled out nuclear exports from the Nuclear Suppliers Group to India (under IAEA safeguards), imposing a sanction that froze nuclear energy assistance for the two heavy water reactors that were undergoing construction, and threatening to revoke economic assistance.

Unfortunately, these actions seemed to have the opposite effect as intended: India continued to develop its nuclear program, primarily indigenously (given restrictions on

bilateral and multilateral nuclear assistance), with growing domestic political support (Bajpai 2009). India's initial decision to pursue a nuclear program was in part due to prestige and the growing desire to be a regional power, in defiance of the international community (O'Neill 2002). This only grew as the United States, and other western powers, began to ally with India's neighboring rival. Indeed, the decades between Smiling Buddha and Operation Shakti saw the emergence of a hard-lining, hawkish political party, the Bharatiya Janata Party (BJP) that was committed to displaying national power and prestige, where it was becoming clearer that the nuclear program was to be made a national priority (Bajpai 2009; Narang 2009). Brajesh Mishra, Prime Minster Atal Vajpayee's national security advisor, said "I have always felt that you cannot in today's world be counted for something without going nuclear" (Bajpai 2009). Nuclear weapons, to Vajpayee and the BJP regime, instantaneously provided power and status, the capability to protect oneself against foreign threats, and the opportunity to alter the status quo if desired. In this perspective, the international community's opprobrium and negative reaction to the PNE in 1974 had only inflamed a desire to better India's status in the international system through nuclear weapons.

Domestically, this was an effective political strategy for the BJP-led government. According to Vajpayee, his administration, unlike others before, was willing to incur whatever domestic and international costs would be associated with additional nuclear tests if it demonstrated India's resolve to acquire nuclear weapons and enter the main stage in the international community. He stated, "I had faith in the country's inherent strength to withstand any difficulties that may arise out of the test. The fundamentals of the economy were strong and on such issues I believe our people are ready to make any

sacrifice for the security of the country." With the revelation of India's hawk-like nuclear persona, through additional tests or high-level declarations, the ensuing international condemnation that the test would trigger - isolation, sanctions or military action – could only help the BJP's case with the public. The Indian populace, whatever its feelings about nuclear weapons, would support the BJP's risky decision to challenge the international community, especially the United States, and continue down its nuclear path. This domestic calculus and the desire for the BJP to demonstrate its high value for acquiring nuclear weapons only helped to further encourage domestic investment in the developing nuclear weapons program that resulted in the 1998 nuclear tests.

The international community's actions - support for regional rivals that threatened Indian security, threats to revoke economic assistance, and challenges to national prestige - to address India's nuclear program, and hopefully persuade them to abandon their nuclear program before nuclearization made acquiring nuclear weapons significantly more appealing for India. A State Department document from the American Ambassador to India sent the Prime Minister of India's office a memo outlining, and threatening, the very serious consequences associated with a second round of nuclear tests. The document entitled, 'Preventive Diplomacy – Indian Nuclear Test Preparations,' revealed the Ambassador's memo to the Indian Foreign Ministry.[38] It stated,

> We have urged India not to conduct a test, and have laid out the serious consequences a test would have for India. In addition to the likely international and regional ramifications, we stressed the great damage a test would do our bilateral relations. We explained that an immediate consequence would be Glenn Amendment sanctions, under Section 102(b) of the Nuclear Proliferation Prevention Act of 1994 (which amended the

[38] "Preventative Diplomacy – Indian Nuclear Test Preparations." U.S. Department of State. Case No. M-2009-00895. Doc No. C17601493.

> Arms Export Control Act), and that the U.S. would be required to terminate most forms of economic assistance, defense sales and services, and credit guarantees to non-nuclear weapons states that detonate a nuclear explosion. The Glenn Amendment would also cut off U.S. Export-Import Bank support for India, and require the U.S. Government to block American bank loans as well as exports of dual-use technology. We would also be required to oppose World Bank and other IFI loans to India. The implications of these sanctions for India's economic reforms are significant" (US Department of State, 1995).

The US's primary nuclear nonproliferation policy emphasized the role of threatening and/or imposing negative inducements on proliferators to alter their nuclear behavior. Furthermore, in the Congressional testimony, that included a question and answer session, the Ambassador was specifically asked whether the administration was considering offering India inducements to not test additional nuclear devices. The Ambassador's response, stated, "we do not believe presenting the issue to India as negotiable is practice or desirable. Our focus is to make PM Rao aware of the full costs and bilateral, regional, and international implications of a nuclear test, and to leave it to him to draw the right conclusion."[39] This answer suggests that there may have been some recognition amongst US policymakers that the offer of inducements could have actually helped facilitate nuclear reversal among potential nuclear proliferators, including the Indians. It also highlights that, unsurprisingly and perhaps unwisely, the United States was not interested in bargaining with the Indians to prevent this undesired outcome.

Yet, other evidence from US archives also suggests that alternative approaches, that sought to mitigate India's concerns and provide assurances rather than threats, were discussed as potential means for achieving deproliferation. After the PNE in 1974, US

---

[39] "Preventative Diplomacy – Indian Nuclear Test Preparations." U.S. Department of State. Case No. M-2009-00895. Doc No. C17601493.

intelligence began to suspect that the Indians might be well on their way to producing nuclear weapons. Fearful of the potential implications of India's formal nuclearization on the subcontinent, US policymakers began to discuss other potential avenues for approaching India to encourage nuclear reversal. Declassified State Department memos from 1995 (on the eve of Operation Shakti) reveal discussions emphasizing how the US, in conjunction, with the broader international community, would have a difficult time deterring India and Pakistan from further embarking down the nuclear path without a shift in strategy. Robert Rochlin, senior scientist at the Arms Control and Disarmament Agency, stated in 1995 in a memo to a senior State Department official as they contemplated action in South Asia,

> U.S. leverage alone is probably insufficient to head off this gloomy scenario. It is possible, however, that strong, concerted intervention by all the major states could deter India and Pakistan from embarking on this dangerous course. It would require vigorous U.S. leadership to mobilize the worldwide effort required to persuade India and Pakistan that their long-term national security interests can be best served by joining, rather than obstructing, the global movement toward nuclear disarmament. To succeed, the major states would need to give the effort top priority in their dealings with South Asia. Moreover, the chances of success will be greater to the extent that the nuclear-weapons states demonstrate significant progress of their own toward global nuclear disarmament (US State Department, 1995)[40]

This document reveals that the US was at least somewhat aware that their current nonproliferation strategy was unlikely to prevent India (and Pakistan) from acquiring nuclear weapons without a marked change in tactics. This also suggests that it is possible that some portions of the US government were exploring nuclear nonproliferation policies that de-emphasized unilaterally punishing proliferators and instead examined

[40] "Implications of an Indian Nuclear Weapon Test." U.S. Department of State. Case No. M-2009-00895. Doc No. C17601520.

how multilateral efforts focused on providing incentives in line with India's and Pakistan's national interests. Given some understanding that punishing states that pursue nuclear weapons may not provide the desired outcome, why then didn't Washington adopt a more conciliatory and positive approach towards bargaining with New Delhi?

