Online Appendix for: Christopher Lawrence, "Normalization by Other Means – Technological Infrastructure and Political Commitment in the North Korean Nuclear Crisis," *International Security* Vol. 45, No. 1 (Summer 2020) pp. 9-50.

A0. Outline of Empirical Sources and Additional Case Studies

The article utilizes a variety of empirical sources, including declassified documents; financial data and annual reports of the Korean Energy Development Organization (KEDO); and semi-structured interviews with U.S. officials and track II diplomats. This Appendix outlines these data sets, and provides sources for several specific claims in the article. It then provides two additional short case histories to illustrate the general model of proliferation crisis proposed in penultimate the article.

Table *A.1* provides a (non-exhaustive) list of primary document sources utilized for this article. Declassified documents are drawn from two document sets available at the National Security Archive at George Washington University: *The United States and the Two Koreas I (1969-2000)*,[1] and *The United States and the Two Koreas II (1969-2010)*.[2] Together they contain over one thousand declassified documents from the Bush I and Clinton Administrations, offering insight into the strategy and internal politics of these administrations. They also provide indirect insight into North Korea's behavior and intentions in two ways: diplomatic cables often indicate which areas became "sticking points" for the North Korean delegation, and intelligence summaries report close observation of internal regime debates by area specialists in the U.S. Central Intelligence Agency (CIA) and State Department Bureau of Intelligence and Research (DoS-INR). Without direct access to North Korean documentation or interview subjects, these indirect datas are crucial for interpreting the history of engagement with North Korea.

Technical information on North Korea's nuclear program comes from a variety of sources. Notes and correspondence from the Stanford Track 1.5 Delegation visits to the Yongbyon Nuclear Complex were accessed, supplemented by semi-structured interviews and informal conversations. Open-source information on uranium centrifuge procurements was checked with former U.S. officials who previously had access to classified information. Data on KEDO negotiation and implementation can be found in KEDO protocols and annual reports.[3] Data on nuclear activities at Yongbyon during Agreed Framework (AF) implementation are drawn from the reports and daily logs of the U.S. Department of Energy (DoE) Spent Fuel Team, who worked side-by-side with North Korean nuclear scientists to stabilize North Korea's spent fuel for longer-term storage at Yongbyon (n = 195 from 1995-1998).[4]

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[1] Robert Wampler (edt.), *The United States and the Two Koreas, Part I (1969-2000)*, National Security Archive (2014), available at: https://proquest.libguides.com/dnsa/2koreas1. (Hereafter abbreviated *NSA-US2K-I*).
[2] Robert Wampler (edt.), *The United States and the Two Koreas, Part II (1969-2010)*, National Security Archive (2014), available at: https://proquest.libguides.com/dnsa/2koreasII. (Hereafter abbreviated *NSA-US2K-II*).
[3] Some of these are available at the KEDO website: http://www.kedo.org.
[4] These are available in Wampler (edt.), *NSA-US2K-II*.

Tab. A1: Documentary evidence

Source type	Sources
Declassified US Document sets	*The United States and the Two Koreas (1969-2000)* *The United States and the Two Koreas II (1969-2012)*
Additional US Documents	Review of US Policy Toward North Korea: Key Findings and Recommendations (aka the "Perry Report"), Oct. 12, 1999
US-DPRK Joint Statements and Agreements	US-North Korean Joint Statement; Jun. 11, 1993; Geneva Agreed Statement Between the USA and the DPRK; Aug. 12, 1994; Geneva Agreed Framework Between the USA and the DPRK; Oct. 21, 1994; Geneva Joint US-DPRK Press Statement; Jun. 13, 1995; Kuala Lampur US-DPRK Joint Communique; Oct. 12, 2000; Washington DC
RoK-DPRK Joint Statements and Agreements	North-South Agreement on Reconciliation, Non-aggression, and Exchanges and Cooperation, Dec. 13, 1991 Joint North-South Declaration on the Denuclearization of the Korean Peninsula, Dec. 31, 1991
KEDO Agreements and Protocols	Agreement on the Establishment of the KEDO, Mar. 9, 1995 Agreement on the Supply of a LWR Project to the DPRK between the KEDO and the DPRK, Dec. 15, 1995
KEDO Annual Reports and Statements	*KEDO Annual Reports 1995-2005* *Statement by KEDO Executive Board, Nov. 14, 2002* *KEDO Final Report 2005*
Congressional Hearings	"Implications of the US-North Korean Nuclear Agreement," Senate Committee on Foreign Relations (SCFR), Dec. 1, 1994 "US-North Korea Nuclear Issues," Senate Committee on Energy and Natural Resources, Jan. 19, 1995 "North Korea Nuclear Agreement," Senate Committee on Foreign Relations, Jan. 24-25, 1995 "KEDO and the Korean Agreed Framework: Problems and Prospects," Senate Committee on Foreign Relations, Jul. 14, 1998

Many of those who participated in the history of U.S. engagement with North Korea have written books or memoirs on it,[5] and these provide a starting point for oral accounts. Beyond this,

[5] Memoirs include: Joel Wit, Robert Gallucci and Daniel Poneman, *Going Critical: The First North Korean Nuclear Crisis*, (Brookings, 2004); Lim Dong-won, *Peacemaker: Twenty Years of Inter-Korean Relations and the North Korean Nuclear Issue*, (Stanford University, 2012). Other written accounts include Don Oberdorfer, *The Two Koreas* (New York NY: Basic Books, 2014); Leon Sigal, *Disarming Strangers*, (Princeton University Press, 1998); Mike Chinoy, *Meltdown: The Inside Story of the North Korean Nuclear Crisis* (St. Martin's Griffin, 2008); Charles Kartman, Robert Carlin and Joel Wit, *A History of KEDO 1994-2006*, (Center for International Security and Cooperation (CISAC), 2012); Robert Carlin and John Lewis, *Negotiating with North Korea* (CISAC, 2008).

there is a wealth of publicly-available interview data that has been under-utilized by scholars. The KEDO History Project collected interview data with former KEDO officials from the United States, South Korea and Japan, and much of the raw data is published by Stanford University's Center for International Security and Cooperation (CISAC) in *A History of KEDO 1994-2006*.[6] The recollections of Ambs. Stephen Bosworth and James Laney are recorded at length in the "Senior Statesman Series" at 38North.org.[7] To supplement this information, I've conducted semi-structured interviews with several U.S. officials and Track 1.5 diplomats (n = 16). Selected passages from for-attribution interviews are collected in *Sec. A.3* on oral accounts below, along with additional passages drawn from the CISAC project.

