Why Does North Korea Engage in Provocations?[1]

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Abstract

Given the increasing number and severity of North Korean provocations, this paper analyzes the relationship between North Korean actions and different types of actions and events taken by the international community commonly described as "triggers" for these provocations. A database of 257 possible trigger events and 88 North Korean provocations, covering the period from January 1, 2012 through November 21, 2016, was developed for investigation. Statistical analyses assessed correlations between specific types of trigger events and North Korean provocations writ large as well as the specific type of provocation. The paper concludes that, despite media and academic assessments to the contrary, the notional trigger events explored in this paper are uncorrelated with either North Korea's undertaking a provocation or its level of severity. The strongest finding supports the concept of provocation cycles, in which the clearest predictor of a North Korean provocation is simply whether or not another provocation has recently taken place. Yet, the paper also finds that in these situations, additional provocations may more likely to be of a lower level, such as short-range missile tests or limited naval incursions. International leaders' decisions should be informed by this lack of significant correlation between provocations and events such as U.S.-South Korean military exercises, United Nations Security Council resolutions, or a high-level U.S. visit to the region.

Introduction

When the United Nations adopts a Security Council resolution condemning the Democratic People's Republic of Korea (DPRK), can we expect that North Korea will engage in a missile test, in a show of anger and defiance? When the United States elects a new president, should we anticipate a nuclear test around election or inauguration day, perhaps as a way for North Korea to convince the new U.S. leader of its importance? Or, perhaps, North Korea would decide not to engage in a provocation, either because it accepts its UN-mandated punishment or because the country wants to get off to a good start with the new U.S. administration. More broadly, are North Korean provocations actually statistically correlated with U.S. and international actions, following the regime's vociferous public announcements? Current literature on these issues lacks a statistical basis to determine either the correlation or directionality of any relationship between these types of events. Better insight and comprehension are required for governments and policymakers to make informed decisions.

Since the end of the Cold War – and even more so in the past several years under Kim Jong Un – the DPRK has engaged in an increasing number of significant military provocations. The simplest explanation for these provocations, especially advanced missile and nuclear tests, is that they are conducted to improve

[1] The views expressed in this paper are solely those of the author and do not represent the views or official policy of the U.S. government. This draft has been prepared for the International Studies Association annual meeting, June 2017. Please do not cite without permission.

North Korean technical capabilities; this may well be true. However, this explanation does not account for the timing of such tests, or the timing or reasoning behind other types of provocations like incursions over the de facto maritime border between the two Koreas.

As such, regional analysts have often looked beyond the technical-development rationale and characterized DPRK provocations as reactions to a wide variety of "trigger" events. Such events include South Korean (Republic of Korea, ROK)-U.S. military exercises, the deployment of advanced U.S. weaponry to the region, ROK or U.S. elections, actions by the international community, and U.S. sanctions, among many other possibilities. However, only limited quantitative analysis has been done to determine the correlations, if any, between the putative trigger events and either the occurrence of DPRK provocations or the specific type of provocation it chooses. This paper attempts to fill that gap through the analysis of an original set of data on possible trigger events and DPRK provocations from 2012 through 2016.

The rest of the paper is organized as follows. Section one describes the data. Section two explores the background of prior research in this area and develops the possible independent variables. Sections three and four examine the statistical models utilized as well as the results, and section five discusses and concludes.

Data

For this paper, I developed a dataset covering the time period of January 1, 2012 and November 21, 2016, during which 88 DPRK provocative events as well as 257 possible trigger events occurred. The specific date range was selected because on November 21, 2016, the DPRK foreign ministry released a memorandum listing international, U.S., and South Korean events and actions – trigger events in the parlance of this paper – that it declared as provocative. This memorandum provided both a delineated time period to analyze as well as another independent variable. This time period also roughly correlates with the exact period of Kim Jong Un's leadership, as he came to power in mid-December 2011. Events were collected through a comprehensive and exhaustive electronic search effort to develop a timeline of all possible trigger events and DPRK provocations taking place during the time period under analysis. All research was based on open source documents, including newspaper articles and publicly available government and international organization releases. Event dates and types are recorded.

Determining what to both include and exclude as a provocation was surprisingly not straightforward. Ultimately, I defined a provocation as an action taken by the DPRK that could reasonably have been assumed or understood by the DPRK to be seen as a provoking event by the United States, its allies, or the international community more broadly. Trigger events were similarly defined – actions taken by the United States, its allies, or the international community that could reasonably be seen as potentially provoking or upsetting to the DPRK. This is in large part based on prior analyses, which are described further below.