Evidence of the Indian nuclear case suggests the United States was perceived to be playing both sides in the India-Pakistan rivalry and allying with whichever state provided more benefits to the United States in the global fight against encroaching Soviet influence. When both Nehru and to a lesser degree, Indira Gandhi, for example, sidled up to the Soviet Union, the United States turned to Pakistan for assistance in containing Soviet power. Alternatively, when the United States believed that India, as a founding member of the Non-Aligned Movement, could be a stronger ally, they began cozy up to New Delhi and turned away from their friendship with Islamabad (Perkovich 2001). Indeed, one side effect of the US's '*security-first narrative'* regarding proliferation in South Asia prompted both India and Pakistan to believe that the United States saw them as 'pawns' in the broader context of the Cold War (Perkovich 2001). The Indians, especially, saw this instrumental approach to nuclear negotiations as distasteful and began to further distrust American nonproliferation intentions (the Indians already saw the nuclear club as being unfairly exclusive). Thus, according to the Indians, rather than opting to mitigate India's concerns about security and prestige both regionally and globally, the United States' policy towards nuclear proliferation in the subcontinent exacerbated India's hesitance to come to table and leverage their only bargaining chip, a nascent nuclear weapons arsenal (Perkovich 2001).

Instead, the US opted to pursue a coercion-based strategy that sought to deter the Indians from continuing their nuclear program. Unfortunately, this strategy only played into the BJP's nuclear strategy and encouraged India to continue down its nuclear path. In the next section, I explore the evolving relationship between India and the international community as it shifts from a potential nuclear proliferator to a formal, de jure nuclear weapons state.

Operation Shakti to the '123 Agreement'

The formal declaration of India's nuclear weapons program – with the tests of the five nuclear devices – presented yet more information to the international community about India's value for acquiring a nuclear deterrent and, potentially, another opportunity for multilateral or bilateral pressure to arrest development or, hopefully, reverse India's nuclear progress. In part, in accord with international law and domestic laws, the international community, especially the United States, opted to impose economic sanctions against the Indians. According to Undersecretary of State Strobe Talbott,

> The sanctions imposed [on India and Pakistan] were necessary for several reasons. First, it's the law. Second, sanctions create a disincentive for other states to exercise the nuclear option if they are contemplating it. And third, sanctions are part of our effort to keep faith with the much larger number of nations that have renounced nuclear weapons despite their capacity to develop them.[41]

In the United States, the 1998 nuclear tests triggered the provisions in the Glenn Amendment to the Arms Export Control Act of 1994 that required the president to initiate the following seven sanctions against the target state:

---

[41] Daniel Morrow and Michael Carriere. "The Economic Impact of the 1998 Sanctions on India and Pakistan." *The Nonproliferation Review.* Fall 1999.

a) suspend foreign aid except for humanitarian assistance, food, or other agricultural commodities;
b) terminate sales of military items;
c) terminate other military assistance;
d) stop credits or guarantees to the country by US government agencies;
e) vote against credit or assistance by international financial institutions;
f) prohibit the US from making loans to the foreign government concerned;
g) prohibit exports of goods and technology with civilian and military nuclear uses.

Additionally, the United Nations, Japan, and a host of other European countries imposed sanctions on India, primarily in the form of suspension of foreign aid to India and government-to-government credit lines.[42] The effects of these negative economic inducements on India's ultimate nuclear development were negligible but their overarching impact on India's economy and her standing in the international community are stark. For example, the suspension of bilateral loans was costly but the decline in international lending institutions, foreign direct investment, and capital flows was significant for India (Morrow and Carriere 1999). Analysis from the World Bank reveals that the sanctions imposed on India had a "modest but measurable adverse effect on India's economy," mostly due to globalization's ripple effects that led to reduced capital flows to India. United States law, under the Glenn Amendment, required the termination of bilateral aid programs that were seemingly substantial, but miniscule relative to India's blossoming public sector. US sanctions prompted fourteen other states to impose sanctions against the Indians, again to varying degrees of efficacy. Interestingly, the real impact of US sanctions was indirect and could potentially have an effect on India's economy through three distinct means: "1) changes in financial flows from bilateral

[42] Only France and Russia refrained from sanctioning the Indians after their nuclear tests.

creditors and agencies; 2) changes in flows from the international financial institutions (IFIs), especially the IMF and the World Bank; 3) changes in private capital flow as a direct or indirect response to the presence of the official sanctions" (Morrow and Carriere 1999). While these related costs on the Indians were temporarily significant, there is no doubt that these effects on the Indian economy would have been far more dramatic if they had been in place longer. However, in 2001 the Bush administration decided to drop all sanctions on India and ostensibly reverse the series of negative inducements that were imposed on India after the 1998 nuclear tests.

Despite these heavy financial costs, the international community's response to the Indian nuclear tests did little to slow India's nuclear advancement and modernization, or incidentally, dynamics on the subcontinent. Within ten years of Operation Shakti, India had been involved in three major disputes/militarized incidents with the Pakistanis, fueled in part by the parties' new nuclear status and the belief that nuclearization may actually prevent full-scale war between the two rivals. Additionally, India's rapid nuclear development resulted in vertical proliferation (growth of the nuclear arsenal) and diversification of delivery of nuclear weapons (the development of air, sea, and land-based platforms). While it is impossible to know what would have happened if the United States or other members of the international community had opted to use positive inducements (especially in the earlier stages of India's proliferation), it is clear that economic sanctions and other negative inducements were counterproductive: while it momentarily slowed the Indian economy, which validated the predictions of the BJP and increased the Indian populace's support for nuclearization, punishing the Indians had the

opposite effect as intended and may have motivated them to continue down their path to proliferation (Bajpai 2009; Morrow and Carriere 1999).

Almost ten years later, the US's hardline stance against Indian proliferation was overturned with the 123 Agreement or US-India Civil Nuclear Agreement that allowed India access to nuclear materials and the opportunity to carry out nuclear commerce with the Nuclear Suppliers Group and international community, the only de facto nuclear weapons state to be granted such an exemption by the NSG. By agreeing to separate its civil and military nuclear facilities and to place all its civil nuclear facilities under International Atomic Energy Agency (IAEA) safeguards, the US and India decided to pursue full nuclear cooperation that allowed India to purchase nuclear fuel and technology from the United States. This new agreement provided an instrumental advantage to India over other non-NPT signatory, nuclear weapons states and helped to reset the relationship between India and the United States after a decade of tense relations. In accord with the new agreement, and with the assistance of the United States, the Indians have made significant strides towards safeguarding their arsenal and taking measures to ensure the safety and security of their nuclear facilities – a key demand issued by the international community in the wake of India's sudden nuclearization. While there is no indication that India has any plans to stop, reduce, or dismantle its nuclear program, New Delhi has made an important concession to the international community, and especially the United States, by agreeing to place its civilian nuclear program under IAEA safeguards in exchange for these rewards.

Concluding Remarks

In accord with the theoretical framework introduced earlier, the Indian nuclear case reveals interesting implications about the conditions or factors that might best contribute to a proliferator's decision to reverse its nuclear course. In addition to providing a detailed account of a particular case among the universe of cases, in-depth case study analysis also provides the opportunity to delve into mechanisms at play and make better inferences about causality, here, how the international community applies pressure to induce states to reverse their nuclear programs. By imagining the Indian proliferation case as a strategic interaction between New Delhi and Washington DC (a representative of the broader international community), we're able to gain better insight into how the United States had the opportunity to discourage proliferation at various points of India's nuclear development but failed to do so. Through case study analysis, an interesting picture of these dynamics emerges.