A1. The North Korean Nuclear Crisis as a Commitment Problem

A central claim of this article is that the North Korean nuclear crisis in the early 1990s can be characterized as a *commitment problem*.[8] Thus, I argue that there existed an envisioned political end state that both sides seem to have preferred to their current standoff: namely, normalization and denuclearization. This claim requires clarification and further support. It is important to understand that the United States and North Korea had different goals, and hence normalization and denuclearization should be seen not as mutually-desired future, but more as a *zone of mutually acceptable futures*. Within that zone, each side obviously prioritized various elements differently. This is consistent with a commitment-problem model. The nuclear crisis also appears to have been greatly complicated by incentives for both sides to mis-represent their bottom lines, another bargaining dynamic that is well-theorized by other authors.[9] This section summarizes evidence for these various claims.

A1.a. U.S. positions on denuclearization and normalization under Bush I and Clinton

Several interviewees emphasized that U.S. negotiators did not seek normalization with North Korea for its own sake. Rather, the goal of U.S. policy was to denuclearize the Korean Peninsula. Both the Bush I and Clinton Administrations appear to have viewed normalization as connected with that goal of denuclearization, and to have considered normalization acceptable if (and only if) denuclearization were to occur.

For the Bush I Administration, a good starting point is a series drafts that lay out the "US-RoK Basic Positions" on North Korea in late 1991, which state that "the USG (U.S. Government) would be willing to lift economic sanctions and lead an end to diplomatic isolation of DPRK in return for termination of the North's nuclear program."[10] However, other documents indicate disagreement between officials in U.S. Departments of State (DoS) and Defence (DoD) over how "forward

[6] Kartman et al., *History of KEDO*.
[7] For history of the AF, see "Oral History Archive," 38North, https://www.38north.org/2014/10/video101914/. For "Senior Statesman Series," see: https://www.youtube.com/playlist?list=PLJ6_RV2EKu3rab4CB99evT-AaucY8CyQg.
[8] James Fearon, "Rationalist Explanations for War," *International Organization*, 49:3:379-414 (1995).
[9] Fearon, "Rationalist Explanations."
[10] From *NSA-US2KI*: DoD paper, "U.S.-RoK Basic Positions", ca. 9/1991, version a, point 6; version b, point 9.

leaning" to be with the word "Normalization." These internal debates are best illustrated in a "Briefing Book" for a National Security Council Deputies Committee Meeting in December of 1991. Officials from DoS propose that normalization should be explicitly promised at the first high-level meeting with North Koreans, while DoD officials suggest that the additional meetings would imply a possible path toward normalization, but that it was too soon to explicitly put normalization on the table.[11] This illustrates the perceived importance of timing of concessions (suggesting a commitment problem) and desire to mis-represent bottom line (as some U.S. officials clearly wanted to be vague about the how far the U.S would go toward normalization). However, the Bush Administration explicates to North Korea that denuclearization will initiate steps toward "better relations" in direct communication on multiple occasions.[12]

Under the Clinton Administration, the prospect of normalization was more explicit. Flexible options for normalization are outlined in a briefing paper written in early 1993.[13] U.S. officials indicated the prospect of "improving relations" in their opening statement during the first policy-level meeting with North Korean officials in May of 1993,[14] and that implication evolved into explicit articulations of the prospect of diplomatic normalization.[15]

A1.b. North Korean positions on denuclearization and normalization.

There is ample evidence that in the late 1980s, normalization with the United States became a top foreign policy objective for the North Korean regime. Several authors have made this case elsewhere.[16] All U.S. officials and track 1.5 diplomats interviewed for this project remarked at length about North Korean fixation on normalization.

The specifics of denuclearization were officially spelled out on December 31, 1991 in the Joint North-South Declaration on Denuclearization of the Korean Peninsula (JNSDN), and later statements and agreements between the United States and North Korea (with the exception of the Singapore Statement of June 12, 2018) make reference to these terms. The commitments spelled out in the JNSDN went well beyond those of the nonproliferation treaty, indicating that neither North Korea nor South Korea should possess enrichment or reprocessing capabilities. However, these terms were complicated by the fact that North Korea's gas-cooled reactors (GCRs) used MAGNOX fuel which must be reprocessed for safe storage. The KEDO Light Water Reactor (LWR) project offered, in part, a resolution of that contradiction.

[11] From *NSA-US2KI*: Briefing Book, Deputies Committee Meeting, 12/13/1991.
[12] Examples from *NSA-US2KI-II*: DoS-EAP, Talking Points (US-DPRK Relations), points 1 and 2.5, c. 1992; DoA-EAP, Meeting with North Koreans, bullet 2, Jan. 30, 1992; US-DoD, Memo on Contact with Amb. Ho Jong, Jun. 22, 1992; US-EAP, Night Note on Contact with Amb. Ho Jong, Nov. 19, 1992.
[13] From *NSA-US2KI*: DoS, Briefing Paper on Establishing US-DPRK Relations, c 1993.
[14] From *NSA-US2KI-II*: DoS-EAP
[15] See Wit et al., *Going Critical*.
[16] Prominent examples include: Sigal, *Disarming Strangers*, pp. 24, ch. 6; Oberdorfer, *Two Koreas*, pp. 207; Lim Dong-won, *Peacemaker*, pp. 124.

A2. Correlations between North Korea's nuclear behavior and KEDO implementation

The subsection of the article entitled "A New Reality, but No Guaranteed Outcome" argues that the most salient aspects of North Korea's nuclear behavior correlate in time with the political and financial status of the KEDO project. I illustrate this here by tracking three pertinent variables – activities at Yongbyon,[17] developments in the centrifuge program,[18] and the missile track[19] – in relation to U.S. political and financial support for the KEDO implementation. I also point to extensive evidence that the regime was watching these indications of U.S. commitment closely throughout the process, demonstrating the signaling function that KEDO played.

The AF's partial success in rolling back North Korea's nuclear program is somewhat uncontroversial: as an objective matter, over ninety-eight percent of North Korea's emerging plutonium-production capacity was irreversibly destroyed as a consequence of the freeze,[20] making the AF the only U.S. policy to date that has physically rolled back the North's nuclear weapons complex in an irreversible way. What is under-recognized is what this observation says about the regime's long-term nuclear decision making. It is well-known that steel and concrete structural components of unfinished construction projects will degenerate quickly when left exposed to the weather. Yet the regime appears to have taken no steps to preserve the 50MWe and 200MWe GCRs when it froze them under the AF,[21] even though those steps would not have been prohibited under the AF until the point at which the reactors would be dismantled alongside construction of the second LWR. This highlights the "bet" North Korea took after it signed the AF.

