COOPERATIVE COUNTERPROLIFERATION WITH ALLIES AND RIVALS

June 2019

Ariel F.W. Petrovics

Center for Global Security Research
LAWRENCE LIVERMORE NATIONAL LABORATORY

COOPERATIVE COUNTERPROLIFERATION WITH ALLIES AND RIVALS: Nuclear Negotiations with South Korea and Iran

Ariel F.W. Petrovics[1]

Research Assistant

Executive Summary

Nuclear reversal is an important policy goal of the United States and its partners in the Treaty on the Non-Proliferation of Nuclear Weapons. While significant work has examined the effects of common coercive strategies, little analysis has yet explored the effects of possible cooperative strategies. This project therefore explains which cooperative counterproliferation strategies are most successful, and how these strategies differ between engagement with allies and rival states. To that end, it asks what cooperative engagement strategies exist, and under what conditions do they successfully induce nuclear reversal in proliferating states? Through this, it seeks to provide better clarity on why some counterproliferation engagement succeeds in halting or even reversing nuclear proliferation while others fail, and the conditions under which these outcomes occur. Based on historical analysis of the negotiations with South Korea and Iran, this project concludes that strategies that promise ongoing cooperation rather than one-time rewards have been most successful, but that the credibility of such commitments differ depending on the relationship of the negotiating states. Specifically, both allied and rival partners have use nuclear cooperation agreements, security guarantees, and long-term economic deals to successfully negotiate counterproliferation agreements, however allied partners made credible commitments based on their history of mutual trust, while rival states used costly signals of assurance to credibly commit to their agreements.[2]

[1] The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States government or Lawrence Livermore National Security, LLC, and shall not be used for advertising or product endorsement purposes.

[2] Acknowledgements: The author would like to thank Dr. Brad Roberts, Dr. Mona Dreicer, Dr. Zachary Davis, Ms. Sarah Laderman, and the scholars at the Center for Global Security Research for their valuable feedback on prior drafts of this paper. The author also thanks the participants of the APSA 2018 panel, Institutions' Role in Mitigating or Exacerbating Conflict, for their comments related to this work. Any remaining mistakes belong entirely to the author.

Definitions and Terms

- *Sender, or sending state:* The state seeking to induce reversal in the other, such as by providing nuclear assistance or sending financial assistance in exchange for nuclear reversal.
- *Target, or recipient state:* The proliferating state, that agrees to reduce its nuclear activity in exchange for cooperation.
- *Deproliferation:* Also known as nuclear reversal, or roll-back, deproliferation refers to an observable reduction in the nuclear weapons capability of a proliferating state. This can be a freeze of ongoing weapons pursuit, or the partial incomplete roll-back of existing capability, up to and including complete denuclearization.
- *Denuclearization:* This term is used here to refer to the complete end of a nuclear weapons program. This includes the elimination existing arsenals and end of any further nuclear weapons development.
- *Counterproliferation:* This term refers here to efforts aimed at preventing, ending, or reverse nuclear weapons pursuit. This may include *ex post* reversal of existing programs, but may also include *ex ante* prevention of new programs.
- *Nonproliferation:* This term here refers to the *ex ante* prevention of new nuclear weapons programs, as well as the prevention for further proliferation activity in existing programs. It does not necessitate the reversal of existing programs *ex post.*
- *International Atomic Energy Agency (IAEA):* An autonomous international organization established in 1957 to "promote the peaceful use of nuclear energy and inhibit its use for military purposes, including nuclear weapons." (www.IAEA.org).
- *United Nations (UN):* The UN is an intergovernmental organization founded in 1945 and which currently has 193 member states. Governments of member states meet within the UN to discuss and cooperate on issues of shared international importance, including natural disaster relief, security concerns, and peace-building.
- *United Nations Security Council (UNSC):* The UNSC includes five permanent members and 10 non-permanent members that change on a rotating basis. It is one of the principle organs of the UN and is tasked with maintaining peace and security around the world. It is the only body of the UN that has the authority to make binding resolutions, and every member of the P5 has veto power over agreements put before the UN.
- *P5 and P5+1:* The P5 are the permanent five members of the UN Security Council, while the P5+1 (China, France, Great Britain, Russia, and the United States) are these five along with Germany (+1).
- *EU3 (E3/EU):* The three largest founding states within the European Union, which includes France, Great Britain, and Germany.
- *Nuclear Non-Proliferation Treaty (NPT):* an international treaty negotiated within the United Nations and signed into force in 1972. This agreement stipulates that the five states already armed with nuclear weapons at the time (China, France, Great Britain, the Soviet Union, and the United States) would all work towards eventual disarmament, while the non-nuclear weapon states (NNWS) would abstain from non-peaceful uses of nuclear energy.
- *Korean Peninsula Energy Development Organization (KEDO):* A joint venture established in 1995 by the United States, South Korea, and Japan to help implement aspects of the 1994 US-North Korean Agreed Framework.

Introduction

Limiting the spread of nuclear weapons is a major goal of the United States and its allies, but some states have continued to pursue these sensitive technologies for questionable purposes[3]. Evaluation of the possible counterproliferation strategies and their effectiveness for reversing ongoing proliferation could have significant policy implications. While coercive policies or 'sticks,' like economic sanctions and diplomatic censure, have been the dominant form of counterproliferation tactics, much less is understood about more cooperative strategies. This project therefore asks which cooperative counterproliferation strategies most successfully induce nuclear reversal, and how do these strategies differ between allied and rival states. It uses historical analysis of nuclear negotiations with Iran and South Korea to evaluate the success of cooperative strategies, finding that nuclear cooperation agreements, security assurances, and economic deals have proven most successful, however the form that these three strategies take differs between allied and rival states.

The project is structured as follows. It begins by outlining the range of cooperative policies available, including their effects on nuclear reversal. Next, the policies the United States used in two cases of counterproliferation negotiation: South Korea (an ally), and Iran (a rival) are described. It compares which strategies were successful at reversing ongoing nuclear enrichment or reprocessing (ENR) in each, as well as the negotiation conditions under which those successes were achieved. Based on these results, the project illustrates how different partners credibly commit to cooperative counterproliferation, either through mutual trust in the case of allies or through costly signals of assurance between rival partners. This paper concludes by outlining policy implications for crafting successful nuclear counterproliferation strategies.

Cooperative Counterproliferation

Engagement Types

Cooperative counterproliferation strategies range from economic incentives, to technical sharing arrangements or security agreements. Each unique form of cooperation necessitates different political obligations and utilize different incentive structures, but all seek to stop nuclear proliferation by offering rewards in exchange for reversing or halting nuclear weapons activity. The general strategies that can be used to prevent or reverse weapons proliferation, and the specific policy forms each strategy can take are outlined below:

- *Technical Cooperation and NCAs:* Technical agreements and nuclear cooperation agreements (NCA) involve the sharing or transfer of nuclear material, machinery, or technical expertise.
- *Sale or provision of fissile materials and machinery*: This form of technical cooperation provides the recipient with some of the physical components necessary for the enrichment or reprocessing (ENR) of nuclear fissile materials. The donor (or sending

[3] For a list of states with past and current nuclear weapons programs, see the Appendix.

state) agrees to support the recipient (or target) state's ENR capabilities, but does not necessarily provide technical knowledge or training to operate such machinery. Such assistance poses some dual-use risks — appropriating the machinery for both civilian energy and weapons development — so are often accompanied by oversight regulations to control misuse and reduce proliferation risks. For example, the 1994 Agreed Framework stipulated that the US (the donor state) would help build a light water reactor (LWR) for North Korea (the recipient), but the facility would be constructed and operated under joint oversight with the Korean Peninsula Energy Development Organization (KEDO) and IAEA safeguards.