In the second half of the chapter, I examined India's path to proliferation – distinguishing between time periods before and after nuclearization – to determine what, if any, opportunities that the United States or other members of the international community may have had to persuade the state to abandon its nuclear intentions and return to non-nuclear status. I begin by providing a detailed account of India's surprising and, primarily, clandestine transition from a potential proliferator, seemingly interested in the benefits of a civilian nuclear program, to a state determined to acquire nuclear weapons for a variety of motivations, including external security assurances, domestic political incentives, and cultural prestige. While this rationale for pursuing nuclear weapons is relatively common and consistent with other proliferation instances, the

manner in which India ultimately acquired nuclear weapons, without any significant or costly interference from the international community is more surprising. This analysis delves into this question by examining the factors that helped or hindered India's rise as a nuclear weapons state.

Throughout the course of India's nuclear program that began with assistance from the United States through the Atoms for Peace program, India's nuclear intentions had been ambiguous: while Prime Minister Nehru, and other subsequent heads of state, were strictly against the introduction of nuclear weapons to the subcontinent, there was tremendous pressure from the Indian industrial-bureaucratic and scientific communities to develop weapons that would hopefully deter aggression from neighbors. As the Indians moved from a primarily civilian-based program to one that had the capacity to develop non-peaceful uses of nuclear power, New Delhi revealed its value for nuclearization but received little pressure, either positive or negative, from the international community, including the United States, to abandon their plans. It is likely that this vague and self-serving policy decision stemmed from the US's desire to keep India as an ally in the midst of the Cold War while simultaneously maintaining a strict nonproliferation policy for the international audience: without a clear and consistent policy towards New Delhi, the international community was unable to take a singular and active stand against the Indian nuclear program before it tested its first nuclear device in 1974. It is possible that if the United States had firmly expressed its preferences for nonproliferation while offering inducements desired by New Delhi, such as further nuclear assistance or security guarantees to ensure her survival against exigent threats from Pakistan or China prior to nuclearization, that the Indians may have been willing to

come to the bargaining table with the US to discuss their nuclear plans, and potentially come to an agreement that prevented nuclearization.

It is, however, also possible that the Indians would have been unwilling to permanently dismantle its nuclear program and abandon their nuclear intentions even if they had received inducements that equaled their anticipated benefits from a nuclear program. Some proliferators with exceedingly high values for acquiring nuclear weapons – such as China, North Korea, or India – prefer to incur the costs of proliferation (whether direct through economic sanctions or indirect through lost political and economic opportunities or international pressure) than stop their nuclear development and remain non-nuclear weapons states. Though the United States pursued a relatively ineffective counterproliferation strategy with India, it is difficult to assess whether they would have accepted rewards offered by the US (or other members of the international community) and deproliferated.

Indeed, the most similar case study design employed in this chapter lends itself to comparing Egypt and India to better identify how they diverge on the dependent variable of interest in this broader analysis, deproliferation or the factors that contribute to a state's decision to reverse its nuclear program. While we cannot examine the counterfactual, analyzing the Indian case with that of Egypt's provides a useful comparison between two similar proliferators that received significantly different treatment from the international community, primarily the United States, that resulted in dramatically different outcomes with regards to their nuclear pursuits. Additionally, by using the equilibrium outcomes derived from the theoretical model as a guide to the path to proliferation, these case studies are integral to understanding the critical role that the

international community, especially powerful member states like the United States, can play in inducing significant changes in nuclear policy. By allowing for more detailed process tracing of these nuclear programs over time, we get better insight into these individual instances that provide a useful tool in understanding future instances of proliferation. The concluding chapter examines the interesting patterns that emerge from these different empirical analyses – ranging from the large-n quantitative analysis to the specific case studies of the Egyptian and Indian nuclear programs – and provides a discussion of policy implications for nuclear proliferation and counter-proliferation.

CHAPTER 6: CONCLUSIONS AND POLICY IMPLICATIONS FOR FUTURE PROLIFERATORS

Introduction

In this dissertation, I explored the phenomenon of nuclear reversal and the conditions under which nuclear proliferators are willing to abandon their nuclear intentions. While previous work has centered on examining how individual leaders and states make policy decisions about their nuclear weapons programs in response to domestic or regional considerations, I proposed a novel examination of this question with regard to the role of the international community's menu of policy instruments. Specifically, I argued that nuclear proliferators may be more willing to give up their weapons pursuits if offered positive incentives, such as military or economic assistance, while punishment strategies, such as the use of economic sanctions, may have the opposite effect.

To explore these dynamics, this dissertation begins with a discussion of the broader research literature – the causes and consequences of nuclear proliferation and the role of rewards and punishments in international relations – and suggests that the international community, especially powerful member states like the United States can actually play a critical role in influencing the nuclear trajectory of proliferators before they successfully acquire nuclear arsenals. I then introduce a formal model that examines the strategic interaction between proliferators and the United States as they negotiate the continuation of a nuclear weapons program and works to derive two primary propositions for empirical testing: given the conditions specified; 1) rewards are

more likely to induce nuclear reversal; 2) sanctions are less likely to induce nuclear reversal. Chapters 3, 4, and 5 present three different empirical approaches to help answer these questions. Evidence from the series of empirical tests on the effects of inducements on nuclear reversal, ranging from the first large-n quantitative analysis of nuclear weapons activity since 1945 to two in-depth case study analyses on the Egyptian and Indian nuclear weapons programs, reveal a consistent and important finding: the offer of rewards is more often associated with proliferators abandoning their nuclear weapons program while the imposition of economic sanctions may actually contribute to the continuation of nuclear weapons program, especially among persistent states. In the first part of this chapter, I briefly describe the dissertation's research design and empirical strategy, and key findings. The second part discusses its contributions to the study of international relations, and to international and US nonproliferation and foreign policy.

* * *

Part 1

The Theory of Deproliferation and Empirical Approaches to the Study of Deproliferation

This dissertation centers on examining the conditions under which states that have begun nuclear weapons programs are willing to stop their pursuit, particularly in response to inducements being offered or imposed by members of the international community. Thus far, the literature on rewards and punishments in international relations has resulted in mixed findings, whereby both tools are found to be ineffective and/or operate as mere opposites. Yet, to best answer this fundamental question about the role of inducements and their impact on nuclear deproliferation, it is necessary to differentiate between these

two instruments and to understand the mechanisms that may facilitate or inhibit changes in state behavior. If, as existing theories claim, the benefits of rewards are simply the inverse of the costs of sanctions, their effects are virtually indistinguishable. To help move beyond the inherent indetermination between types of inducements, I employ a game-theoretic design to model the strategic interaction between two actors as they bargain over inducements.

In Chapter 2, *The Theory of Deproliferation,* I present the underlying structure of the formal model, the core intuition underlying the interaction, and discuss the interesting and counter-intuitive findings that result from the analysis. Specifically, the analyses help to reveal a second and critical characteristic about the role of rewards: under certain circumstances, the offer of rewards can help reveal important information about the preferences of an opponent, ostensibly, helping to reveal a wolf in sheep's clothing. A proliferator's response to the offer of a reward to reverse its nuclear program reveals information about its preferences for continuing or stopping its nuclear program to the international community. If there is a possibility that the US or other members of the international community may be willing to use military force against the proliferator, even the most persistent and committed of proliferators may be willing to abandon their nuclear weapons programs, accept the rewards offered, and deproliferate – fully aware that if they don't, they have essentially revealed their hawkishness regarding proliferation and are more likely to be punished by the US in an effort to stop the former's weapons program. By acting to induce a significant change in behavior among some of the most intransigent proliferators now fearful of a military strike against their territory, the offer of rewards is revealed to have a striking, secondary coercive role.