Further insight can be gained when we examine key events during the AF era. Looking at the three variables listed above, we can discern four distinct periods with differing levels of positive engagement or retrenchment. Note that the apparent policy adjustments of each side appear to lag in time behind the signals received from the other side, indicating an action-reaction dynamic.

1994-1996 – AF honeymoon period. As heavy-fuel-oil (HFO) shipments commenced and the specifics of the LWR project were being formalized in the KEDO LWR supply agreement,[22] the regime appears to have enjoyed a period of optimism regarding the prospect of future engagement with the United States. In addition to the absence of observable maintenance on

[17] Primary data: collaboration between DoE and Yongbyon technicians is extensively documented in daily reports of the U.S. spent fuel team, available at: *NSA-US2K-II*.
[18] Open-source data on centrifuge program outlined in: Siegfried Hecker, Chaim Braun, Chris Lawrence, "North Korea's Stockpiles of Fissile Material", *Korea Observer*, 47:4:721-749; David Albright and Paul Brannan, "Taking Stock: North Korea's Uranium Enrichment Program," ISIS (2010); (2016). These have been checked with former US government officials with prior access to US intelligence.
[19] Primary data: declassified cables on missile negotiators accessed from: *NSA-US2KI-II*.
[20] See Hecker et al., "North Korea's Stockpiles of Fissile Material."
[21] Visual observations of Stanford Track II Delegation (2004), and conversation with Yongbyon Dir. Ri Hong Sop, (2004-2006), recounted to author by Siegfried Hecker and John Lewis, 2015. See also: Siegfried Hecker testimony to Senate Foreign Relations Committee, "Visit to the Yongbyon Nuclear Scientific Research Center in North Korea", 1/ 21/2004; Siegfried Hecker, "Report on North Korean Nuclear Program", CISAC, 11/2006.
[22] One difficult stretch of engagement with North Korea that did occur during this period was the dispute over the naming of the reactor during the LWR supply agreement negotiations. This was related to the "reactor identity" issue outlined in *sec. 2.a* of the article.

North Korea's plutonium-production facilities, Yongbyon technicians collaborated closely with US-DoE experts to stabilize the spent fuel pond and encase North Korea's Plutonium-bearing spent fuel rods in casks for safe storage without reprocessing,[23] and eventual shipment outside of North Korea for disposition (pending delivery of special nuclear components of the first LWR at Kumho site). Little, if any activity appears to have taken place in the centrifuge program,[24] and U.S. diplomats were able to persuade the regime to cancel its first planned satellite launch to keep engagement on a positive footing.[25]

But the seeds of retrenchment were already appearing during this time. As Clinton Administration officials returned from abroad to outline the AF for Congress,[26] they faced fierce opposition to any policy that could be framed as "nuclear blackmail." This opposition culminated in Congressional mandate that no U.S. funding could contribute to the reactor project, and that U.S. funding for HFO would be limited to $30 million per year (approximately half the projected cost). These limitations in U.S. funding brought KEDO into deficit financing within a year of its existence.[27] Additionally, after the LWR supply agreement was signed, the AF quickly became "politically orphaned" in Washington,[28] where there was a perception that the nuclear issue had been resolved, and implementation was seen as less urgent. Key U.S. negotiators such as Ambs. Gallucci and Hubbard moved on to other issues, and KEDO personnel report a general disconnect from Washington.[29] North Korean officials expressed explicit concern over these developments to U.S. negotiators as early as Fall 1994,[30] indicating their close attention to the financial health of the KEDO project, and to the political status of the AF in the United States.

[23] Since the cladding of MAGNOX fuel used in North Korea's GCRs corrodes in water, major technical challenges had to be overcome in order to store the North's eight thousand spent fuel rods without reprocessing them. These include careful balancing the PH of the spent-fuel pond water, and introduction of rods into specially designed storage casks. These challenges are outlined in documents from *NSA-US2KI-II*: US-DoS, "Record of Meeting, US-DPRK Expert-level Meeting on Spent Fuel," 6/23/1995; for description of cooperation level, see US Embassy Korea confidential cable, "Trip Report, Ken Yates, Spent Fuel Team, DPRK 1-17 October, part two," 10/23/1995; for general report on AF implementation, see: US-DoS, "US Policy Toward North Korea, Next Steps," 1/291996.

[24] There appear to have been two meetings with Pakistanis during which the North Koreans demand cash, rather than centrifuge parts, in exchange for missile assistance, suggesting low priority for the centrifuge program. See Pervez Musharraf, *In the Line of Fire: A Memoir* (Free Press, 2006), pp. 288; Feroz Hassan Kahn, *Eating Grass: The Making of the Pakistani Bomb* (Stanford University Press, 2012), pp. 244; Albright, "Taking Stock."

[25] See Carlin, "Negotiating,", pp. 6-7.

[26] "U.S.-North Korea Nuclear Issues," hearing before the Senate Committee on Energy and Natural Resources (SenComENR), 1/19/1995.

[27] Wit et al., *Going Critical*, pp. 350.

[28] See: Wit et al., *Going Critical*, ch. 11; Kartman et al., "History of KEDO," pp. 12-13.

[29] Example: remarks of Amb. Bosworth, reported in Kartman et al., "History of KEDO," pp. 18.

[30] There is ample indication that the North Korean regime closely monitored the political status of the AF in Washington. North Korean officials expressed concern over Congressional control over KEDO funding to US negotiators when they were presented with a Presidential letter of US commitment to facilitate LWR export. These remarks reported to author by Amb. Gallucci in 2018. Declassified documents also report North Koreans' expression of concern over Congress' negative response to the AF shortly after the 1994 mid-term election. See: *NSA-US2K-II*, US-DoS-INR, "The Secretary's Morning Intelligence Summary DPRK: Worried About Tomorrow," *The secretary's morning intelligence summary DPRK: Worried about tomorrow*, 11/29/1994.