While it is clear that actions such as missile and nuclear tests are clear provocations, some analysts have defined events as DPRK provocations that I chose not to include in my dataset. For example, some may see the execution of Kim Jong Un's uncle, Jang Song Taek, as a provocation – and also count the more recent execution of Kim Jong Un's half brother, Kim Jong Nam. However, assassinations of North Korean citizens do not seem to me to be a clear-cut provocation, and so were excluded. Similarly, one analyst has included the cancellation by the DPRK of a concert tour in China of a DPRK pop group (Gladstone 2017); again, this does not seem to be a clear provocation and therefore was excluded. In general, the test applied

was whether the United States and its allies, including the ROK and Japan, would see an action as a direct provocation. At least for the purposes of this paper, I believe it is unlikely the United States would consider political assassinations and the cancelation of a pop-group's tour in China as particularly provocative events.

Due to the many different types of provocations, I further categorized these events into three levels or types of provocation based on size and impact: small, medium, and large provocations (see Table 1). Unfortunately, the small number of nuclear tests (three) during the time period under analysis precluded analysis of nuclear tests as a separate sub-category. The small-scale provocation category includes tests of small missiles,[2] tests of one or two missiles of unknown size at the same time, naval incursions over the Northern Limit Line (NLL), DPRK military exercises, provocations at the Demilitarized Zone (DMZ), reported GPS jamming incidents, negative diplomatic actions, and closing communications channels. The medium-scale provocation category included medium-sized missile launches,[3] launches of three or four missiles of any size at one time, and most cyber attacks. Large-scale provocations included tests of a large[4] or extra-large[5] missile; nuclear tests; launches of five or more missiles of any size at the same time; negative actions regarding the Kaesong industrial complex; abductions of US, Australian, or Canadian citizens; and the cyber attack on Sony. Summary statistics broken down for each of these types of provocations are available in Appendix 1.

Table 1: DPRK Provocations, Descriptive Statistics

Level of Provocation	Number of Provocations (January 1, 2012 – November 21, 2016)	Mean	Variance
Small provocation	31	.352	.231
Medium provocation	16	.182	.150
Large provocation	41	.466	.252

For all statistical analyses in this paper, the specific possible trigger events within a 7- or 14-day range, on either side, of the DPRK provocation, were determined. Data on events both before *and* after the DPRK provocation were included because in many of the events, such as regular U.S.-ROK military exercises, UN resolutions under discussion, or planned high-level visits, the DPRK was aware beforehand that such a trigger event was going to happen – and therefore could engage in a provocation *before* the actual trigger event took place. Furthermore, both 7- *and* 14-day ranges were included because while the existence of a link between a trigger event and a provocation is more likely the shorter the timeframe between the two events, many DPRK provocations – such as nuclear and missile tests – require some planning and logistics preparation, which may take longer than a week to decide upon and implement. Recent research has shown that the DPRK under Kim Jong Un engages in a provocation within one or two weeks of a specific trigger event; the idea of the two-week timeframe has been cited previously as well (Cha

[2] Scud, Hwasong-5, Hwasong-6, Toksa, KN-01, KN-02, KN-06, and Frog missiles
[3] Nodong-1 and Taepodong-1 missiles
[4] Musudan/Hwasong-10
[5] Taepodong-2, Taepodong-3/Kwangmyongsong/Unha-3, SLBM (Polaris)

2016; Cha 2017). Of the 88 total provocations during the time period under analysis, only one was not within 14 days of a putative trigger event.

Background and possible explanations

Previous research on the linkages between specific types of trigger events and DPRK provocations has been limited, with few empirical studies. Most analyses are composed of conjecture or anecdotal evidence that at beast only weakly supports the relationship claimed. For example, a recent article in *The New York Times* developed a timeline of provocations near significant dates, arguing that these provocations were not coincidences (Gladstone 2017). Events cited included July 4th 2006; a 2014 summit between the United States, Japan, and Korea; and China hosting a G20 summit in 2016. It seems that often, once a provocation has taken place, experts, the media, and government will search for any possible trigger event that can explain the observed behavior. Quantitative analysis has been limited to cross-tabulations or basic correlations of DPRK provocations and one type of trigger event, measuring the average time windows between the two events – which could be years – or whether one type of trigger event appears correlated with DPRK provocations (Cha et al 2016a, 2016b; Cha 2016).