Additionally, the theory of deproliferation reveals that, perhaps less surprisingly, rewards of varying sizes will influence dove states – those proliferators with low values for acquiring nuclear weapons – to deproliferate to avoid sanctions or the small likelihood of military force. For these types of states, even small rewards can encourage nuclear reversal. Lastly, the model reveals an interesting and contradictory finding on the effectiveness of sanctions. For many types of states, but especially those with high values for acquiring nuclear weapons, the threat and/or use of economic sanctions may actually encourage them to continue their nuclear program. This is especially likely if the international community is unwilling to use military force to permanently stop a nuclear weapons program. Under this condition, which can apply to interactions with both hawk proliferators like North Korea and more dovish, though still committed, proliferators like Taiwan, sanctions have limited utility. Indeed, according to the model, some proliferators may actually be more likely to continue their nuclear weapons pursuit after being sanctioned. The model yields two primary propositions for testing throughout the remainder of the dissertation: 1) rewards are positively correlated with nuclear deproliferation; 2) sanctions are negatively associated with nuclear deproliferation.

The theory suggests that the proliferator's standing in the international community and whether the United States or other member states find that the use of military force is a viable option predicates much of the structure of the strategic interaction between the two actors. The model also hinges on a critical piece of information about what value the proliferator maintains for using nuclear weapons –a critical implication on deproliferation policy today: there are some states for whom nuclear acquisition is a foregone conclusion.

This dissertation's empirical strategy in Chapters 3 through 5 attempts to analyze these theoretical propositions through three complimentary approaches: a first of its kind large-n quantitative analysis of the determinants of deproliferation; an examination of archetypal deproliferation cases that illustrate the primary theoretical outcomes from the formal model; and two detailed analyses of the Egyptian and Indian nuclear weapons programs over time. Each empirical chapter aims to examine the key parameters and implications that result from the formal model to assess the validity of the propositions laid forward in the theoretical chapter. Additionally, the medium and small-n empirical case study chapters are aimed to provide a nuanced picture of the causal relationship between the United States ascertaining how best to bargain with the proliferator and the proliferator's decision to continue or stop its nuclear pursuit. By working to 'test' the theory of deproliferation in greater detail, we are able to better assess the specific conditions under which the United States can motivate a significant change in nuclear policy and provide an important additional answer to the puzzle put forward in this dissertation.

By employing a multi-method research design that first examines patterns in the data about all nuclear weapons proliferators over time and explores these measurements and coding schema in a more nuanced fashion, we can better approximate the types of effects that positive and negative inducements are having on the likelihood of deproliferation. The eight cases presented in this dissertation allow a more in-depth probe into the variables, a careful tracing of states' nuclear paths, and a discussion of the implications for discerning preliminary conclusions from these data. Indeed, an analysis of the tests in this research design helps to reveal a consistent set of findings: conditional

on the option to use military force, rewards are more positively associated with nuclear reversal while the imposition of sanctions may actually have the opposite effect. This dissertation's key finding reveals a significant role for the use of positive policy incentives in nuclear counterproliferation policy, and international relations theory more broadly. The following section discusses these contributions in greater detail.

* * *

Part 2

Implications for International Relations Theory and Policy

This dissertation makes three primary contributions: one theoretical, one methodological, and one policy-oriented. The key theoretical contribution has been to construct a theory of deproliferation that models a critical interaction, that between a proliferator and the international community as they negotiate over a nuclear weapons program. The theory, in modeling this interaction, helps to determine the set of conditions under which proliferators may be willing to abandon their nuclear programs. Furthermore, the theory identifies a secondary role for rewards that distinguishes it from punishments. This mechanism can be used to explain many other policy behaviors where bargaining helps to reveal information about the actor's preferences and type, such as conflict initiation or human rights.

Secondly, this dissertation's key methodological contribution has been to conduct the first-of-its-kind large-n, quantitative analysis of nuclear weapons activity over time to help identify the determinants of deproliferation. Previous observational research has focused on examining regional dynamics or single instances of nuclear deproliferation that challenged our ability to observe the universe of cases simultaneously. This research

design, which uses a large-n test in tandem with a series of case studies, helps to alleviate this problem by identifying patterns across all proliferators since the inception of nuclear weapons in 1945.

Lastly, the central policy contribution of this discussion has been to construct and test a new theory of deproliferation that yields interesting implications for how the international community can best structure its interactions with proliferators to induce a change in nuclear proliferation policy. Understanding the preferences of proliferators, and their desire for acquiring nuclear weapons, is critical when designing policies to encourage nuclear reversal and a permanent return to a non-nuclear weapons status. In the remainder of this chapter, I delve into these contributions and their bearing on international relations theory more broadly.

Introducing the International Community and 'Carrots and Sticks'

The theory of deproliferation developed in this dissertation sought to examine a missing piece of the nuclear reversal puzzle – specifically, the potential influence of the international community to persuade proliferators to reconsider continuing their nuclear weapons programs. Analyzing this aspect of the deproliferation process may yield some interesting implications regarding how powerful states can peacefully modify state behavior in the international system through positive incentives. The inclusion of the international community as a primary actor in domestic nuclear weapons proliferation decisions, especially decisions to reverse nuclear weapons program, is a novel addition to the literature and policy discussion on nuclear counterproliferation: if it is possible that nuclear proliferation decisions incorporate more than just domestic and regional

considerations and could be shaped by international pressure, how best can the international community achieve its desired aim at arresting further nuclear development and preventing the spread of nuclear weapons beyond the nuclear club?

A primary, though not new, avenue for exploration in understanding international pressure involves the use of carrots and sticks. Despite their prevalence in attempting to shift negative state behavior through punishment, there is an evolving discussion about the role of more positive approaches to negotiating with states to adapt certain policies. While recent discussions and policy on nuclear weapons proliferation have centered on the use of coercive tactics, unilateral and multilateral economic sanctions and the threat and/or use of military force, there exists a political demand for alternative, potentially more peaceful, avenues to address this issue. The use of rewards and punishments in international relations is a hotly debated issue that has yielded few consistent results and more importantly, suggests that the lack of distinction between the two policy instruments challenges our ability to make inferences about their effectiveness.

In this dissertation, I take a step towards reconciling this issue by using a formal model. Aside from helping to model the strategic interaction between a proliferator and a member of the international community, typically the United States, the game-theoretic approach lends itself to better understanding counterintuitive or previously unknown implications and outcomes. The theory of deproliferation presented previously in Chapter 2 does exactly that. In addition to describing the process by which states either stop their nuclear weapons programs or continue them in response to international pressure, the model also reveals some interesting findings about the mechanisms by which rewards and sanctions operate and perhaps most importantly, how to distinguish

their impact on state behavior. Analysis of the formal model reveals a surprising secondary purpose for rewards in international relations: an actor's response to the offer of rewards to modify her behavior can reveal critical information about her preferences such that her opponent is able to update its strategy. In this model, if a proliferator rejects a reward when the use of military force is an option, she has ostensibly revealed her high desire for acquiring nuclear weapons, which can make the United States more willing to use military force against her to stop her nuclear program. Some proliferators will seek to avoid this by simply accepting the reward and deproliferating, while others will not be compelled to do so. In this way, however, rewards can serve a critical, and previously unseen, secondary purpose in essentially coercing a shift in behavior in some proliferators: rewards are not necessarily about buying off friends, they are about helping to reveal enemies. This novel finding presents a key contribution to the literature on rewards and sanctions in nuclear counterproliferation policy, and perhaps more importantly, international relations theory.