1997-1998 – Looming KEDO insolvency and North Korean hedging. As KEDO's debts grew,[31] analysts projected it would become financially insolvent in 1998.[32] While a preliminary-works contract (PWC) on the LWR was signed in August 1997,[33] this only enabled relatively minor construction steps at Kumho. Disagreements among KEDO member states and an 8% gap in LWR funding led to delayed completion on a turn-key contract (TKC) that would allow the substantive construction steps to commence.[34] Meanwhile, North Korea began explicitly questioning U.S. commitment to future engagement in official statements, direct negotiations[35] and Track 1.5 settings.[36] At Yongbyon, North Korean technicians openly performed maintenance on the 5MWe reactor and reprocessing facility,[37] and cooperation on the spent-fuel canning process was slowed and eventually suspended.[38] Behind the scenes, the regime hedged on possible collapse of the AF in 1997 with its first procurement of enrichment technology from the A.Q. Kahn network, acquiring enough centrifuge parts for a single enrichment cascade for an R&D-scale effort.[39] It then rescheduled its previously-canceled satellite launch, which it conducted on August 31, 1998. As they complained to Track 1.5 diplomats about the political and financial unsustainability of the KEDO process, North Korean officials obliquely hinted that the centrifuge program had been resumed, and suggested that part of the goal of the satellite launch was to jump start engagement with the United States.[40]

If the regime's strategy was to give the KEDO process a booster shot, it worked. A high-level review of Clinton Administration policy on North Korea was commenced in late 1998, both as a way to cauterize the AF's political weakness in Congress and respond to the satellite launch.[41] Dubbed the "Perry Process" and led by former Secretary of Defense William Perry, the review re-established U.S. focus on KEDO implementation at the highest levels. Congress held a hearing in July of 1998 to address KEDO's funding shortfalls,[42] and ultimately approved

[31] See Wit., "The Korean Peninsula"; Kartman, et al., "History of KEDO", ch. 7.
[32] KEDO financial insolvency and North Korean response described in: *NSA-US2KI*, US-DoS-EAP, "Situation Report: KEDO's HFO Funding Crisis *Situation report: KEDO's HFO funding crisis*, 5/15/1998.
[33] KEDO Annual report: 1998-1999, pp. 8.
[34] Many KEDO participants describe the lack of US funding for the LWRs as the main factor delaying the TKC. These remarks are reported in Kartman et al., "History of KEDO," see remarks of Nakano Kenji (Japan), pp. 50; Kim Young-mok (RoK), pp. 64; Yamamoto Eiji, pp 65-66.
[35] Several declassified official U.S. documents discuss North Korea's expressions of skepticism about the credibility of U.S. commitment to the AF. Example: *NSA-US2KI*, US-DoS-EAP, "Situation Report: KEDO's HFO Funding Crisis," 5/15/1998.
[36] Reported to author Track 1.5 diplomats John Lewis in 2015; Leon Sigal in 2018.
[37] Maintenance noted in "KEDO and Korean Agreed Framework: Problems and Prospects," Hearing before the Senate Foreign Relations Committee (SFRC), 7/14/1998.
[38] Spent-fuel canning was suspended in April 1998 in response to KEDO financial troubles. See pp. 2 of *NSA-US2KI*, US-DoS-EAP, "Situation Report: KEDO's HFO Funding Crisis," 5/15/1998.
[39] Albright, "Taking Stock."
[40] Reported to author Track 1.5 diplomats John Lewis in 2015; Leon Sigal in 2018.
[41] The demand for a high-level review of the AF, culminating in the "Perry Process," originated from congressional negotiations for KEDO funding appropriation for FY 1999. US-DoS memoranda point to "difficulties on the Hill" and the missile test as impetus for the review. See: *NSA-US2KI-II* US-DoS-EAP, "Meeting with Former SecDef Perry Regarding Role of the North Korea Coordinator, 10:40-11:10AM, October 22 in Your Office Includes Talking Points," 10/22/1998; US-DoS-EAP "Status of North Korea Policy Includes Draft Job Description," 10/26/1998; US-DoS-EAP "North Korea Policy Coordinator," 12/7/1998.
[42] See: "KEDO and Korean Agreed Framework," SFRC Hearing, 7/14/1998.

enough funding to fully cover HFO shipments and begin paying KEDO's depts. And shortly after the satellite launch, the United States persuaded its allies to accelerate the LWR process.[43]

1999-2000 – Renewed KEDO implementation and missile moratorium. With political support for KEDO implementation renewed in Washington and KEDO negotiations on the LWR process accelerated, a TKC was signed in late 1999.[44] Early in 2000, major construction of the LWR foundation began at Kumho, and manufacturing of the reactor vessel and steam turbine generator for the first LWR began at the Doosan heavy manufacturing site in South Korea.[45] These developments constituted the major investments in the first LWR, and were reported back to Pyongyang by the regime's General Bureau of the LWR project.[46]

Alongside this, spent fuel canning was resumed and ultimately completed at Yongbyon.[47] While the R&D on North Korea's previously-obtained centrifuge cascade surely continued in the background, intelligence on procurement indicates that these remained at the experimental level, and did not yet advance to a committed production-scale effort.[48] The regime instituted a complete missile moratorium throughout these years, and presented U.S. diplomats with a technically-sound, point-by-point proposal to completely end the missile program in exchange for further steps toward normalization with the United States.[49] These developments represent the high-water mark of both the KEDO process and U.S.-North Korean engagement.

2001-2002 – Retrenchment and collapse. The 2000 election of George W. Bush brought in several prominent U.S. officials who entered office with the explicitly-stated intention of ending the AF. While they faced some resistance from Secretary of State Colin Powell, who initially indicated that the U.S. may continue engagement with North Korea where the Clinton Administration left off,[50] he appears to have been out-maneuvered by hardliners like John Bolton and Robert Joseph. He was eventually forced to publicly retract conciliatory remarks by saying he had "gotten out ahead of his skis."[51] While the LWR construction processes set in motion in 2000 continued, all channels of official U.S. communication with the North Korean regime were abruptly silenced as the Administration conducted its review of Clinton policy.[52] Intelligence on centrifuge procurement suggests that these political developments coincided with expansion of North Korea's pilot enrichment program from a minor R&D effort to a production-scale program.[53]

These data points illustrate a clear correlation between KEDO developments (both political and physical) and North Korea's observable nuclear choices, strongly suggesting that techno-

[43] See remarks of Nakano Kenji (First Sec. of Japan to UN), reported in Kartman, "History of KEDO," pp. 49-50.
[44] See KEDO Annual Report 1999/2000, pp. 7-8.
[45] See Kartman, "History of KEDO," pp. 49-50;
[46] See Kartman, "History of KEDO," pp. 83.
[47] *NSA-US2KI-II*, US-DoS, "US and DPRK Agree on Schedule to Finish Spent Fuel Canning (Heavily Excised)," 4/6/2000.
[48] See Albright, "Taking Stock."
[49] See Chinoy, *Meltdown*, pp. 21-34.
[50] See Chinoy, *Meltdown*, pp. 54-55.
[51] Remarks of Colin Powell, CNN interview, 5/14/2001.
[52] See Chinoy, *Meltdown*, pp. 46, 62-64.
[53] See Albright, "Taking Stock."