The independent variables – the trigger event types – were chosen for inclusion in this paper based primarily on a literature review, along with several additional hypotheses developed for this paper (see Table 2 for descriptive statistics). Most of the proposed trigger events are expected to have a positive correlation, increasing the likelihood of a DPRK provocative event. For instance, one possible trigger could in fact be another provocation temporally adjacent. A cycle of provocations or escalation could result in one provocative event directly leading to a second event shortly thereafter; such a cycle can also be linked with brinksmanship on the part of North Korea (Gause 2015, 15-24; Chang 2014).[6]

Another possible trigger event could be the ROK taking a negative action regarding Kaesong, such as temporarily or permanently shutting down the industrial park that has been seen as one of the few bright spots in ROK-DPRK relations over the past 15 years. Unfortunately, there were few such actions during the period under analysis.

A third possible trigger event is a DPRK diplomatic initiative; the regime may want to refrain from provocations in order to demonstrate sincerity, meaning a negative relationship between diplomatic initiatives and provocations. On the other hand, it could be argued that the DPRK may follow diplomatic outreach with a provocation to make sure that it maintains a strong international and domestic image. This was seen in the Leap Day Agreement, agreed on February 29, 2012. The United States agreed to provide substantial food aid in return for the DPRK agreeing to a moratorium on nuclear tests, nuclear activities including uranium enrichment, and long-range missile test. However, the DPRK tested a long-range missile, several weeks later, scuttling the deal. During the time period under investigation, there were few such diplomatic initiatives.

A similar trigger event could be a U.S. or ROK diplomatic initiative. Again, this may cause the DPRK to respond in kind and not engage in a provocation. Or, the DPRK could decide to engage in a show of strength through a provocation. However, during the time period under analysis, there was only one significant U.S. or ROK diplomatic initiative.

[6] This independent variable was only used in the second analysis (type of DPRK provocation).

Another possible trigger event is important DPRK holidays and political events, including the birthdays of leaders, a Party conference, or the country's independence day. The DPRK could use provocations as shows of strength and celebrations on or near such holidays. For instance, Victor Cha has argued that DPRK provocations were likely to surround Kim Il Sung's birthday on in mid-April 2015 as well as the DPRK Workers' Party Congress in early May 2016 (Cha 2016).

An additional potential trigger event could be high-level U.S. visits, as the DPRK may see these visits to the region as offensive or hostile actions. In the context of this paper, a high-level visit is defined as a visit to the ROK, Japan, and/or China by a U.S. president, secretary of defense, or secretary of state. High-level statements are those made about the DPRK by these three officials or as identified by the DPRK Foreign Ministry in their November 21, 2016 memorandum. Also included in this variable are visits by the leaders of China, the ROK, and/or Japan to the United States.

Similarly, DPRK provocations could be triggered by negative U.S. unilateral actions, including U.S. Executive Orders, sanctions, designations, proclamations, laws, specific reports released by the U.S. government that the DPRK found offensive, and statements made about the DPRK by a U.S. president or secretaries of defense or state (or as identified by the DPRK Foreign Ministry in their November 21, 2016 memorandum). Many of these actions have direct negative consequences for the DPRK, and could therefore be expected to lead to the DPRK engaging in a provocation in order to protest such U.S. moves. On the other hand, if the U.S. actions – many of which are designed to dissuade North Korea from developing its weapons of mass destruction and ballistic missile programs – are actually effective, we could expect to see a reduction in DPRK provocations surrounding the U.S. action.