Indeed, this interesting conclusion from the theoretical model is likely to have implications and applications to other key issue areas and debates in international relations. If positive inducements can incentivize flexible and amenable actors as well as those intensely committed to a particular policy, this may help us to better understand what types of instruments are best suited towards changing certain policies. For example, the offer of rewards may help distinguish between various types of human rights abusers: there may be some states, even truly persistent human rights violators, for whom the offer of some form of positive inducement can help motivate a change in behavior if the alternative is an increased likelihood of conflict with member states in the international

community. If rewards can act coercively to alter nuclear proliferation policy, it may have a similar impact on states engaged in other forms of costly, negative behavior. Thus, the theory of deproliferation has the ability to make significant contribution to IR theory.

Nuclear Weapons Activity Over Time

Additionally, the dissertation seeks to contribute to the growing quantitative literature on the causes and consequences of nuclear proliferation by analyzing the phenomenon of deproliferation over time. Thus far, most of the existing literature has examined a single case, such as South Africa, or pair of cases, like Argentina and Brazil, primarily seeking to identify the determinants of deproliferation at the domestic or regional level. These explanations are both valid and compelling and provide an important part to a complex story. Yet, it is equally important to consider how other actors, the international community or even other proliferators, may impact deproliferation dynamics. In this complex, multi-causal process, it is increasingly evident that there is a clear and critical role for the United States and other powerful nuclear weapons states such as China and Russia in ongoing nuclear policy decision-making. To determine the exact nature of this role, it is necessary to evaluate the impact of these actors on a broad set of deproliferated states to determine the conditions under which states can be persuaded to abandon their nuclear weapons programs. This puzzle yields itself to examination with a large-n, quantitative test of the determinants of deproliferation.

This dissertation takes an important step in this direction by evaluating a variety of factors in tandem since the inception of nuclear weapons in 1945. By considering all states that have engaged in nuclear weapons activity over time, rather than simply states that have deproliferated, I bypass a key flaw of many research designs, selection bias. The analysis presented in Chapter 3 examines all nuclear proliferators since 1945 and determines the key inducements that yielded a shift, and to this date permanent, in nuclear weapons status. This new approach to studying nuclear reversal provides several benefits, not least of which is a set of findings of which types of inducements are most closely associated with nuclear reversal and which have the opposite effect. It provides compelling evidence in support of the propositions from the theoretical model presented previously. Other empirical approaches to nuclear reversal have not been able to assess the range of policy instruments that can induce a change in nuclear policy or examine how the mechanisms of rewards and sanctions may operate differently. In addition to being the first large-n analysis of nuclear deproliferation over time, this novel test takes the first cut at examining the theoretical outcomes derived from the formal model and how they manifest in the historical record.

Lastly, this type of empirical analysis, one that specifically focuses on establishing broader patterns of nuclear reversal across states and time, provides a key contribution to the emerging wave of nuclear weapons research that employs similar methodological approach. Recently, nuclear weapons scholars have begun to adopt multi-method research designs to address important questions about nuclear weapons and international security, including determining the causes and consequences of nuclear weapons proliferation. This project can contribute to this discussion by helping to answer

an important related, but understudied question, what are the causes and consequences of nuclear deproliferation. Thus far, this dissertation has presented different approaches to answering the first part of the question – the determinants of nuclear deproliferation – and has yielded a clear and consistent finding: by and large, positive inducements given by members of the international community are associated with nuclear reversal. The remainder of this chapter is dedicated to addressing the latter half of this question.

Contributions to Policy Discussions on Nuclear Counterproliferation

Unsurprisingly, this dissertation is aimed, in no small part, towards engaging with policymakers and contributing to broader policy discussions on how the international community, especially the United States, can best incentivize a change in nuclear policy among early proliferators, and potentially, reduce the likelihood of nuclear proliferation in the first place. The interesting patterns that emerge from the empirical analyses provide a useful framework with which to discuss potential next steps for US or global nonproliferation policy. In this final section, I delve into these implications in greater detail and provide a set of recommendations that stem from the theoretical model and empirical analyses for policy makers to consider when bargaining over nuclear policy with potential proliferators.

Rewards on Tough Cases

The international community is likely to face new challenges to the nonproliferation regime in the coming years, both from current proliferators like North Korea and states that are interested in acquiring nuclear weapons. One of the most important and difficult questions in US foreign policy is determining the optimal strategy

for engaging these states and ideally, preventing the spread of nuclear weapons beyond the existing nuclear club and de facto nuclear weapons states. This research takes a step towards answering this question and yields a somewhat provocative suggestion for approaching current and future proliferators, even those with high values for acquiring nuclear weapons.

In contrast to some of the more recent approaches to negotiating with proliferators – especially the US and international community's policy to employ negative sanctions and coercive threats against both Iran and North Korea in recent years – this research suggests that under certain conditions, ostensibly where the use of military force against a proliferator is possible, rewards may be able to persuade even the toughest proliferators to deproliferate. This presents a surprising, and potentially counter-intuitive, policy recommendation for the United States as they assess how best to approach new nuclear proliferators: though coercion might seem like an appropriate strategy for tough, committed proliferators, especially ones where the US could consider the use of force, the offer of positive inducements may be more effective and can successfully incentivize even these hard case states to give up their nuclear weapons programs.

How does this strategy change if the international community begins the negotiations with sanctions or other punishments? The model suggests that sanctions are less likely to effectively induce nuclear deproliferation among hawk states and may encourage these types of states to continue their proliferation pursuit. Evidence from the historical record, and analysis of the recent Iranian nuclear deal, suggests that hawk proliferators that are initially punished with sanctions will seek to recoup 'losses' from the sanction, in addition to other benefits offered by the international community. This

research, and contemporary proliferation cases, suggests that if the international community begins bargaining with a proliferator with negative inducements, it may end up paying more to persuade these states to abandon their nuclear weapons programs. The use of rewards from the beginning, in conjunction with a threat to use military force against the proliferator, may be a more efficient way of getting the desired outcome. Thus, when approaching new, challenging proliferators on the cusp of developing their own weapons programs, it is critical to consider the use of positive inducements.

Rewards and Allies

Perhaps more intuitively, this research confirms that carrots are more likely to work on friends and allies that are interested in acquiring nuclear weapons. A significant portion of the instances of nuclear deproliferation are with states that are considered to be close to the United States and other key members in the international community. Yet, if the relationship between the US and proliferators is tenuous or unclear, how can US foreign policy decision-makers determine the best avenue for engagement with these proliferators? If it's not immediately clear that the proliferator in question is likely to be easily persuaded to abandon its nuclear weapons program if offered incentives to do so, the process of bargaining can still reveal critical information about a proliferator's preferences. In these instances, where the proliferator is likely to be amenable to negotiation over the status of the nuclear weapons program, it is important for policymakers to consider the long-term consequences of this strategy and focus on positive inducements.

What then are the consequences if the international community or specific member states choose to employ negative policy instruments against these dove

proliferators with a much lower value for acquiring a nuclear weapons deterrent? If the international community opts to punish a proliferator with a moderate value for nuclear weapons, it may actually work to encourage their pursuit of nuclear weapons. This is not only counter-productive to achieving the aim of nonproliferation with those states but may set a poor precedent for future proliferators, especially those with better relations with the United States, that may be more resolved to pursue and maintain their nuclear weapons programs if sanctioned or otherwise punished for pursuing nuclear weapons. Even if rewards can identify enemies, they also are likely to work on friends.