- *Sale or provision of technical knowledge:* Technical knowledge sharing provides the recipient partner with nuclear training or learning opportunities to empower indigenous manufacturing and operation of machinery, thereby increasing the recipients enrichment independence in the future. This is different from the provision of physical materials necessary for enrichment, as it does not necessarily increase the recipients immediate enrichment capabilities (without the machinery this knowledge is solely theoretical). The Atoms for Peace program of the 1950's is one such example, sharing nuclear energy expertise provided it was not used for weapons[4] purposes.
- *Nuclear economic cooperation*: This form of cooperation usually involves civilian energy trade agreements, which outline the sale of nuclear energy materials or expert assistance, but does not necessarily require aid.
- *Denuclearization/safeguards assistance*: This cooperative inducement involves the provision of money, personal, or materials to help the recipient dismantle existing weapons or proliferation infrastructure. For example, the United States helped Ukraine safely dismantle and return former Soviet Union weapons to the new Russian government as part of the 1994 Budapest Memorandum.

Economic inducements: Economic inducements are monetary rewards or improvements provided in exchange for nuclear reversal. They can be direct monetary transfers or increased access to markets, but all improve the recipient's financial conditions and outlook.

- *Foreign aid and direct financial award*: This inducement provides a direct transfer of money or goods from one donor state or organization directly to a recipient state or its beneficiaries. The aid can be in the form of bank-to-bank transfer, or in basic goods or services, but does not include technical agreements or nuclear-specific exchanges. Aid does not necessitate enduring state cooperation, though occasionally donor states do stipulate that continued installments are contingent upon the ongoing political interaction.
- *Sanction easement and relief*: This inducement eases tor entirely eliminates economic sanctions costs for the target's (recipient's). Though sanction easement is actually an end to specific costs rather than a new positive transfer, it's effect is still better economic

[4] Cole, Paul (1997), "Atomic Bombast: Nuclear Weapon Decision-Making in Sweden, 1946–72", Washington Quarterly, 20 (2).

prospects for the recipient, much like the goal of foreign aid[5]. This inducement entails either the blanket or targeted lifting of pre-existing sanctions and therefore providing access to the economic gains from trade which the sanctions had previously restricted. For example, in 2001 the United States waived sanctions against India's 1998 nuclear test in exchange for latter adopting IAEA safeguards.

Diplomatic recognition/increased political ties

- *Increased diplomatic ties:* This inducement either establishes new formal diplomatic ties between sender and proliferator, or increases the level of existing diplomatic ties. Increased ties could include establishing a new liaison office or interest desk in a state with no prior relations, or increasing from an interest desk to full diplomatic ties with an ambassador in residence. Such recognition does not necessarily represent an entirely new formal recognition of the target state, and often simply establishing closer ties and higher-level diplomatic communication. For example, the United States held high-level diplomatic negotiations with Iran as part of the JCPOA negotiations, the first such meetings since the closing of the US embassy in Tehran in 1979.
- *Formal state recognition*: This inducement is more rare and involves the formal recognition of the recipient's government as the sole representative body of the state. The majority of states are recognized by the majority of all others, meaning new explicit recognition generally occurs only with the establishment of an entirely new government (including a new constitution and leadership), or in rare circumstances where such recognition had been previously withheld. For example, the United States opened an ambassadorial office in Tripoli in 2004 after Libya agreed to denuclearize, cooperate with the IAEA, and sign the Additional Protocol (AP).
- *Security assurances and alliances:* These inducements provide specific commitments from the sender for the security of the recipient. They may be direct positive assurances or limited negative assurances, but in all cases they involve explicit commitments that improve the recipients national security environment.
- *Defensive alliance and positive security assurance*: Defensive alliances promise that the partner(s) will come to the ally's aid in case of foreign attack or aggression. These may include positive assurances through nuclear weapons, as well as mutual conventional deterrence without the specific assurance of a nuclear guarantee. For example, Brazil and Argentina concluded joint security guarantee as part of their mutual denuclearization in the 1990s.
- *Nuclear umbrella*: An umbrella is one forms for positive security guarantee and only available from a nuclear-armed donor. It has been offered to disarming weapons states to offset the loss of an indigenous nuclear deterrent and promises protection from foreign attack. Nuclear umbrellas can be an explicit offer in which the sender promises to use its nuclear arsenal in defense of the protege. They can be explicit or implicit offers

[5] Some work argues that sanction easement is the returning to zero of previous costs (i.e. see Nincic 2009 for discussion), but because of their prevalence and similarity to foreign aid in nuclear reversal negotiations, they are included here for the sake of completeness.

and are sometimes accompanied by sharing agreements[6].

- *Nonaggression pact and negative security assurance*: Nonaggression pacts are a commitment to refrain from an attack on the target state. These may be mutual pacts or one sided offers, and do not necessitate that the partners come to one another's aid in the case of an outside attack. They do promise, however. that the signatories will not initiate armed conflict with the other. For example, the United States discussed a comprehensive security agreement as part of the 1994 North Korean Agreed Framework, ending the Korean War officially but providing no guarantees against third-party attacks.
- *Negative nuclear security assurance*: One form of non-aggression pacts are nuclear-specific negative security assurances, which stipulate that the sender will not use or threaten nuclear weapons again the target state. Nuclear specific negative assurances do necessarily extend to conventional arms, meaning the sender may still employ non-nuclear arms, but explicitly refrains from nuclear threat or use.[7]

Each of these cooperative counterproliferation strategies have been implemented to varying degrees of success on many occasions and under different conditions. To better understand which of the available cooperative policies are most successful at countering ongoing proliferation, I compare their use in two different cases — US engagement with South Korea and US engagement with Iran. Both South Korea and Iran pursued indigenous nuclear weapons programs for many years including in years after each signed and ratified the Nonproliferation Treaty. In each case, the United States implemented a variety of counterproliferation policies including cooperative inducements over a series of negotiations. The two cases bear some important similarities: both South Korea and Iran are regional powers, faced a regional adversary backed by a nuclear power, and engaged in a series of counterproliferation negotiations with the United States. Comparing these two cases thus provides insight into which policies were consistently successful at reversing proliferation activity in both allied and rival targets, and also uncovers important differences in the specific implementation tactics in each state. The primary difference between the two is that while South Korea was an ally and protégé of the United States at the time of their negotiations, Iran was a rival with a history of strained relations with the United States.

Nuclear Negotiations: South Korea

Early Weapons Pursuit

The Republic of Korea (ROK) — or South Korea —first began exploring an indigenous nuclear weapons program in the 1970s, when the United States was drawing down its forward deployed

[6] Nuclear Umbrellas and Umbrella States, International Law and Policy Institute. http://nwp.ilpi.org/?p=1221 Accessed July 11, 2018.