Some argue that U.S. or ROK political events – including congressional elections, presidential elections, and a president entering office – cause the DPRK to engage in a provocation as a show of power and a warning to the incoming politicians. A recent analysis of DPRK provocations and ROK presidential and national assembly elections finds that the provocation window has narrowed from 11 weeks under Kim Il Sung to only one-to-two weeks under Kim Jong Un (Cha 2017). One recent newspaper article noted that "North Korea has a long record of provocative moves, such as nuclear and missile tests, around elections in both the U.S. and South Korea," referencing the views of "a growing number of experts" that DPRK provocations in the fall of 2016 were directly linked to the 2016 U.S. presidential election (Sullivan 2016). Similarly, a short analytical piece by Victor Cha argued that the DPRK has initiated a DMZ or missile provocation within an average of one week before or after a ROK legislative election (Cha 2016). More systematically, Victor Cha and CSIS released analysis of a dataset of U.S. presidential and congressional elections between 1956 and 2016, and cross-tabulated this with a dataset of DPRK provocations, measuring the "provocation window," i.e., how far before or after an election the DPRK engages in a provocation. The research found that the average window was 13 weeks under Kim Il Sung, six weeks under Kim Jong-Il, and four weeks under Kim Jong Un.[7] The authors concluded that we can expect DPRK provocations between the first week of October 2016 through the transition period for the next administration, presumably February 2016 – a period of five months (*CSIS Beyond Parallels* 2016). While this analysis seems to show that there is indeed a correlation between U.S. elections and DPRK provocations, according to the methodology of the present paper, many of these "links" would not be validated. Namely, it is unclear the extent to which an election trigger event and a DPRK provocation happening within several months of each other are actually likely to be related to each other.

[7] However, the sample size for the Kim Jong Un period was only two elections.

An additional trigger event that has often been put forward in the media is U.S.-ROK military drills in the region (Chang 2017; Acton 2017).[8] Other types of militarily significant events included in the analysis were activities involving advanced U.S. aircraft, , such as B-2 bombers, flying over the peninsula; an advanced U.S. ship or nuclear-powered submarine visiting the peninsula; and a transfer to the region of advanced U.S. military technology, such as THAAD (Cha, Lee, and Lim 2016; *Associated Press* 2013). It is expected that all such actions would trigger provocations on the DPRK as a defensive show of strength. However, previous quantitative analysis, spanning the 1998-2010 period, has shown that military exercises are not correlated with heightened levels of conflictual rhetoric or actions by the DPRK (D'Orazio 2012). Two less rigorous studies of the annual spring and fall military exercises from 2005-2016 found that the exercises had a null effect on DPRK belligerence; if the bilateral relationship was on a positive track before the exercises, relations remained positive during and after the exercises ended – and vice-versa for negative relations (Cha et al 2016a, 2016b).

DPRK provocations could also be triggered by actions taken in the international arena, especially the United Nations (UN) or the International Atomic Energy Agency (IAEA). Included in the model are a variety of international community actions that the DPRK regularly complains bitterly about: IAEA resolutions, UN Security Council resolutions (UNSCRs) and adjustments, UN General Assembly (UNGA) resolutions, UN Security Council talks and statements on the DPRK, meetings at the UN about the DPRK, and UN human rights activities vis-à-vis the DPRK. In many of these instances, North Korea has complained stridently through its official media, portrayed itself as a victim, and sent letters of protest to the UN.

A variable representing whether the DPRK considered the putative trigger event to be a hostile event was also included in the model. This variable is based on the DPRK Foreign Ministry memorandum, in which North Korea labels 106 U.S., U.S.-instigated ROK, and international actions as "extreme," "hostile," "anachronistic," "criminal," "aggressive," "heinous," "frantic," "provocative," "reckless," "dangerous," "heinous," "vicious," and "abhorrent." If DPRK provocations are in response to U.S., ROK, and international community actions, then it would be expected that this variable would be correlated with provocations occurring as well as all types of DPRK provocations.

Finally, for the second analysis only,[9] I included a variable indicating whether each provocative event occurred temporally near another DPRK provocation. This variable approximates a provocation cycle; perhaps the DPRK is more likely to engage in several provocations in a row in order to more strongly demonstrate its military competence. Alternatively, a recent provocation could act as a restraining force on the DPRK, as decision-makers may not want the international community to believe that the provocations will continue to come at a rapid pace, possibly leading to a military reaction by the United States or South Korea– which would in most cases likely be a sub-optimal outcome for the DPRK. Resource constraints could also play a part in decreasing the likelihood of provocation cycles.

Table 2: Possible Trigger Events, Descriptive Statistics

Type of Trigger Event	Number of Trigger Events (January 1, 2012 – November 21, 2016)	Mean	Variance
ROK negative action regarding	2	.008	.008

[8] This includes drills that involve additional countries, such as Japan or the UK, but does not include drills outside of the region in which both the United States and ROK participate.