diplomacy of the AF successfully influenced the regime's long-term nuclear decision making at the highest levels. But they also highlight the Clinton Administration's inability to establish a substantial U.S. stake in future engagement with North Korea. In this sense, the low cost of KEDO to U.S. taxpayers or companies may have been one of the fatal defects in the AF, because it meant low vested interest from one of its key players. Had substantive investment in the KEDO project flowed more directly from U.S. actors, then those actors may have exerted political incentives on the subsequent Bush Administration to salvage the AF. Alternatively, a more pronounced "American face" to the KEDO project may have translated Japan's and South Korea's massive sunk costs into audience costs for the United States vis-a-vis its regional allies. But American financial and political commitment to KEDO had been whittled away to mere window dressing shortly after the AF was signed. And while North Korea's clandestine centrifuge procurements are relatively uninformative when interpreted as a "cheat" on the AF – all states will "cheat" on an agreement if they perceive their security to be at stake – their timing as a "hedge" in response to the signals entailed in KEDO's financial insolvency is precisely what a techno-diplomatic understanding would predict.

A3. Subjective Accounts of Agency within a Techno-diplomatic Structure

Semi-structured interviews and informal conversations were carried out with several U.S. and KEDO officials, as well as track 1.5 diplomats who engaged with the North Korean regime. These were supplemented by publicly available interview data.[54] Selected passages from these interviews are presented in Tab. A2 below.

Tab. A2: Selected passages from oral accounts of the Agreed Framework.

Name	Role	Comments	Source
Robert Carlin	Chief, DoS-EAP 1989-2002	The North Koreans saw the LWR construction process as a way to ensure U.S. involvement with the DPRK over a long period, thus improving the prospect of normalizing political relations.	2016 interview with author
Amb. Robert Gallucci	Head of U.S. delegation to North Korea	The LWR project was a manifestation of that changing relationship, because it was gonna take quite a long time to build these things, and a substantial financial investment...the North Koreans wanted the U.S. to be the ones who were on the hook, and that is what the LWR project was to be a manifestation of. It wasn't just that they were gonna get 2,000 MWe of electricity, but that the LWR project would have meant that the U.S. was hardwired in. And we would have gone further if there was a way for us to finance it, but there wasn't.	2018 interview with author

[54] See: "Oral History Archive," 38North.org, https://www.38north.org/2014/10/video101914/; "Senior Statesman Series," 38North.org, https://www.youtube.com/playlist?list=PLJ6_RV2EKu3rab4CB99evT-AaucY8CyQg; Kartman et al., *History of KEDO*.

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Name	Role	Comments	Source
Amb. Charles Kartman	DoS-EAP, 1992-2001 Special Envoy for Korean Peace Talks 1997-1999 Dir. of KEDO 2001-2005	The KEDO's activities were essentially designed to provide a better basis for sustained and substantive contacts (with North Korea). Imagine if we had rebuilt that grid (in order to run the LWRs). We'd be able to see into every square foot of that country, and they'd be able to see first-hand what western-style construction and energy infrastructure looks like. And the North Koreans probed us over and over about the prospect of rebuilding the grid.	2012 Written comment; verif. by author 2017 2017 interview with author
Thomas Fingar	Dir. Analysis; DoS-EAP 1989-1994	We didn't think of the KEDO LWRs as a carrot so much as an instrument to manage the relationship over time.	2015 interview with author
Joel Wit	Senior Advisor to U.S. Delegation (DoS)	KEDO has two broad functions: encouraging systematic change through modernization in the DPRK; and increasing ties between the DPRK, its regional neighbors, and the international community, in the hope that such ties would help ease tensions and build peace on the Korean peninsula. As a result of the (KEDO) project, the North will have to strengthen its regional and international ties to ensure the completion and effective operation of the two nuclear reactors.	1999 written comment; verif. by author 2017. 1999 written comment; verif. by author 2017.

Tab. A2: Selected passages from oral accounts of the Agreed Framework.

Name	Role	Comments	Source
Mitchell Reiss	Lead Negotiator for KEDO 1995-1999	LWRs would require much more extensive training, they'd be harder for them to manage, they'd take longer to bring online. A LWR is hard to operate, and really hard to repair, much harder than FFPPs. So we (were) gonna be in there for a really long time. (On the grid): we talked about World Bank or IMF loans, the Japanese were quietly talking about tens of billions of dollars of infrastructure development. So yeah, we'd be all over that country (if the LWRs had materialized). People were thinking that there is an upside to us being so intimately involved with some of their fundamental national decisions. Bob and I used to argue that the AF didn't guarantee anything. What it did was to provide an opportunity that didn't previously exist for North Korea and the outside world to have a fundamentally different relationship. That's not to minimize what Bob did, he created a new reality. But he didn't guarantee the outcome. It was up to the players to fill that role, and we did for a while. But ultimately North Korea failed to failed to seize the opening that the AF provided.	2018 interview with author
Amb. Thomas Hubbard	Princ. Neg, U.S. Delegation to North Korea 1993-1996.	I think they saw it less from the perspective of the electrical power that would derive from it, and more from the perspective that our willingness to provide these reactors would be a sign that we could be a reliable partner out in the world.	2018 interview with author
Gary Samore	DoS Nonproliferation (1993-1996) NSC Dir. of Nonproliferation (1996-1998)	We should (design the LWR supply agreement) in a way that makes it possible that they'll stick to the Agreement, that they won't back out of it once the balance of power shifts. ...are you sure I didn't say 'balance of plant?	2012 interview, KEDO History Project. 2017 interview with author

Tab. A2: Selected passages from oral accounts of the Agreed Framework.