[7] This is the case for the Nuclear Weapons States of the NPT assurances to Non-Nuclear Weapons States as part of the NPT. The US stipulates that this guarantee does not necessarily extend to NNWS states protected by a foreign nuclear umbrella or those in violation of IAEA safeguards or verification protocols.

US Forces Korea (USFK). This drawdown in US support heightened South Korea's regional security concerns, particularly its fear of attack from its neighboring rival, North Korea[8]. Though South Korea was a long-time ally of the United States with integrated security systems and a history of nuclear cooperation, the reduction of US presence increased ROK fears of North Korean military adventurism[9]. South Korean President, Park Chung-hee responded by initiating a clandestine nuclear program in 1970 to pursue an indigenous deterrent initially seeking assistance through French and later Canadian reactor technology[10].

Fearing such a program could spark an arms race on the Korean peninsula, the United States opposed any indigenous nuclear weapons pursuit, even one in its allied protégé.[11] Washington pursued several tracks to counter further proliferation and reverse development of the program. France and Canada were pressured to cancel their nuclear deals or to make any agreement contingent on acceptance of IAEA safeguards.[12] American diplomats simultaneously conducted a series of negotiations with President Park and other South Korean leading officials to bring the existing program under civilian control and to dismantle the military components of the program. In exchange for South Korea joining the Nuclear Nonproliferation Treaty (NPT) and ending its weapons program, the US promised to help jointly construct and operate a civilian nuclear reactor[13], thereby reducing Seoul's domestic burden for producing civilian nuclear energy. These negotiations were conducted in private backroom meetings, in which American diplomats also reiterated US commitments to its protégé's security through unilateral positive security guarantees.[14] They ended with South Korea ratifying the NPT in 1975 and officially ending its nuclear weapons program.

[8] Burr, W. (Mar 14, 2017) "The United States and South Korea's Nuclear Weapons Program, 1974-1976" Nuclear Proliferation International History Project, Woodrow Wilson International Center for Scholars; Burr, W. (2017), "Stopping Korea for Going Nuclear, Part II," Briefing Book #584, National Security Archive; Kristensen, H. & R. Norris (2017) "A history of US nuclear weapons in South Korea," Bulletin of the Atomic Scientists 73(6):349-357.

[9] Burr 2017; Kristen and Norris 2017.

[10] Pike, J. "South Korea Special Weapons", https://www.globalsecurity.org/wmd/world/rok/index.html (accessed June 11, 2018); US NSC Memorandum, Nov 14, 1974 (Wilson Center Digital Archive, https://digitalarchive.wilsoncenter.org/document/114631.pdf?v=6e177edd1172220a94be1d789661b4a0 Accessed November 10, 2018.

[11] The US feared proliferation in its ally could spark a nuclear race in North Korea.

[12] "US National Security Council Memorandum, Sale of Canadian Nuclear Reactor to South Korea," November 14, 1974, History and Public Policy Program Digital Archive, Gerald R. Ford Presidential Library, Office of the Asst. to the President for National Security Affairs, Henry Kissinger and Brent Scowcroft Files (1972), 1974-1977, Temporary Parallel File, A1, Korea 10-74--1-75. Obtained by Charles Kraus. http://digitalarchive.wilsoncenter.org/document/114631.

[13] According to Ambassador Richard Sneider, senior South Korean officials asked how Washington could assist in meeting their "peaceful nuclear ambitions" through various technical services, including the fabrication of nuclear fuel. A "technical agreement," he suggested, was a "better face-saver than political arguments." (Sneider in Burr, W. (2017), "Stopping Korea from Going Nuclear, Part II," Briefing Book #584, National Security Archive).

[14] Ambassador Richard Sneider in Burr, William (2017), "Stopping Korea from Going Nuclear, Part II," Briefing Book #584, National Security Archive.

Though negotiations officially concluded with South Korea's ratification of the NPT, unbenounced to the US South Korea continued a clandestine program until President Park's assassination in 1979. Through the 1970's, the US continued downsizing its South Korean troop presence, which Ambassador Sneider claimed "connote[d a] loss of US tripwire and with it loss of US military support in event of North Korean attack following withdrawal, which [was then] broadly expected.[15] The clandestine program finally ended in 1979 after the US agreed to halt and later reverse its troop drawdown, instead leaving a forward presence deployed in South Korea to protect against North Korean threats.[16] These reassurances were supported by reiterations of a continued US nuclear umbrella for South Korea, explicit bilateral commitments that would endure regardless of US ground presence[17].

1982 and 2000 Enrichment Experiments

While South Korea's nuclear weapons pursuit (both overt and clandestine) ended in the late 1970's, it twice engaged in enrichment outside its declared civilian program, including plutonium experiments in 1982 and uranium enrichment in 2000. Both events produced only very small quantities of fissile material as part of "scientific experiments on a small scale."[18] While South Korea reported these experiments to the IAEA in 2004 after signing the Additional Protocol, the IAEA Board of Directors expressed concern about the years of nondisclosure and undertook an investigation into South Korea's enrichment activities.

The US likewise expressed concern but agreed to advocate on ROK's behalf that the issue not be submitted to the UN Security Council. In exchange, South Korea allowed IAEA Additional Protocol inspections and the issue was dropped without sanctions[19]. Washington continued its bilateral commitment by providing South Korea with civilian nuclear technology and economic support. The two partners concluded bilateral reprocessing agreements in 2002, and continued to successfully cooperate on a number of 123 agreements[20], including safeguard and protection regimes, spent fuel management, reliable fuel supplies[21].

[15] Sneider in Lonaszka 2017.
[16] Embassy of Hungary Report, May 22, 1979; Hayes and Moon 2011.
[17] While such commitments were not new as far as the US was concerned, South Korea has apparently previously assumed positive assurances only came with troop presence (Sneider in Lonaszka 2017).
[18] ElBaradei in "South Korea's Nuclear Experiments" (2004) Strategic Comments 10(8).
[19] Kim, S. (2005) "ROK's Nuclear Experiments: A Successful Case of Alliance Management" Asia Pacific Security Studies 4(4).
[20] A 123 agreement outlines the 9 criteria that the US Atomic Energy Act of 1954 demands for all nuclear cooperation with the US. See Arms Control Association "The U.S. Atomic Energy Act 123 Agreements at a Glance", https://www.armscontrol.org/factsheets/AEASection123 Accessed 12/4/2018.
[21] Many, M., E. Charlotte-Avery, M. Nikatin, B. Williams, and J. Corrado (2017) "US-South Korea Relations" Congressional Research Service", Congressional Research Service.

Pyroprocessing and the 2015 Agreement

In recent years, South Korea has sought to update their spent fuel management in an attempt to mitigate the growing problem of nuclear waste from civilian reactors. Today South Korea relies heavily on nuclear energy, and interim storage of spent fuel has caused domestic political clashes over storage sites and reprocessing capabilities. As a result, South Korea has explored pyroprocessing as a way of recycling spent fuel, but development of true indigenous reprocessing capabilities is in direct contravention of 1972 bilateral agreements with the United States and the 1992 Joint Declaration with North Korea. In addition, the United States opposed indigenous reprocessing in South Korea as a contravention to the nonproliferation requirements of Section 123 of the Atomic Energy Act, and threatened to suspend nuclear support, jeopardizing the planned NCA renewal in 2014. Over the course of four years, the two allies negotiated a deeper nuclear sharing agreement in which the US help fill South Korea's fuel supply and reprocessing needs in the interim — temporarily solving spent fuel storage problems — and to revisit South Korea's indigenous enrichment and reprocessing capabilities in the future when the technology could be made sufficiently proliferation resistant.[22] As a result of these cooperative agreements, South Korea has remained a nuclear weapons-free state for decades despite its advanced nuclear capabilities, economic resources, and persistent nuclear security threat from a weaponized North Korea.