Bargaining Value of Military Force

This research also reveals an important additional purpose for the use of military force in nuclear reversal. Thus far, military force has been used to permanently stop nuclear weapons program, as in Iraq and Syria, by destroying suspected nuclear facilities and infrastructure. Yet, the model and evidence proposed in this project suggests that the threat of military force may actually be an effective bargaining tool that can shape future negotiations with proliferators. The efficacy of rewards, especially with hawk states, is conditional on the ability of the United States or other states in the international community to credibly signal that they will follow through on the use of force if proliferators don't accept the rewards being offered.

In this way, the United States' position on the use of force with regard to a particular proliferator can have a dramatic impact on the strategic interaction between the two actors. If the use of force is a politically viable tool and policymakers can credibly signal that the threat to use force is a credible one, it may shape how a proliferator responds to the offer and may stop even the most committed of proliferators. This is, no

doubt, a controversial implication that demands more in-depth analysis with policy and nuclear decision-makers. How reasonable is it for the United States to threaten a military strike, and thus increase the likelihood of conflict with a potential nuclear weapons state, to shift the bargaining dynamic between the two states? While the research suggests that this strategy is likely to be effective, especially against hawk states that truly desire nuclear weapons, it is important to assess the long-term, potentially unforeseen, consequences of this type of strategy, especially if it becomes necessarily to follow through on the threat of military use.

Military Aid Versus Security Guarantees

Evidence from the empirical analysis also suggests that there may be a consistent and effective role for positive inducements, especially military aid, to significantly increase the likelihood that a state is willing to deproliferate. Analysis of both the extant scholarship and historical record has yielded a comprehensive set of carrots that could be used by the United States or other members of the international community to encourage states to reverse their nuclear weapons programs. This research reveals some interesting implications about the efficacy of some forms of inducements over others and yields important recommendations for policymakers who may be considering what type of policy tool to rely on for current or future instances of proliferation.

When comparing across the different types of positive inducements, the analysis suggests that the offer and extension of military assistance is likely to have the most positive and significant impact on nuclear reversal decisions. Discussions of specific proliferation instances, including Egypt, provide additional evidence in support of these claims: US military aid, perhaps more so than the American nuclear umbrella, is the

inducement most closely associated with nuclear reversal. How might this finding affect US foreign policy and/or nonproliferation policy?

Recently, discussions on the nuclear umbrella in the policy community are focused on both assuring current protégés of the credibility of the US nuclear umbrella and possibly extending the US security guarantee to proliferating states in an attempt to curb or prevent nuclear weapons acquisition. In the recent negotiations with Tehran, the idea of extending the security umbrella to Iran was considered and quickly dismissed as non-credible, and thus unappealing, to the Iranians. Conditional on the relationship with the United States, whether one that is friendly or antagonistic, it is increasingly challenging for the United States to guarantee the ability to project power and protect a variety of states across the world. This potentially appealing, though inherently uncertain reward may not be as attractive a carrot as the provision of US military or economic assistance, guaranteed upon deproliferation.

In addition to being an appealing reward to potential proliferators, the offer of US military assistance may turn out to be more efficient strategy for the United States. The US security guarantee demands the ability to project power to a variety of regions with protégé states. Shifts in US foreign and military policy toward specific regions of the world, e.g. the Obama administration's pivot towards East Asia, is likely to have significant effects on a protégé state's perception of the US's ability to credibly commit to defend them against an adversary. Given that security concerns often motivate nuclear proliferation, proliferators may seek alternative means of ensuring their survival, such as turning to other nuclear weapons states for an extended nuclear deterrent or attempting to

resolve the conflict on their own. Neither of these outcomes are preferable for the United States, especially with regards to its nonproliferation or global security aims.

Thus, refocusing attention on the provision of US military assistance, though both politically and economically costly to the United States, may ultimately be a more efficient and effective strategy than opting to broaden the US nuclear umbrella to proliferators, as a means of inducing nuclear reversal. If used in tandem with political and economic rewards that seek to more peacefully mitigate a proliferator's security concerns, positive military inducements is likely the policy tool most likely to induce nuclear reversal among both dove and hawk proliferators.

Proliferation Outbreak is a Foregone Conclusion

Lastly, this research suggests an unfortunate, but relatively unsurprising, implication about global nuclear weapons proliferation. Despite the best efforts of the international community, especially key member states like the P-5, it is still likely that a state will successfully acquire a nuclear weapons deterrent outside the confines of the nonproliferation regime. Though deproliferation is almost three times as likely as successful proliferation, even in recent times, some nuclear weapons states are not fully receptive to the types of inducements, both positive and negative, employed by the international community. Are all of these states likely to be as bellicose and threatening as North Korea is increasingly to South Korea and the broader East Asian community? That is, unfortunately, unclear.

Yet, it is important for policy-makers to extrapolate patterns for future policy decisions from both the typical proliferation case and the anomalous instances of proliferation. No doubt, anomalous cases like North Korea provide important

information about how truly hawkish states can respond to negotiation attempts by the United States and other members of the international community. But it is equally important to consider how the wide majority of deproliferated states reacted to bargaining efforts by the US or other powerful member states. This dissertation contributes to this ongoing discussion by providing a detailed account of how many states that embarked on nuclear weapons activity responded to international pressure to abandon their weapons programs. While it is probable that the nuclear club may continue to expand, it is still critical to understand the complex dynamics between proliferators and the international community.

Questions for Future Exploration

This research, while helping to answer important questions about the role of US and international pressure in modifying state behavior, sparks a host of related questions for future study. To conclude, I will focus on two such questions.

First, the recent agreement between the international community and Iran to suspend its nuclear development in exchange for substantial economic rewards, such as the removal of sanctions worth nearly $7 billion, raises questions as to the role domestic actors may play in international negotiations. If the international community is willing to offer rewards to proliferators to stop their nuclear pursuit, what constituencies must be satisfied for leaders to successfully negotiate these settlements? Drawing on the extant literature on two-level diplomacy, it is critical to examine how the preferences of domestic groups, such as the military or other hardliners, and subnational institutions, affect the likelihood of cooperation between the proliferator and the international

community. Investigation of this puzzle is likely to yield some additional implications and policy recommendations integral to our understanding of dynamics between proliferators and the broader international community and shed further light on how best we can incentivize states to permanently and peacefully abandon their nuclear weapons programs.

Lastly, studying the question of nuclear reversal prompts questions about how the United States or other powerful member states in the international community can best *prevent* proliferation from occurring in the first place. This research has focused exclusively on states that have already begun nuclear weapons activity and the mechanisms at play when they choose to stop – ostensibly, the examination of two political decisions to start and stop nuclear exploration. Yet, it is likely that the theoretical model and empirical framework could be adapted to examine this equally critical question. If the international community can modify its strategies and the principles of the nonproliferation regime to stop proliferators before they begin down this path, it could work both to prevent the continued spread of nuclear weapons and potentially, strengthen the nonproliferation regime and Nonproliferation Treaty. Better understanding of the dynamics of nonproliferation in a similar manner – specifically, analyzing the complex strategic interaction between proliferator and international community – demands greater scrutiny and scholarship.

REFERENCES

Albright, David/Hibbs, Mark 1993: South Africa: The ANC and the Atom Bomb, *Bulletin of the Atomic Scientists.* 49 (3) 32-37.

Albright, David. 1994. South Africa and Affordable Bomb. *The Bulletin of Atomic Scientists.* 50(4):37-47.