Name	Role	Comments	Source
Amb. Chang Sun Sup (RoK)	Exec. Board Chair, KEDO	KEDO was not a purpose itself; it was sort of a vehicle to reach North Korea…(Kim Young Sam) was excited to use this project to promote his own objectives to improve relations with North Korea.	2012 interview, KEDO History Project.
Amb. Cho Khy-hyung (RoK)		I think there was no serious disagreement among the government agencies in that it should be implemented, not only for the solution of the nuclear problem but also for the sake of national reconciliation between South and North Korea.	2012 interview, KEDO History Project.
Kim Young-mok (RoK)	Advisor; Gyeonggi Gov.	North Korea opposed KEDO at the beginning and hoped that everything would be done by the US government or US companies.	2012 interview, KEDO History Project.
Amb. Choy Young-jin (RoK)		To my mind, KEDO represented the first example of Koreans, Americans and Japanese working together in our entire history.	2012 interview, KEDO History Project.
Amb. Yanai Shunji (Japan)		…nuclear power generation is a business from which we could expect returns in the future. So against this background, we got the idea of borrowing money from the (Japanese) ExIm Bank.	2012 interview, KEDO History Project.
Amb. Kang Sok Ju (DPRK)		The LWR proposal is "backed by Kim Il Sung and is designed to open up North Korea.	1993 June negotiations
Amb. Kim Gye-guan		No LWR no deal.	2005 (to Siegfried Hecker during track II visit)

Tab. A2: Selected passages from oral accounts of the Agreed Framework.

Name	Role	Comments	Source
DPRK FM statement		The U.S. should not even dream of the...DPRK's dismantlement of its nuclear deterrent before providing LWRs -- a physical guarantee of confidence building (emphasis added). One should wait and see how the U.S. will move in actuality at the phase of 'action for action' in the future.	2006 DPRK FM statement after KEDO dissolution announced
Amb. Kim Gye-guan		We are taking very good care of your LWR project.	2009 (to Amb. Bosworth)

A4. Anomalies that arise in common interpretations of the North Korean nuclear crisis

The subsection in the article entitled "Anomalies Under the Common Interpretation of the Nuclear Crisis" presents a popular interpretation of the collapse of the AF, and illustrates anomalies that arise in that interpretation. Here I examine an additional popular interpretation – which I'll call the "have their cake and eat it too" narrative – that suggests that North Korea hoped to use LWRs to produce energy *and* plutonium for bombs at the same time. Proponents of this interpretation point out – correctly – that the refueling schedule for LWRs can be shortened to produce weapons-grade plutonium, or that reactor-grade plutonium can also be used for nuclear weapons if weapons-grade is unavailable. But this theory disregards the global interdependencies that LWR operation depends on (see subsection entitled "Do Light Water Reactors Have Politics?"). Shortening the refueling schedule (to retain the isotopics of weapons-grade plutonium) or diverting plutonium (whether reactor- or weapons-grade) from countable-unit spent-fuel assemblies would be visible to the international community, which could then withhold fuel and technical support. Then, the North would be left with two cores of fuel – enough plutonium for a limited number of nuclear weapons – and no reliable prospect of running those reactors further. They would have no reliable implosion device; no test data; no delivery vehicle; no experience or facility for reprocessing spent LWR fuel, and the LWRs themselves would be sitting ducks for a preemptive strike. Some analysts argue that the clandestine enrichment program might enable them to independently run the reactors. But industrial-scale enrichment for large power reactors is a profoundly different technical challenge than a fledgling uranium program sized for nuclear weapons. At the time the AF was signed, North Korea was nowhere near able to enrich uranium at all, and even today it is doubtful they can enrich on the industrial scale required for large power

reactors.[55] It is difficult imagine how such a plan could be justified to regime decision makers in 1994 from a technical perspective, when the major parts of a sure and timely route to nuclear weapons were already in place at that time in the form of the GCR complex.

A key piece of empirical data further complicates the theory that North Korea wanted to use the LWRs to produce plutonium. When the issue of spent fuel came up during negotiations, the U.S. delegation expected the North Koreans to resist the possibility of shipping all LWR spent fuel out of North Korea for disposition. This would be a way to ensure that no accumulation of weapons-usable material resulted from LWR operation in North Korea. But when the proposal was made, the Americans were pleasantly surprised that the North Korean delegation did not put up any resistance. "Sure, you can take this stuff if you want it, then we won't have to deal with it," is the reported North Korean response.[56] If part of North Korea's plan was to accumulate plutonium using Western LWRs, then one should expect them to have vigorously resisted this proposal.

A5. Beyond the Agreed Framework – Understanding Nuclear Proliferation Crises

The penultimate section of the article goes beyond the AF to develop a techno-diplomatic model of nuclear proliferation crisis diplomacy, and illustrates that model through examples drawn from the histories of U.S. engagement with North Korean and Iran. Due to space limitations, only two examples could be included in the main text. This appendix outlines two additional examples: the Six-party Talks leading up to the Sept. 19 Statement with North Korea, and the Joint Comprehensive Plan of Action with Iran (JCPoA).

A5.a. Six-party talks – CVID versus "action for action"

After the collapse of the AF, U.S. diplomacy with North Korea remained at a stand-still until several months into George W. Bush's second term. Some important features of the Bush Administration's "Bold Approach"[57] to engaging North Korea – a promise to normalize relations in exchange for a denuclearized Korean Peninsula – are not fundamentally different from the political future envisioned in the AF.[58] Just like during the Clinton era, economic engagement and energy cooperation were on the table, alongside diplomatic recognition.[59] But the Bush Administration's preferred description of denuclearization masked a crucial distinction. While their catch phrase "comprehensive, verifiable, irreversible dismantlement" (CVID) seems on the surface to articulate nothing more than the basic requirements for a denuclearized peninsula, its historical use by the United States in negotiations has been to reject a "phased approach" to nuclear rollback, and demand that denuclearization *precede* any negotiations or steps toward

[55] Hecker et al. "North Korea's Fissile Material Stocks".
[56] Recounted by Samore, interview Feb. 2018.
[57] The Bush Administration's "Bold Approach" to engaging North Korea was first described by Colin Powell in speech at Asia Society, 6/10/2002.
[58] See Chinoy, *Meltdown*, pp. 80, 92, 217.
[59] See Chinoy, *Meltdown*, pp. 113, 217.

normalization.[60] When North Korean negotiators opposed this phrase, they argued that while they shared the end goal of eventual denuclearization of the Korean Peninsula,[61] if they wished to continue to "engage with the U.S. (they would) need leverage."[62] Therefore, they could only surrender their nuclear capabilities in a step-by-step process of "action for action."[63]

One of the overlooked aspects of the six party talks is that LWRs remained one of North Korea's top demands.[64] And while the six parties exhaustively explored possible paths toward denuclearization and eventual normalization,[65] the road maps that emerged in talks began to bear a striking resemblance to the AF.[66] This became a huge problem for the U.S. Delegation, which sought to avoid anything that resembled the Clinton-era policy that hardliners in the administration had worked to discredit.[67] The other delegations in the six parties came to view the U.S. refusal to discuss resumption of LWR construction at Kumho, and its insistence on the front-loaded time structure of CVID as the main impediments to a diplomatic breakthrough.[68]

The central importance of LWRs was explicated at length in Track 1.5 settings as well.[69] While hosting the Stanford Track 1.5 Delegation at Yongbyon and Pyongyang in 2004 and 2005, North Korean Foreign Ministers Kim Gye-guan and Li Gun emphasized that LWRs were a required component of any credible path toward denuclearization and normalization. They also spelled out what they viewed as two crucial distinctions: between "words for words" and "actions for actions," and between reversible steps and ones that were "essentially irreversible" in time.[70] The Stanford Delegation left North Korea with an unequivocal message for Washington: "No LWR, no deal."