Nuclear Negations: Iran

Early Weapons Pursuit

While South Korea agreed to forgo military applications of its nuclear program and has largely been found in compliance with IAEA safeguards for many years, nuclear negotiations with Iran are far less settled. While a definitive end to the disagreement has proven elusive, the years of repeated engagement achieved a number of limited successes and provide insight into cooperative counterproliferation with a rival proliferator.

Iran first began pursuing nuclear technology for energy purposes in the 1950s as part of the US Atoms for Peace program with enjoying international support from the United States, Great Britain, and France. The program stagnated after the 1979 Islamic Revolution as internal upheaval and a protracted war with Iraq diverted Iran's resources toward short term conventional capabilities. Iran returned to its nuclear program in the 1980s, initially on an exploratory scale but accelerated to organized pursuit of both nuclear energy and a clandestine weapons program by the late 1990s[23].

[22] Kim, Duyeon, September 30, 2015 "Decoding US-South Korea Civilian Nuclear Cooperation Agreement: From Political Differences to Win-Win" CSIS, Korea Chair Platform (https://csis-prod.s3.amazonaws.com/s3fs-public/legacy_files/files/publication).

[23] Sinha, Shreeya and Susan Campbell Beachy, April 2, 2015, "Timeline of Iran's Nuclear Program", New York Times, (https://www.nytimes.com/interactive/2014/11/20/world/middleeast/Iran-nuclear-timeline.html).

International concern about possible nuclear proliferation in Iran began in the 1990s following evidence discovered by the United States of a clandestine weapons program.[24] The US passed the Iraq-Iran Nonproliferation Act in 1992 and followed with the Iran-Libya Sanctions Act in 1996, both of which levied sanctions to limit the supply of sensitive nuclear material and technology to Iran. By 2003, however, further evidence had surfaced of ongoing enrichment at Iranian facilities in Natanz and Arak. This evidence prompted greater international interest in the Iranian nuclear program, sparking a decade-long counterproliferation battle. Over the course of this battle, Iran faced various forms of pressure and inducements levied by unilateral states, informal groupings of states, and formal international organizations. These counterproliferation policies ranged from coercive treatments like economic sanctions and threats of military attack, to positive inducements like technical cooperation and sanction relief. As a result, the changing negotiation tactics from international powers and the corresponding responses from Tehran provide ample within-case variation to assess the conditions that facilitated or hindered nuclear roll-back.[25]

2004 Paris Agreement

The first round of counterproliferation negotiations with the Islamic Republic began in 2003 after evidence of ongoing enrichment at Iran's Natanz and Arak plants prompted an IAEA resolution calling on Iranian compliance with its NPT commitments.[26] Iran first broached the possibility for nuclear negotiations in May 2003, using back-channels through the Swiss embassy to broach a possible "Grand Bargain" — offering nuclear transparency, promoting stability in Iraq, and negotiating peace with Israel in exchange for US security assurances.[27] Though the United States did not respond to these offers, UK, France, and Germany (E3/EU) did. In a joint statement in October 2003 known as the Tehran Declaration, Iran offered to sign the NPT Additional Protocol, and in return the European states agreed to recognize Iran's right to civilian enrichment, to work toward future nuclear cooperation under IAEA safeguards, and to

[24] The US discovered evidence of collusion between the Iranian government and the nuclear supplier network of AQ Khan, including the transfer of schematics for weapons designs in 1987. (Sinha, Shreeya and Susan Campbell Beachy, April 2, 2015, "Timeline of Iran's Nuclear Program", New York Times, (https://www.nytimes.com/interactive/2014/11/20/world/middleeast/Iran-nuclear-timeline.html).

[25] Note that variation in Iran's nuclear proliferation responses does not imply complete nuclear dismantling or conversely nuclear breakout. Rather, proliferation behavior in the context of nuclear negotiations refer to Iran's incremental steps toward limiting or conversely increasing its nuclear capabilities and nonproliferation oversight compliance.

[26] GOV/2003/40 - "Implementation of the NPT safeguards agreement in the Islamic Republic of Iran" (PDF). Accessed June 21, 2018.

[27] Porter, G. "POLITICS: Iran Proposal to U.S. Offered Peace with Israel" Inter Press Service News Agency, May 24 2006 http://www.ipsnews.net/2006/05/politics-iran-proposal-to-us-offered-peace-with-israel/; Wastnidge, E. "Iran, the US, and Letter Diplomacy: From Private tor Public Dabate" Journal of International Affairs, July 31, 2015, https://jia.sipa.columbia.edu/online-articles/iran-us-and-letter-diplomacy-private-public-debate; Hirsch, M. and National Journal "The Case for a Grand Bargain with Iran", The Atlantic, Nov. 7 2013, https://www.theatlantic.com/international/archive/2013/11/the-case-for-a-grand-bargain-with-iran/281261/ Accessed 1/15/2019.

work with Iran toward a Middle East Nuclear Weapons Free Zone.[28] "The objective of the talks were to create confidence and set up working groups on nuclear, security and economic cooperation, and to reach to an agreement within the next three months on exactly how Iran's nuclear programme [would] be monitored.[29]"

In accordance with these negotiations, Iran signed the Additional Protocol and agreed to IAEA safeguard inspections. The initial months of implementing the tentative agreement were rocky, with Iran refusing some inspections and the IAEA issuing rebukes for lack of full cooperation.[30] Despite this, the EU3 and Iran successfully concluded negotiations in November 2004 in what is known as the Paris Agreement.[31] In this agreement, Iran agreed to continue to implement the Additional Protocol, suspend its enrichment activities, and publicly support the development of a constitutionally elected government in Iraq.[32] In exchange, the EU3 offered to support Iran's accession to the World Trade Organization, its inclusion in the IAEA Nuclear Fuel Cycle Expert Group,[33] and to continue negotiations toward future energy and security cooperation. Following the Paris Agreement, the IAEA Board of Directors agreed not to refer Iran to the UN Security Council for its prior infractions.