Art, Robert J and Patrick M. Cronin, eds. *The United States and Coercive Diplomacy*. Washington; United State Institute of Peace Press, 2003.

Asal, Victor and Kyle Beardsley. 2007. "Proliferation and International Crisis Behavior." *Journal of Peace Research* 44(2):139–155.

Baldwin, David. A. "The Power of Positive Sanctions." *World Politics* 24.1 (1971): 19-38.
-*Economic Statecraft.* Princeton, NY: Princeton University Press, 1985.
-"The Sanctions Debate and the Logic of Choice." *International Security* 24.3. (2000): 80-107.

Bapat, Navin and T. Clifton Morgan. "Multilateral vs. Unilateral Sanctions Reconsidered: A Test Using New Data." *International Studies Quarterly*, 53.4 (2009): 1075-94.

Beardsley, Kyle & Victor Asal. 2007. "Winning with the Bomb: The Advantages of Being a Nuclear Power." Typescript. Emory University and the State University of New York, Albany.

Bennett, D. Scott & Allan C. Stam. 2001. "EUGene: Expected Utility and Data Management Program, version 2.250." Computer Program. The Pennsylvania State University and Dartmouth University.

Betts, Richard K. 1977a. *Nuclear Blackmail and Nuclear Balance.* Cambridge, MA: Harvard University Press.

Betts, Richard K. 1977b. "Paranoids, Pygmies, Pariahs and Non-Proliferation." *Free Press* 26(1):157–183.

Bowen, Wyn Q. 2996: Libya and Nuclear Proliferation, *International Institute for Strategic Studies, Adelphi Paper 380*, London 2006.

Brodie, Bernard. 1959. *Strategy in the Missile Age*. Princeton: Princeton University Press.

Brodie, Bernard, ed. 1946. *The Absolute Weapon: Atomic Power and World Order*. New York: Harcourt, Brace & Co.

Bueno de Mesquita, Bruce & William H. Riker. 1982. “An Assessment of the Merits of Selective Nuclear Proliferation*.” Journal of Conflict Resolution* 26(2):283–306. 103

Campbell, Kurt M., Robert J. Einhorn, and Mitchell B. Reiss. 2004. *The Nuclear Tipping Point: Why States Reconsider Their Nuclear Choices.* Washington, DC: Brookings Institution Press.

Clark, David H., and Patrick M. Regan. "Opportunities to Fight A Statistical Technique For Modeling Unobservable Phenomena." *Journal of Conflict Resolution* 47.1 (2003): 94-115.

Cohen, Avner. 1998. Israel and the Bomb. New York: Columbia University Press.

Cole, Paul M. 1996. Atomic Bombast: Nuclear Weapon Decision Making in Sweden 1945 –1972. Occasional Paper 26. Washington, D.C.: The Henry L. Stimson Center.

Cortright, David, and George A. Lopez, eds. *Economic Sanctions: Panacea or Peacebuilding in a Post-Cold War World?*. Westview Press, 1995.
- Cortright, David, and George A. Lopez, eds. *Smart Sanctions: Targeting Economic Statecraft*. Rowman & Littlefield, 2002.

Cowhey, Peter. "Domestic Institutions and the Credibility of International Commitments: The Cases of Japan and the United States," International Organization, April 1993. (Reprinted in Benjamin Cohen and Charles Lipson (eds.), Theory and Structure in International Political Economy, MIT Press, 1999).

Crumm. Eileen. “The Value of Economic Incentives in International Politics.” *Journal of Peace Research*. 32.3 (1995): 313-30.

Davis, James. *Threats and Promises: The Pursuit of International Influence*. Baltimore: Johns Hopkins University Press, 2000.

Drezner, Daniel. *The Sanctions Paradox: Economic Statecraft and International Relations.* Cambridge, UK: Cambridge University Press, 1999.

Drury, A. Cooper. 1998. “Revisiting Economic Sanctions Reconsidered.” *Journal of Peace Research*. 35:497-509

Fearon, James D. 1994. “Signaling Versus the Balance of Power and Interests: An Empirical Test of the Crisis Bargaining Model.” *Journal of Conflict Resolution* 38(2):236–269.

Fearon, James D. 1995. "Rationalist Explanations for War." *International Organization* 49(3):379–414.

Galtung. Johan. "On the Effects of International Economic Sanctions: With Examples from the Case of Rhodesia." *World Politics*, 19.3 (1967): 378-416.

George, Alexander. "The Development of Doctrine and Strategy." *The Limits of Coercive Diplomacy: Laos, Cuba, Vietnam*. Eds. Alexander L. George, David Hal, and William Simons. Boston: Little, Brown 1971. 1-35.
-*Forceful Persuasion: Coercive Diplomacy as an Alternative to War.* Washington: USIP Press, 1991.
-"Theory and Practice." *The Limits of Coercive Diplomacy.* 2nd ed. Eds. Alexander L. George and William E. Simons. Boulder, CO: Westview Press, 1994. 13-22.

Ghosn, Faten, Glenn Palmer & Stuart Bremer. 2004. "The MID 3 Data Set, 1993-2001: Procedures, Coding Rules, and Description." *Conflict Management and Peace Science* 21(2):133–154. 104

Goldschmidt, Bertrand. *The Atomic Complex* (La Grange Park, III: American Nuclear Society, 1982).

Halperin, Morton 1974. *Bureaucratic Politics and Foreign Policy*. Washington, DC: Brookings Institution.

Harney et.al. 2006. "Anatomy of a Project to Produce a First Nuclear Weapon." *Science and Global Security, 14:163–182.*

Haaas Richard, and Meghan O'Sullivan. Eds. *Honey and Vinegar: Incentives, Sanctions, and Foreign Policy.* Washington: Brookings Institution Press, 2000.

Hirschman, Albert. *National Power and the Structure of Foreign Trade.* Berkeley, CA: University of California Press, 1945.

Horowitz, Michael. 2007. "The Spread of Nuclear Weapons and International Conflict: Does Experience Matter?" Typescript. University of Pennsylvania.

Hufbauer, Gary C., Jeffrey J. Schott, Kimberly Ann Elliot, and Barbara Oegg. (HSE) *Economic Sanctions Reconsidered*. 3rd ed. Washington: Peterson Institute for International Economics, 2007.

Huth, Paul K. 1988. *Extended Deterrence and the Prevention of War*. New Haven: Yale University Press.

Huth, Paul K. 1990. "The Extended Deterrent Value of Nuclear Weapons." *Journal of Conflict Resolution* 34(2):270–290.

Huth, Paul K. & Bruce Russett. 1984. "What Makes Deterrence Work?: Cases from 1900 to 1980." *World Politics* 36(4):496–526.

Huth, Paul K. & Bruce Russett. 1988. "Deterrence Failures and Crisis Escalation." *International Studies Quarterly* 32(1):29–45.

Huth, Paul K. & Bruce Russett. 1993. "General Deterrence Between Enduring Rivals: Testing Three Competing Models." *American Political Science Review* 87(1):61–73.

Hymans, Jacques 2001: Of Gauchos and Gringos: Why Argentina Never Wanted the Bomb, and
Why the United States Thought it Did, in: *Security Studies* 10 (3), 153-185

Hymans, Jacques E.C. 2006. *The Psychology of Nuclear Proliferation: Identity, Emotions, and Foreign Policy*. Cambridge: Cambridge University Press.