[9] Assessing the correlation between trigger events and the type of DPRK provocation

Kaesong			
DPRK diplomatic initiative	9	.035	.034
DPRK holiday or political event	27	.105	.094
U.S. high-level visit	36	.140	.121
U.S. or ROK political event	8	.031	.030
U.S.-ROK military event	83	.323	.220
U.S. negative political actions or statements	44	.171	.142
U.S. or ROK diplomatic initiative	1	.004	.004
UN event	48	.187	.152
Event identified by DPRK as a provocation	107	.416	. 244

** Note: Numbers do not total 257, as "Identified as Provocation" covers many events.*

Trigger Events and the Occurrence of a DPRK Provocation

This dataset was utilized in two ways. First, one iteration was developed to look at the question of which putative trigger events are correlated with the occurrence of a DPRK provocation. The unit of analysis is the trigger event, while the dependent variable is the number of DPRK provocations taking place within a certain time period of the trigger events (see Table 3 for descriptive statistics). The independent variables included in both the first and in the second analyses are listed in Table 1. Because the dependent variable is a nonnegative count variable – number of DPRK provocative events within a certain timeframe of a trigger event – the basic regression methodology was a Poisson model, which was compared with similar regression models to determine which best fit the data.

Table 3: Provocations (Count) Within 7 or 14 Days of Trigger Events, Descriptive Statistics

	7 days	14 days
Mean	1.21	1.95
Variance	2.50	4.22
Min (count)	0 (97)	0 (61)
Max (count)	11 (2)	13 (1)

** n = 257*

The dataset was analyzed via regressions using the Poisson, negative binomial, zero-inflated Poisson, zero-inflated Poisson with robust standard errors, zero-inflated negative binomial, and zero-inflated negative binomial with robust standard errors models. Zero-inflated versions were included in the analysis because there could be multiple reasons for the occurrence or non-occurrence of a provocation. For instance, the DPRK may have decided to not engage in a provocation or the DPRK may have desired to engage in a provocation but the provocation was unable to be carried out within 14 days. Alternatively, a provocation could have been attempted but was unsuccessful. The results of each are reported in Table 4 below.

Table 4: Poisson and Negative Binomial regressions, 7 and 14 days

Variables	Poisson Model		Negative Binomial Model		ZIP Model		ZIP Model - RSE		ZINB Model		ZINB Model - RSE	
	7 days	14 days	7 days	14 days	7 days[1]	14 days[2]	7 days[3]	14 days[4]	7 days[5]	14 days[6]	7 days[7]	14 days[8]
ROK Kaesong actions	-.123 (.720)	-.269 (.586)	-.131 (.863)	-.275 (.759)	-.117 (.741)	-.278 (.586)	.298 (.201)	-.278 (.267)	.168 (1.157)	-.276 (.740)	-.132 (.725)	-.276 (.267)
DPRK diplo-matic initiative	.101 (.344)	-.046 (.277)	.092 (.426)	-.052 (.377)	.103 (.355)	.133 (.298)	.102 (.433)	.134 (.379)	.091 (.406)	-.053 (.367)	.091 (.424)	-.053 (.380)
DPRK holiday	-.327 (.252)	-.233 (.186)	-.336 (.298)	-.239 (.246)	-.344 (.258)	-.011 (.202)	-.343 (.236)	-.010 (.214)	.337 (.287)	-.240 (.239)	-.337 (.231)	-.240 (.221)
U.S. high-level visit	-.364 (.229)	-.256 (.168)	-.373 (.271)	-.261 (.224)	-.372 (.234)	-.060 (.180)	-.371 (.230)	-.060 (.197)	-.371 (.260)	-.261 (.217)	-.371 (.228)	-.261 (.202)
U.S. or ROK political event	-.410 (.430)	-.356 (.319)	-.418 (.498)	-.362 (.408)	-.429 (.437)	-.224 (.337)	-.427 (.350)	-.224 (.409)	-.419 (.481)	-.363 (.398)	-.420 (.349)	-.363 (.405)
U.S.-ROK military event	.185 (.192)	-.014 (.152)	.168 (.250)	-.033 (.218)	**. 454 (.242)** *	.240 (.163)	**.461 (.258)** *	.241 (.189)	.348 (.266)	.058 (.231)	.346 (.233)	.058 (.221)
U.S. negative actions	**-.474 (.242)*** *	**-.351 (.183)** *	-.490 (.303)	-.371 (.255)	**-.446 (.256)** *	-.084 (.196)	**-.445 (.257)** *	-.084 (.211)	-.466 (.294)	-.357 (.251)	**-.467 (.264)** *	-.357 (.226)
U.S. or ROK diplo-matic initiative	**1.856 (.474)** ***	**1.569 (.422)** ***	**1.85 (.846)** *	**1.569 (.825)** *	**1.802 (.494)** ***	**1.380 (.435)** ***	**1.809 (.436)** ***	**1.380 (.358)** ***	**1.856 (.763)** **	**1.569 (.787)** **	**1.856 (.394)** ***	**1.569 (.359)** ***
UN event	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*