After the Paris Agreement, however, implementation and deepened collaboration proved elusive, with no specific benchmarks or deadlines for either side.[34] While Iran insisted that it would maintain its right to civilian enrichment as agreed under the 2004 stipulations, the EU3[35] decided could not accept Iranian pursuit of civilian nuclear energy.[36] The agreement broke down in 2006 when the IAEA Board of Directors voted to report Iran to the UN Security Council for

[28] According to Sinha (2005). However, no specific deadlines or steps were set, meaning verification and stepwise agreements proved impossibly difficult (Kubbrig 2006).
[29] Sinha, S. (2005) Paris Agreement and the Iranian Nuclear Case, Institute for Peace and Conflict Studies, http://www.ipcs.org/comm_select.php?articleNo=1606 Accessed May 12, 2018.
[30] See IAEA June 2004 report for full list Iran's "pattern of concealment" ("GOV/2004/83 – Implementation of the NPT Safeguards Agreement in Iran" (PDF). Accessed June 20, 2018.
[31] "INFCIRC/637 - Statement to IAEA on Paris Agreement" (November 26, 2004) .https://www.iaea.org/sites/default/files/publications/documents/infcircs/2004/infcirc637.pdf Accessed June 20, 2018.
[32] This agreement came shortly after the War in Iraq, in which Iran had supported insurgent groups against the new Iraqi government. In this stipulation, Iran would end support for rebel groups against the Iraqi government.
[33] https://www.iaea.org/INPRO/2nd_Dialogue_Forum/mna-2005_web.pdf Accessed June 20, 2018.
[34] Kubbrig (2006) www.europarl.europa.edu/hearings/20060914/sede/kubbrig_en.pdf Accessed June 15, 2018.
[35] In response to from the US, who argued that Iran's history of concealment made its civilian enrichment too risky.
[36] "EU rejects Iran call to speed up nuclear talks". Web.archive.org. Reuters. 1 February 2005. Archived from the original on 7 February 2005; Morrison, David (21 January 2006). "The EU misleads on Iran's nuclear activities" (PDF). Labour & Trade Union Review.

noncompliance.[37] In response, Iran suspended its voluntary Additional Protocol implementation and special inspections. In response to Iran's renewed enrichment activities in Iran, the UN Security Council imposed comprehensive trade and financial sanctions.[38]

2007 Work Plan

After the breakdown of the Paris Agreement and the resulting UN sanctions, Iran and the IAEA again returned to negotiations in 2007. They concluded a general work plan that would bring the Islamic Republic back under IAEA inspections and into compliance with their NPT obligations. The plan specified inspection protocols and in exchange promised to ease UN economic sanctions pending Iran's compliance. Unlike the Paris Agreement, the work Plan made no specific promises of diplomatic recognition of Iran's right to civilian enrichment. Rather it focused on economic incentives to Iran in the form of reducing sanction costs.[39] However, this plan did not progress far, as the US continued to press for sanctions and Iran resisted some special inspections that it claimed would grant undue "access to sensitive information related to its conventional military and missile related activities.[40] After the breakdown of the Work Plan, Iran and the UN Security Council Permanent Five plus Germany (P5+1) agreed in principle to a fuel swap.[41] Iran refused to make any such deal with France, however, claiming their past failures to follow through on a bilateral nuclear deal caused it to have an "unfortunate confidence deficit" in the latter.[42]

Eventually Iran agreed to negotiate on suspending high-level uranium enrichment in exchange for a nuclear fuel swap agreement in 2010, though it reiterated preconditions that it would not stop Low Enriched Uranium enrichment activity. Iran signed an agreement with Turkey and Brazil, with Russian oversight, in which Turkey and Brazil would supply Iran with Russian TRR fuel as long as Tehran exported its spent fuel to Russia for reprocessing. The agreement was concluded without the UNSC or IAEA. While the NCA would purportedly aid Iran's civilian program and reduce proliferation risks by exporting spent fuel, the lack of transparency into Iranian dual-use enrichment capabilities concerned the US and its allies. Concerned that Iran would misappropriate the resources towards a future weapons program, the US, United Kingdom, and France opposed the deal causing it to break down. Instead, beginning in 2009, a

[37] "Resolution GOV/2006/14 of the Board of Governors: Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran"(PDF) (Press release). International Atomic Energy Agency. 2 April 2006.
[38] UNSCR 1737 Security Council Imposes Sanctions on Iran for failure to Halt Uranium Enrichment, Unanimously Adopted, December 23, 2006.
[39] Note that sanction easement does not transfer money or aid from the sender to the recipient. Instead it removes existing barriers to trade and banking so that Iran might re-engage with global markets.
[40] Kerr, P. (2018) "Iran's Nuclear program: Tehran's Compliance with international Obligations" Congressional Research Service, p.2.
[41] Official Proposals of the Iranian Nuclear Issue 2003-2013, Arms Control Association July 2015, https://www.armscontrol.org/factsheets/Iran_Nuclear_Proposals Accessed November 2, 2018.
[42] Crail, P., "Iranian Response to LEU Fuel Deal Unclear," Arms Control Association, https://www.armscontrol.org/act/2009_11/Iran Accessed July 10, 2018

period of deteriorating relations with Iran began. After a series of failed attempts, the US unilaterally and UN Security Council jointly increased sanctions against Iran and its nuclear program.[43] Between 2010 and 2013, UNSC and joint US/EU sanctions continued to intensify against Iran, but the Islamic Republic continued to pursue further enrichment capacity, initiating power plant operations in Bushehr and uranium enrichment at the Fordu facility.

2015 JCPOA

Beginning in 2013, the United States began a series of secret negotiations with Iran in the hopes of reaching an agreement to bring Iran's nuclear enrichment activities under IAEA safeguards and reduce tensions between the two countries. Early in the negotiation phase, the two partners initiated a freeze-for-freeze in which Iran agreed to freeze its enrichment activities and the United States agreed to freeze its economic sanctions against Iran's nuclear program[44]. Within a few months, Iran and the IAEA concluded an initial Joint Statement on Framework for Cooperation, setting out specific steps to verify freeze compliance and to work towards a more permanent resolution.[45] Over the course of a series of high-level diplomatic meeting and technical exchanges, Iran and the P5+1[46] negotiated the Joint Comprehensive Plan of Action (JCPOA) — also known as the Iran Deal — which specified the timeline and scope of Iran's reversal steps and the P5+1 inducements. The parties agreed that Iran would ratify the NPT Additional Protocol, blend down its existing stockpiles to natural or low-enrichment levels, and dismantle many of its existing centrifuges and facilities. In exchange, the P5+1 lifted the existing economic sanctions — including UN, multilateral, and unilateral sanctions — and released an estimated $100 billion in frozen Iranian assets from foreign banks.[47]

The JCPOA negotiations were largely concluded in joint meetings between Iran and the P5+1, with many of the high-level planning meetings between US and Iranian officials on the sidelines of the UNGA meetings. After the agreement was signed, the IAEA was tasked with verifying Iranian compliance, and sanctions easement and asset repatriation from the P5+1 was to be overseen by the UNSC. Unlike the South Korean negotiations, none of the JCPOA agreements were bilateral, instead, each provision was to negotiated and then verified via

[43] Reuters (2011) "Timeline: Iran's Nuclear program since October 2009", https://www.reuters.com/article/us-iran-nuclear-events/timeline-irans-nuclear-program-since-october-2009-idUSTRE70K02P20110121 Accessed July 10, 2018.
[44] Timeline on Iran's Nuclear Program, New York Times, https://www.nytimes.com/interactive/2014/11/20/world/middleeast/Iran-nuclear-timeline.html#/#time243_8733 Accessed November 8, 2018.
[45] "The Iran Nuclear Deal: A definitive guide" (2017) Belfer Center, https://www.belfercenter.org/sites/default/files/files/publication/IranDealGuide2017.pdf Accessed July 10, 2018.
[46] The P5+1 are the 5 permanent members of the UN Security Council (China, France, Russia, the United Kingdom, and United States), plus Germany.
[47] "The Iran Nuclear Deal: A definitive guide" (2017) Belfer Center, https://www.belfercenter.org/sites/default/files/files/publication/IranDealGuide2017.pdf Accessed July 10, 2018.

multilateral/international organizational oversight.[48] The inducements were mainly economic in the form of sanction easement and asset repatriation. A sunset clause, was included that allowing limited Iranian enrichment for future civilian energy pursuits (though they provided no foreign NCA support of any future program). As a result, the economic and nuclear agreements included in the multilateral JCPOA were largely removals of previous limits, as opposed to direct bilateral support as was the case in agreements with South Korea.