Jervis, Robert. *Perception and Misperception in International Politics*. Princeton, NJ: Princeton University Press, 1976.
-"Deterrence and Perception." *International Security* 7.3 (1983): 3-30. 105

Jo, Dong-Joon, and Erik Gartzke. 2007. "Determinants of Nuclear Weapons Proliferation: A Quantitative Model." *Journal of Conflict Resolution* 51, 1 (February): 167–94. *The Journal of Conflict Resolution*. Special Issue. 53(2).

Katzenstein, Peter J., ed. 1996. *The Culture of National Security: Norms and Identity in World Politics*. New York: Columbia University Press.

Keohane, Robert O. and Joseph S. Nye. *Power and Interdependence: World Politics in Transition*. Boston: Little, Brown, 1997

Kiernan, Kevin. "Why Do States Give Up Nuclear Arsenals? Proliferation as Economic Bargaining." Bologna Center Journal of International Affairs, Vol. 13 (2010)

King, Gary et.al. *Designing Social Inquiry*. Princeton: Princeton University Press; 1994.

Kissinger, Henry. 1957. *Nuclear Weapons and Foreign Policy*. New York: Harper.

Kugler, Jacek. 1984. "Terror Without Deterrence: Reassessing the Role of Nuclear Weapons." *Journal of Conflict Resolution* 28(3):470–506.

Kugler, Jacek & A.F.K. Organski. 1989. *The Power Transition: A Retrospective and Prospective Evaluation*. In The Handbook of War Studies., ed. Manus Midlarsky. Boston: Unwin-Hyman pp. 171 -194.

Lake, David. *Hierarchy in International Relations*. Ithaca: Cornell University Press. 2010.

Lake, David. "The New Sovereignty in International Relations." *International Studies Review* 5, 3 (September 2003): 303-323.

Levite, Ariel. "Never Say Never Again: Nuclear Reversal Revisited." *International Security*, Winter 2002/2003.

Leeds, Brett Ashley. 1999. Domestic Political Institutions, Credible Commitments, and International Cooperation. *American Journal of Political Science* 43: 979-1002.

Litwak, Robert. *Regime Change: U.S. Strategy through the Prism of 9/11* (Woodrow Wilson Center Press and The Johns Hopkins University Press, 2007)

Liberman, Peter 2001: The Rise and Fall of the South African Bomb, in*: International Security 26.* (2), 45-86

Mearsheimer, John J. 1984. "Nuclear Weapons and Deterrence in Europe." *International Security* 9(3):19–46.

Mearsheimer, John J. 1990. "Back to the Future: Instability in Europe After the Cold War." *International Security* 15(1):5–56.

Mearsheimer, John J. 1993. "The Case for a Ukrainian Nuclear Deterrent." *Foreign Affairs* 72(3):50–66.

Mehta, Rupal N. 2011. "The Proliferation of Nuclear Patronage: Hierarchy and Extended Nuclear Bargaining." *Working Paper.* Presented at the Midwest Political Science Association Annual Meeting.

Meyer, Stephen M. 1984. *The Dynamics of Nuclear Proliferation*. Chicago: University of Chicago Press.

Most, Benjamin A., and Harvey Starr. 1989. *Inquiry, Logic and International Politics*. Columbia: University of South Carolina Press.

Müller, Harald and Andreas Schmidt. 2008. "The Little Known Story of Deproliferation: Why States Give Up Nuclear Weapon Activities." *ISA Convention Paper*.

Nincic, Miroslav. "Getting What You Want Positive Inducements in International Relations." *International Security*, Volume 35, Number 1, Summer 2010, pp. 138-183.

Organski, A.F.K. & Jacek Kugler. 1980. *The War Ledger*. Chicago: University of Chicago Press.

Pape, Robert A. *Bombing to Win: Air Power and Coercion in War*. Ithaca, NY: Cornell University Press, 1996.
-"Why Economic Sanctions Do Not Work." *International Security* 22.2.(1997): 9-136.

Paul, T. V. 2000: *Power vs. Prudence: Why Nations Forgo Nuclear Weapons*, Montreal, McGill-Queen's University Press.

Pevehouse, Jon. "With a Little Help from My Friends? Regional Organizations and the Consolidation of Democracy." *American Journal of Political Science,* Vol. 46, No.3 (July 2002).

Powell, Robert. 1999. *In the Shadow of Power: States and Strategies in International Politics*. Princeton, NJ: Princeton University Press.

Powell, Robert. 2003. Nuclear deterrence theory, nuclear proliferation, and national missile defense. *International Security* 27 (4): 86-118.

Quester, George H. 1973. *The Politics of Nuclear Proliferation*. Baltimore: Johns Hopkins University Press.

Reardon, Robert. *Nuclear Bargaining: Using Carrots and Sticks in Nuclear Counter-Proliferation*. MIT Dissertation, 2010.

Reiss, Mitchell. 1995. *Bridled Ambition: Why Countries Constrain their Nuclear Capabilities.* Washington, DC: Woodrow Wilson Center Press. 107

Rublee, Maria Rost. *Nonproliferation Norms: Why States Choose Nuclear Restraint*. Athens, GA: University of Georgia Press, 2009.

Russett, Bruce. 1989. *The Real Decline in Nuclear Hegemony. In Global Changes and Territorial Challenges: Approaches to World Politics for the 1990s*., ed. Ernst-Otto Czempiel & James N. Rosenau. Lexington, MA: Lexington Books pp. 177–193.

Sagan, Scott D. 1996/1997. "Why Do States Build Nuclear Weapons?: Three Models in Search of a Bomb." *International Security* 21(3):54–86.

Sagan, Scott D. & Kenneth N. Waltz. 2003. *The Spread of Nuclear Weapons: A Debate*. New York: Norton.

Shultz, George. "Preventing the Proliferation of Nuclear Weapons." *Department of State Bulletin*, Vol. 84, No. 2093 (December 1984), p. 18.

Signorino, Curtis S. & Jeffrey M. Ritter. 2001. "Tau-b or Not Tau-b: Measuring the Similarity of Foreign Policy Positions." *International Studies Quarterly* 43(1):115–144.

Singh, Sonali & Christopher Way. 2004. "The Correlates of Nuclear Proliferation." *Journal of Conflict Resolution* 48(6):859–885.

Slantchev, Branislav. "Territory and Commitment: The Concert of Europe as Self-Enforcing Equilibrium." *Security Studies*, Vol. 14, No. 4. (October, 2005), pp. 565-606.

Solingen, Etel. 1994. The Political Economy of Nuclear Restraint. *International Security* 19 (2):

Solingen, Etel. 2007. *Nuclear Logics: Contrasting Paths in East Asia and the Middle East*. Princeton, NJ: Princeton University Press.

Thayer, Bradley. 1994. "The Risk of Nuclear Inadvertence: A Review Essay." *Security Studies* 3, 3 (Spring): 428- 93.

Walsh, James. *Bombs Unbuilt: Power, Ideas, and Institutions in International Politics.* Cambridge, MA; MIT Doctoral Dissertation, May, 2000.

Walter, Barbara. ""The Critical Barrier to Civil War Settlement." International Organization. Vol. 51, No. 3 (Summer 1997).

Waltz, Kenneth N. 1979. *Theory of International Politics*. McGraw Hill. New York

Waltz, Kenneth N. 1990. Nuclear Myths and Political Realities. *American Political Science Review* 84 (3): 731-45.

Yang, Jiawen, Hossein Askari, John Forrer, and Hildy Teegen. "US Economic Sanctions: An Empirical Study." *International Trade Journal*, Volume XVIII, No. 1. Spring 2004.