After returning from the Track 1.5 visit in 2005, former Los Alamos Director Siegfried Hecker tried to impress the importance of LWRs on Secretary of State Condoleezza Rice. It is unclear whether his appeal influenced the Bush Administration's policy, but in the next round of the Six-party Talks the U.S. delegation dropped the term CVID and allowed consideration of the LWRs in the Sept. 19 Joint Statement between the six parties.[71] While the wording was admittedly vague

[60] CVID language is uniformly deployed in opposition to "phased approach." Examples, see: Chinoy, *Meltdown*, pp. 184, 203, 206.
[61] See Chinoy, *Meltdown*, pp. 184.
[62] See Chinoy, *Meltdown*.
[63] See Chinoy, *Meltdown*, pp. 193.
[64] For LWR demands in 6PT, see Chinoy, *Meltdown*, pp. 184-185, 244-246.
[65] While many observers note the Bush Administration's hardline approach, prominent factions within the State Department remained committed to engaging North Korea. During Bush's first term, they were effectively constrained by hardliners, who kept the U.S. delegation "on a tight leash." See Chiney, Meltdown, pp. 114. During the second Administration, Amb. Christopher Hill led the delegation, and was granted more freedom to earnestly engage with North Korea. See Chinoy, *Meltdown*, pp. 241.
[66] See Chinoy, *Meltdown*, pp. 187, 205, 244, 248.
[67] Negotiators on other delegations of the six parties developed the acronym ABC, standing for "anything but Clinton," to chide the U.S. negotiators for their efforts to distance Bush Administration policy from that of the Clinton Administration. In a rather comical example, the South Korean delegation was forced to camouflage a proposal to freeze the Yongbyon reactor by instead calling for a reactor "standstill." See Chinoy, *Meltdown.*
[68] In the words of Wang Ho, Chinese host of first round of 6PT, "The American policy as the main problem we are facing. Quoted in Chinoy, *Meltdown*, pp. 188. For South Korean expressions via FM Yoon Young-kwan, see pp. 189.
[69] Three members of the Stanford Track 1.5 Delegation were interviewed for this project: Siegried Hecker (2015), John Lewis (2015), and Robert Carlin (2016). In addition, correspondence amongst the delegation, memos and reports drafted for U.S. government officials, and personal notes of Hecker and Lewis were also examined. Corroborated by other Track 1.5 Leon Sigal (interviewed 2018) and Peter Hayes (interviewed 2016).
[70] Reported by Siegfried Hecker in summary of 2005 trip to Yongbyon.
[71] Joint Statement of the Fourth Round of the Six-Party Talks, Sept. 19, 2005.

– the "provision of LWRs would be discussed at the appropriate time" – the Joint Statement was the pinnacle achievement of the six party process. According to Chinese Amb. Yang Xiyu, who drafted the Joint statement, it was the U.S. Delegation's reluctant embrace of LWRs as part of the diplomatic process that made the breakthrough possible.[72]

But the breakthrough would be short-lived. Shortly after signing the Joint statement, U.S. Amb. Christopher Hill received an urgent cable from the White House that mandated several talking points for his unilateral U.S. statement during the closing plenary session. Crafted by hardliners who preferred regime change over engagement, the talking points were "designed to derail negotiations"[73] by articulating several caveats to the Joint Statement implying that the "appropriate time" to discuss LWRs would never arrive, and announcing the dissolution of KEDO once and for all. By further dismantling the "superstructure of power"[74] that had embodied techno-diplomacy during the AF (i.e. the KEDO project), and which now offered a way out of the present deadlock, U.S. hardliners had struck right at the heart of the Sept. 19 Joint Statement, and ensured that the Six-party Talks would not achieve substantive nuclear rollback in North Korea.[75]

As I describe in the article, the North Korean Ministry of Foreign Affairs responded by explicitly describing the KEDO LWRs as a physical path toward denuclearization of the Korean Peninsula. Over the next year, the North broke its missile moratorium with its first long-range missile launch in six years, and tested its first nuclear weapon. But as the last ferry of KEDO personnel left the Sinpo province, the regime quickly took steps to preserve the LWR foundation at the Kumho site.[76] As late as 2010, North Korean Foreign Ministers would remind U.S. officials of the status of the site, seemingly with the hope of resurrecting the project. Speaking with the Amb. Bosworth, North Korean Amb. Li Gun indicated North Korea was still "taking very good care of *your* reactor."[77]

A5.b. The Iran Nuclear Deal and the "Breakout-time" Calculus

It is commonly believed in the West that the U.S.-led international sanctions regime "brought Iran to the table,"[78] and induced it to make big nuclear concessions by signing the JCPOA. But this interpretation violates a fundamental principle of causal explanation – namely that causality must flow forward rather than backward in time. As illustrated in the article, the major concessions that Iran made in the JCPOA were publicly articulated in Iran's official correspondence with the IAEA as early as 2005.[79] Hence, the *subsequent* international sanctions regime enacted in UNSC resolutions cannot be said to have *caused* those concessions. A similarly-flawed inducement narrative is favored by many Iranians, who argue that the expansion of Iran's centrifuge program

[72] Remarks of Yang Xiyu, interview with Author, 2016.
[73] See Chinoy, *Meltdown*, pp. 249-250.
[74] Description by John Bolton, reported in Chinoy, *Meltdown*, pp. 128.
[75] While the Six Party Talks did culminate in "disablement measures" at Yongbyon, Siegfried Hecker, who inspected the measures, described them as "highly reversible," conversation with author, 2016.
[76] Anonymous remarks of KEDO personnel, in conversation with author.
[77] Story recounted by Amb. Stephen Bosworth, "The 20th Anniversary of the 1994 US-DPRK Agreed Framework."
[78] Example: Richard Nephew, *The Art of Sanctions* (CUP, 2017).
[79] "Communication dated 8/1/2005," INFCIRC/648.