Analysis of Cases: Cooperative Strategies with South Korea Versus Iran

The cooperative engagement strategies in the South Korea and Iran cases highlight some important similarities and some critical differences in the way in which inducements were offered and implemented. Iran and South Korea share some common features — like population size, local security concerns, and regional power status — but South Korea is an ally of the US and a member of the international community, while Iran is an authoritarian revolutionary rival of the US and the liberal international community. The two cases illustrate useful comparisons for counterproliferation engagement with allied versus rival proliferators. Both states have had active nuclear weapons programs for a number of years, and possess significant indigenous enrichment capabilities. Both are regional powers in their own right, but face security threats from nuclear-capable, regional adversaries — South Korea faces off against its North Korean neighbor, while Iran faces the militarily-powerful Israel. Finally, they face important domestic considerations, though neither has a perfect record of democratic rule of law,[49] they both have educated and politically involved domestic populations that have at times supported an active pursuit and protection of enrichment capabilities, and at other times supported NPT compliance and nonproliferation goals.

The two states have important differences that influenced the types of engagement they received and the context in which that engagement has been most successful. South Korea is a staunch ally of the United States, and is well integrated into the international community. Iran has had strained relations with the United States since the Islamic Revolution in 1979 and has a revolutionary theocratic system ideologically opposed to the liberal international system. Despite these differences with the international community and the US specifically, both South Korea and Iran have faced similar cooperative inducements over the course of their respective nuclear enrichment programs.

[48] The JCPOA was also a highly detailed agreement, specifying in an over-100p document the responsibilities and repercussions for each signatory. “The Iran Nuclear Deal: A definitive guide” (2017) Belfer Center, https://www.belfercenter.org/sites/default/files/files/publication/IranDealGuide2017.pdf.

[49] South Korea is now a fully-consolidated democracy, but in the 1970’s during its active weapons pursuit, the one-party system controlled internal political dissent. Iran is a theocracy with a semi-competitive electoral system meaning political competition still provides space for domestic public input. Both states are therefore responsive to domestic public demands, though potentially to a lesser extent during their weapons pursuits than a true consolidated democracy with free and fair elections.

Despite variation in these recipients' relations with the providing state (the US), they each negotiated similar types of cooperative offers. South Korea and Iran both received 1) civilian nuclear cooperation agreements, 2) security agreements, and 3) economic benefits. But the differences between the ways in which those agreements were implemented highlight the importance of trust between the negotiating states in counterproliferation cooperation. Although both received nuclear cooperation agreements, South Korea's NCAs were negotiated bilaterally, often in backroom deals,[50] and involved economic aid for an indigenous program as well as robust technical sharing arrangements in both conventional and nuclear domains. Iran's NCAs, on the other hand, were negotiated multilaterally with many policy providers in public settings and involved limited deals such as official recognition of Iran's rights to civilian energy and modest fuel reprocessing. For example, in negotiations following South Korea's enrichment experiments[51] in 1982 and 2000, the US agreed to share nuclear reactor technology and provided economic assistance to the Seoul's civilian energy program. By contrast, in the 2004 Paris Agreement between Iran and the EU3 (Britain, France, and Germany), Iran submitted to supplementary inspections and agreed to sign the Additional Protocol in exchange for recognition of its right to civilian enrichment and an independent nuclear program. While South Korea has regularly obtained economic and technical assistance for its indigenous nuclear energy program as part of counterproliferation negotiations, Iran's nuclear cooperation agreements have been limited to recognition of Iran's right to civilian nuclear energy (those protected under the NPT).

There are also clear differences in the security assurances provided to each state. While South Korea received a number of positive security guarantees, often backed by material force provisions, Iran was faced with negative security assurances promising not to initiate attack against the Islamic Republic's homeland. The differences in the security agreements highlight the variation in the negotiating partners' relational conditions. This is illustrated by the 1975 agreement with South Korea, where the US coupled its counterproliferation demands with reiterations of positive security guarantees, including both conventional and nuclear umbrellas, and maintained a forward deployed presence in a mutual defense pact. By comparison, the security assurances Iran requested in the 2003 Grand Bargain and 2004 Paris Agreement were limited to negative guarantees against an offensive attack that included no positive assurances, security umbrellas, or mutual defense pacts. No defensive guarantees nor positive assurances were included in the any of the US-Iran deals, not even in the comprehensive and multilateral JCPOA.

Finally, even the economic inducements negotiated with South Korea and Iran differed in substantial ways. South Korea enjoyed direct bilateral trade deals and financial support for its

[50] These included for example private golf games with then-President Park Chung-hee, (see William (2017) national security archive documents for further discussions).

[51] Whether these experiments constituted official decisions to highly enrich or were the result of individual scientists experiments is still highly debated. However, because the ensuing negotiations still aimed at reducing ongoing enrichment, they are included here for comparison.

civilian energy program, which provided new economic growth opportunities for Seoul as the recipient, and incurred direct expenses for

	Ally	Rival
Engagement Type	• NCA - civilian energy support • Positive security guarantee or umbrella • Trade and economic deals	• NCA - recognition and proliferation-resistant support (ie fuel exchange) • Limited negative assurance • Sanction easement
Credibility Mechanism	• Inter-relational (historical) trust • Confluence of goals and national interests	• Sunk costs - multilateral negotiations and pre-emptive freezes • Hand-tying - external verification and enforcement

Figure 1: The specific types of cooperative counterproliferation engagement present in allied and rival negotiations, and the credibility mechanisms employed in each.

Washington as the provider. Iran, on the other hand, received sanction easement rather than direct economic support. Such easement created opportunity for economic improvements in Iran by ending sanction barriers against trade and banking, but it did not provide any direct aid. As a result, sanction easement do not guarantee economic improvements for Iran as the recipient (though they do guarantee a lifting of sanctions) and incur no cost to the providing states. The variation between the way in which these three elements were negotiated and implemented highlight the importance the level of trust plays in counterproliferation cooperation. This variation is outlined in Figure 1 above.

Promising Cooperation: Trust and Credibility

As this paper has illustrated, cooperative inducements have generated successful counterproliferation agreements in both allied and rival recipients, but the negotiation processes and specific agreement provisions varied depending on the parties' pre-existing relationship and trust conditions. Unlike coercive strategies, which often rely on the sender's ability to reduce the recipient's *ability* to proliferate, cooperative inducements instead offer material or political rewards for abstaining. This section evaluates the conditions under which these agreements are negotiated, and how the trust necessary for successful agreements can be achieved in different alliance contexts.

In both of these case studies, successful negotiations involved sustained cooperation between sender and recipient — including both agreements that led to complete denuclearization and those that led to partial roll-back. For example, security guarantees, nuclear cooperation agreements, and long-term safeguard provisions often involve multi-year commitments on the part of both partners, maintaining security commitments, allowing safeguard inspections, and supporting technical exchanges. Long-term deals require ongoing cooperation, meaning that

both partners must believe during the negotiation phase that the other will uphold its end of the bargain even after negotiations have concluded.

As a result, assurances are critical on both sides of a counterproliferation engagement: senders need assurances that the recipient will not misuse the benefits from cooperation to perversely further its nuclear pursuit; recipients need assurances that the sender will not take advantage of reversal to exploit its nuclear-free vulnerability later. Committing to long-term cooperation is therefore especially difficult when past nuclear reversals provide evidence for potential future risk. If the sender is to convince the recipient that cooperation will endure and continue to offset the loss of a nuclear weapons program, it must convince the recipient that its commitments can be trusted. At the same time, the recipient must convince the sender that it too can be trusted to respect its counterproliferation commitments even after collecting its benefits from cooperation. Building such credibility is often difficult, impeded by past history and the security risks of the nuclear context, but is nonetheless essential for successful cooperative agreements.

This raises the important question: what do negotiation partners need to credibly commit to their agreements for long-term counterproliferation cooperation? Despite barriers to nuclear cooperation, the South Korean and Iranian examples— as well other counterproliferation negotiations with Brazil, Argentina, Libya, and South Africa, to name just a few — demonstrate that states do in fact overcome these credibility hurdles. The way in which negotiating states commit to their nuclear agreements, however, differs depending on the parties' pre-existing relationship. When the negotiating states have a history of friendly interactions, they build mutual trust in one another over time.[52] The South Korea and the United States example show that having successfully collaborated on non-nuclear issues many times prior to each of their nuclear negotiations, gave them confidence that the other would follow-through on their promises. In addition, allied states like the US and South Korea tend to share underlying common goals and interests, facilitating and reinforcing their mutual cooperative commitments, such as a common interest in a nuclear-free North Korea. A history of cooperation and common national interests [53] builds mutual trust[54] beyond a specific agreement and establishes credibility in each partner's subsequent commitments.

In the absence of such mutual trust, however, rival states like Iran and the US must still find a way to overcome their distrust in order to reach successful counterproliferation agreements. Without pre-existing mutual trust, the burden of confidence is placed instead on the agreement itself, relying on confidence-building measures and credible repercussions for defection that even rival states can agree upon. Each partner must demonstrate its credibility in its commitments, even when neither trusts the other in matters outside the specific boundaries of

[52] Kydd, A. (2005) Trust and Mistrust in International Relations, Princeton University press: Princeton, NJ
[53] Common interests here means similar state objectives irrespective of specific promises or agreements.
[54] Trust here means belief that the other will follow through on promises, even if the partner's interests are not perfectly aligned.

their nuclear agreement. Because negotiators may be wary that unfounded promises are simply "cheap talk" intended to dupe them into a position of weakness[55], these negotiators instead employ agreement-specific assurances to credibly commit to their counterproliferation obligations.

Agreement-specific assurances can take one of two general forms, either sunk costs like pre-emptive nuclear freezes, or hand tying strategies like external verification protocols. Such assurances allow rival states to trust their specific commitments,[56] even if they do not trust one another outside of the boundaries of their counterproliferation agreement. There are therefore several ways in which counterproliferation negotiation partners can credibly commit to their cooperative agreements: allies can rely on mutual trust from past successes or common goals, while rivals can use agreement specific assurances like sunk costs or hand tying. These are depicted in Figure 2 (below).

Agreement Assurances: Costly Signals of Credibility

While only allied states with a history of successful cooperation or common interests can base cooperative agreements on inter-relational trust, any partner states can employ issue-specific assurances to enhance the credibility of their commitments. Why do states — even those with no history of cooperation or shared preferences — trust the assurances of costly signals? How do these assurances help distrustful states overcome their fears and thereby facilitate successful cooperative agreements? This section identifies specific examples of the types of assurances states can implement in counterproliferation agreements, and explains why these assurances increase the credibility of agreements.

Agreement-specific assurances are costly signals of state commitment, costs that only those genuinely committed to upholding their end of the bargain would be willing to take on. These costs can be in the form of *ex ante* sunk costs that demonstrate the state's present commitment, or *ex post* hand-tying strategies that limit the state's ability to renege in the future. Sunk costs occur early in the bargaining phase — *ex ante* meaning before or at the outset — and can include early self-imposed constraints such as a pre-emptive nuclear freeze, detailed agreement obligations, or access to sensitive nuclear information. They are costly signals of the state's credibility because only those committed to successful cooperation should be willing to invest in them.[57] The types of credibility and specific actions they involved are detailed in Figure 2 below, divided into those employed by allied or rival partners.

[55] Schelling, T. C. (1980). The Strategy of Conflict, 1960. Harvard Business School Press: Boston, MA.
[56] Fearon, J. (1995). Rationalist Explanations for War. International Organization, 49(3), 379-414.
[57] See for example, as part of the 1988 Tripartite Agreement with Cuba and Angola, South Africa agreed to preemptively dismantle its nuclear weapons to demonstrate its commitment to peaceful resolution RES/435 Tripartite Agreement .(https://peacemaker.un.org/sites/peacemaker.un.org/files/AO_881222_TripartiteAgreement%28en%29.pdf Accessed June 12, 2018.

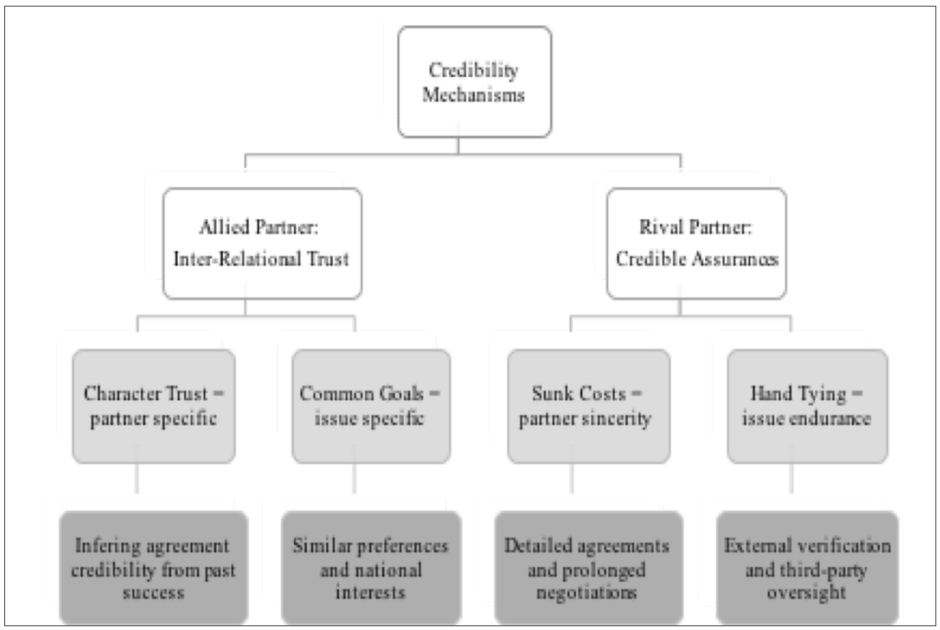

Figure 2: Types of credibility mechanisms that have been successfully employed between allied and rival partners in nuclear negotiations. Light grey indicates general credibility type, and dark grey indicates the specific actions.