forced the Obama Administration to negotiate on the propriety of enrichment on Iranian soil. In reality, Obama's turn toward engagement with Iran appears to have been motivated more by the U.S. geopolitical "pivot" to Asia, and an associated need to shift some of the burdens of shaping Middle East geopolitics to one of the region's most populous countries.[80]

International sanctions and nuclear-weapons-usable materials have nevertheless become the defining features of Iran's relationship with the West. By 2009, Iran's economic isolation was manifest in various physical media, ranging from a dearth of foreign direct investment in its oil infrastructure and aging commercial airline fleet down to the entrenched daily practices of economic and financial actors. In the nuclear realm, its national investments in uranium enrichment capabilities came after more than a decade of exclusion from global nuclear fuel-cycle networks,[81] and its proclaimed "right to enrich" became a fixture in Iran's domestic politics as a defining endowment of a modern, "normal" Iran. In describing the relevance of sanctions, Iranian negotiators report a desire to "de-securitize" Iran's economic relationship with the West, while avoiding nuclear restrictions that would make the special treatment of its civilian nuclear program amongst other non-nuclear weapons states permanent.[82] On the U.S. side, in their more candid moments U.S. negotiators describe the nuclear deal as a possible path to broader rapprochement between the United States and Iran.[83]

But in order to walk down that path, negotiators would need to engineer a way around the commitment-problem. The first design move was tacit U.S. acceptance of limited uranium enrichment on Iranian soil. More than simply a U.S. "concession," this innovation was an elaborate product of technical collaboration that culminated in the "breakout time": a continuously-rolling time horizon designed keep Iran at least one year away from having enough enriched uranium to build a bomb, and to render that technical barrier visible to the international community. While previous negotiating teams treated Iran's enrichment capability holistically as a binary nuclear threat that could either be wielded or traded away en bloc, the "breakout-time" formalism transformed it into a continuous physical medium through which Iran could retain modest nuclear leverage while expressing nuclear restraint cumulatively over time.[84] Further, designing and retaining the breakout horizon would be a meticulously-collaborative endeavor, drawing in national nuclear establishments and opening up Iran's enrichment infrastructure to the most intrusive verification regime ever implemented in a sovereign state.[85]

The second challenge was to identify and agree upon the irreversible steps to be taken by both sides,[86] so that those steps they could be arranged into a "plan of action" to be carried out over a twenty-year period.[87] Iran's steps would include pouring concrete into the core of its Arak Heavy Water Reactor, converting its LEU stockpile to oxide fuel that would be unsuitable for further

[80] See Parsi, *A Single Roll*, ch. 1 and 4; *Losing and Enemy*, pp. 9.
[81] See David Patrikarakos, *Nuclear Iran* (Taurius 2012), pp. 107-116.
[82] See remarks of Hassan Rouhani and Javad Zarif, recounted in Parsi, *Losing an Enemy*, pp. 220.
[83] See Parsi, *Losing an Enemy*.
[84] This culminated in fifteen consecutive IAEA reports stating that Iran was abiding by the nuclear restrictions of the JCPOA.
[85] See Gary Samore (edt.), "The Iran Nuclear Deal: the Definitive Guide," Special Report, Project on Managing the Atom, Harvard University, 8/3/2015.
[86] Focus on irreversibility was explicit. See Parsi, *Losing an Enemy*, pp. 145.
[87] Joint Comprehensive Plan of Action, Vienna, 7/14/2015.

enrichment, and illuminating the procurement and process streams through which its centrifuges were constructed. On the side of the P5+1, the sanctions-relief measures would have their own path dependencies, ensuring that once sanctions were lifted, re-instating them would exact political costs on the United States so long as Iran remained within the parameters of the deal.

While the resulting JCPOA is distinct from the AF in many ways, it has many attributes that seem strange under inducement, but natural under techno-diplomacy (see subsection of article entitled "Inducement versus Techno-diplomacy: Points of Incommensurability"). First, like the AF, the JCPOA is deliberately *not* a binding written commitment. While many U.S. Senators expressed puzzlement that the document contained no signatures, Obama Administration officials argued that the true commitments would take place in the form of reciprocal actions.[88] Second, the sunset clauses on enrichment restrictions have drawn severe criticism that the JCPOA is merely a "kick the can" solution.[89] Yet open-ended time horizons can be crucial for signaling the prospect for more long-term engagement as political relations evolve, and the time structure of the JCPOA appears specifically calibrated to implement restrictions until after the political leadership in Iran will have shifted to the next generation (which is known to be more openly-committed to reconciliation with the West[90]). Third, a nuclear latency is retained in a centrifuge program that has limited intrinsic value for nuclear energy, but retains a modest level of Iranian leverage as a hedge against JCPOA collapse. The retention of Fordow is particularly illuminated in this light, as it helps immunize Iran's hedge against military attack. Finally, like the LWR project of the AF, provisions on nuclear-cooperation in the JCPOA could re-integrate Iran into global nuclear infrastructures and eventually normalize its nuclear program.

The JCPOA's more distinctive features seem more like advancements on the techno-diplomacy of the AF, rather than a retreat from it. While the AF was a four-page document negotiated by diplomats who left many details of implementation for the technologists to sort out thereafter, the JCPOA was negotiated in part by top American and Iranian nuclear scientists. Implementation is extensively outlined in one of the most technically-detailed diplomatic documents in history. But just as many of the major physical steps of the AF were never carried out before a hostile U.S. Presidential Administration entered office, Western foreign direct investment on the ground in Iran did not materialize during the remainder of Obama's second term. With little American stake invested in reconciliation with Iran, the incoming Trump Administration faced few domestic political costs in withdrawing the United States from the deal. And the reasons behind the withdrawal were decidedly non-nuclear – the Trump and Obama administrations differ not in their desire to prevent Iran from getting the bomb, but in their visions for the future of Middle East geopolitics and the U.S.-Iranian relationship therein. Hence, without the physical commitments that may have been facilitated by a lengthier implementation period, the absence of Iranian "cheating" on the JCPOA was insufficient to keep engagement alive.

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[88] Letter from U.S.-DoS to then Secretary Mike Pompeo, 11/19/2015, https://www.scribd.com/document/291042867/Letter-from-State-Department-Regarding-JCPOA#from_embed

[89] Example: David Albright, "The JCPOA Essentially Kicks the Can Down the Road," Institute for Science and International Security, 7/22/2015.

[90] Narges Bajoghli, *Iran Reframed: Anxieties of Power in the Islamic Republic* (Stanford University Press, 2019).