While sunk costs demonstrate the state's early commitment to a successful resolution, they do not prevent the state from reconsidering and breaking it commitment, simply eating the sunk costs. Hand-tying strategies are costly signals that instead prevent future reneging, such as external monitoring and enforcement that punish defection. They rely on *ex post* — or after the fact — costs that only activate if the state reneges on their commitments after the agreement has concluded.[58] For example, the IAEA regularly serves as an objective monitoring and reporting agency, sometimes activating UNSC sanctions if signatories fail to uphold their agreements. Hand-tying therefore increases a state's credibility in its agreements in two ways: first, only those committed to continued compliance would willingly take on such constraints in their agreement, and second, the costs discourage reneging in the future even if the state's interests change. For example, Iran and the P5+1 used multilateral settings and strict external (IAEA) reporting in the JCPOA[59] to overcome mutual mistrust and commit to sanction easement in exchange for nuclear reversal.[60] In this way, international oversight allowed negotiating

[58] Fearon, J. (1995). Rationalist Explanations for War. International Organization, 49(3), 379-414.
[59] The permanence of the JCPOA and its deproliferation stipulations are still unknown. The agreement itself, however, was successfully concluded in 2015, and used hand tying strategies to sign the agreement into force, a conclusion that had eluded past attempts.
[60] Similarly, in 1991 Ukraine cooperated with the United States, Great Britain, and Russia using IAEA oversight, while the Brazil and Argentina created ABACC to independently oversee and enforce their mutual denuclearization. Arms Control Association, https://www.armscontrol.org/factsheets/Ukraine-Nuclear-Weapons Accessed July 12, 2018.

partners to trust that reliable third-parties would oversee and enforce agreements going forward, even if the negotiating states did not have sufficient pre-existing trust to cooperate alone.

Costly signals of credibility, either as sunk costs or hand-tying, reassure negotiating partners and facilitate the success of nuclear negotiations even in low trust conditions. They serve as assurances of the state's sincere commitment to counterproliferation and its agreement obligations. As a result, though only allied states can draw on mutual trust and common national interests, even rival states can implement agreement-specific assurances to overcome security fears and credibly commit to cooperation.

Conclusion and Policy Implications

Cooperation is a viable counterproliferation strategy — as evidenced by the South Korea and Iran cases.[61] In fact, of the states that have sought a nuclear weapon, more have cooperated toward successful nuclear reversal than have persisted and acquired a bomb (see the appendix for a complete list). However, cooperation under such security conditions can be challenging - facing hurdles from distrustful partners and the potential security risks posed by counterproliferation cooperation. States that agree to reverse their nuclear pursuits reduce their access to an indigenous nuclear deterrent and the security such weapons would provide. In addition, nuclear cooperation often requires access to sensitive technologies, secure facilities, and private state records, potentially making all parties — both senders and recipients — vulnerable to future proliferation. As a result, the effectiveness of cooperative strategies rests on the credibility of partner promises. The type of engagement and credibility mechanisms vary from one agreement to the next, however, based largely on the relationship of the negotiating states.

Of the many available engagement tactics[62], nuclear cooperation agreements, security assurances, and economic benefits have consistently proven successful in both allied and rival partners. The specific conditions for cooperative agreements differ, however, between allied and rival negotiation partners:

- Allies receive nuclear cooperation through civilian technical assistance, while rivals receive recognition of civilian energy rights under safeguards.
- Allies receive positive security guarantees, occasionally as part of a nuclear umbrella, while rivals receive negative security assurances.
- Allies receive trade agreements and economic assistance, while rivals receive sanction easement instead. Allies can therefore negotiate deeper cooperation through technical, security, and trade collaboration on common goals, while rivals implement limited

[61] Algeria, Argentina, Belarus, Brazil, Canada, Egypt, Germany, Italy, Japan, Kazakhstan, Libya, Netherlands, Norway, Romania, South Africa, Sweden, Switzerland, Taiwan, and Ukraine have all sought or possessed nuclear weapons at one time, and each cooperated with foreign states to reverse their weapons programs (Singh and Way 2004; Fuhrmann 2009).

[62] Outlined at the beginning of the paper.

agreements that do not rely on joint investment or common goals.

All of these agreements require partner states to commit to enduring cooperation, rather than simply one-time or short-term benefits.[63] Such agreements require credible commitments for the future, but the conditions under which negotiating partners can commit to such enduring cooperation differ depending on the pre-existing relationship between the negotiating states. Allies credibility is forged on past successes and shared interests, relying on mutual trust in one another to independently commit to enduring cooperation using uni- or bi-lateral agreements with little to no external oversight. Rival states, on the other hand, suffer from mutual distrust of one another and instead depend on agreement-specific assurances to credibly commit to their agreements, such as *ex ante* sunk costs and *ex post* hand-tying strategies. Allies can therefore negotiate successful counterproliferation cooperation in private bilateral agreements with no external monitoring, while rival states are most successful when they use multilateral agreements with external oversight and enforcement.

[63] For a cross-national statistical analysis, see Inducing Nuclear Reversal (Petrovics n.d.).

Appendix:

Nuclear Weapons Proliferators and their outcomes

Nuclear Weapons States	Relinquished Indigenous Weapons Program	Relinquished Inherited Arsenal
NPT NWS China France UK USA USSR/Russia ***Reportedly Possessing Nuclear Weapons[a]*** India[b] Israel Pakistan North Korea	Algeria Argentina Australia Brazil Canada Egypt Germany India[b] Indonesia Iran[c] Iraq Italy Japan Libya Netherlands Norway South Africa Sweden Switzerland Taiwan Yugoslavia[b]	Belarus Kazakhstan Romania Ukraine

[a.] See further discussion in Caughley, T. and G. Mukhatzanova (2017) "Negotiation of a Nuclear Weapons Prohibition Treaty: Nuts and Bolts of the Ban" *UNIDIR,* http://www.unidir.org/files/publications/pdfs/nuts-and-bolts-en-684.pdf

[b.] India and Yugoslavia both froze their indigenous programs at one time, and then later restarted them. Yugoslavia #1 ended late 1960s, #2 in 1987 (Former Yugoslavia, *NTI*, June 2015, https://www.nti.org/learn/countries/former-yugoslavia/nuclear/). India #1 stalled in 1974, India #2 started in 1986 and resulted in a nuclear arsenal (Indian Nuclear Program", *Atomic Heritage Program*, August 23, 2018, https://www.atomicheritage.org/history/indian-nuclear-program).

[c.] Iran signed the Joint Comprehensive Plan of Action with the P5+1 (UN permanent members plus Germany) in April 2015. Some experts and policymakers contend that it continues clandestine enrichment and is still pursuing nuclear weapons.

Center for Global Security Research
Lawrence Livermore National Laboratory
P.O. Box 808, L-189 Livermore, California 94551
https://CGSR.llnl.gov

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344. LLNL-TR-793597