Declared by the DPRK to be a hostile act	.270 (.166)	**.244 (.132) ***	.276 (.217)	.258 (.190)	. 231 (.186)	.176 (.143)	. 230 (.170)	.176 (.161)	.248 (.218)	.241 (.192)	.248 (.181)	.241 (.177)

*Notes: Standard errors shown in parenthesis. Two-tailed statistical significance indicated as follows: * p<.1, ** p<.05, *** p<.01). N = 257.*

[1] While testing the various independent variables as inflators, both individually and together, the "best" model, based on the AIC/BIC results, seemed to be the model that inflated only the variable *U.S.-ROK military event.* The results of that model are presented here. All combinations had AICs and BICs within a small range of each other.

[2] While testing the various independent variables as inflators, both individually and together, the "best" model, based on the AIC/BIC results, was the model that inflated only the variable *UN event.* The results of that model are presented here. All combinations had AICs and BICs within a small range of each other.

[3] While testing the various independent variables as inflators, both individually and together, the "best" model, based on the AIC/BIC results, was the model that inflated both *ROK Kaesong actions* and *U.S. high-level visit.* The results of that model are presented here. However, while this had the lowest AIC/BIC, it was only infinitesimally lower than *U.S.-ROK military event.* All combinations had AICs and BICs within a small range of each other.

[4] While testing the various independent variables as inflators, both individually and together, the "best" model, based on the AIC/BIC results, was the model that inflated the variable *UN event.* The results of that model are presented here. However, while this had the lowest BIC, the model inflating all the variables had a very slightly lower AIC. All combinations had AICs and BICs within a small range of each other.

[5] While testing the various independent variables as inflators, both individually and together, the "best" model, based on the AIC/BIC results, was the model that inflated the variables *ROK Kaesong actions* and *U.S.-ROK military event.* The results of that model are presented here. However, while this had the lowest AIC/BIC, it was only infinitesimally lower than *U.S.-ROK military event.* All combinations had AICs and BICs within a small range of each other.

[6] While testing the various independent variables as inflators, both individually and together, the "best" model, based on the AIC/BIC results, was the model that inflated only the variable *U.S.-ROK military event.* The results of that model are presented here. All combinations had AICs and BICs within a small range of each other.

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[8] While testing the various independent variables as inflators, both individually and together, the "best" model, based on the AIC/BIC results, was the model that inflated the variable *U.S.-ROK military event.* The results of that model are presented here. All combinations had AICs and BICs within a small range of each other.

An initial look at the results seems to show that the *U.S./ROK Diplomatic Initiative* variable is statistically significant in all of the 7- and 14-day models, with the *U.S.-ROK Military Event* variable occasionally significant in the 7 day models, the *U.S. Negative Actions* variable significant in most of the 7-day and one of the 14-day models, and the *Declared by the DPRK to be a hostile act* variable significant in one of the 14-day models. However, which of the models presented best fits the data?

In answering this question, several goodness-of-fit tests were used (see Table 5). First, the results of the Vuong test are somewhat indeterminate for assessing whether a zero-inflated Poisson was a better fit for the 7-day provocation data than the regular Poisson regression.[10] The Vuong test indicated that regular negative binomial was a better fit for the 7-day provocation data than the zero-inflated version.[11]

[10] p = .0525; when p>.05, the standard model is better.

[11] For the seven-day-provocation data p = .2102 and for the fourteen-day provocation data p = .3040; when p>.05, the standard model is better.

Based on the AIC/BIC criterion,[12] the BIC of the 7-day regular negative binomial regression model is slightly lower than the zero-inflated negative binomial regression with robust standard errors; however, the AIC for the regular negative binomial model is slightly higher. Overall, the regular negative binomial model may be a slightly better fit for the 7-day data.

Table 5: Goodness-of-fit Comparisons, 7 days

Model	Pseudo R^2	AIC	BIC	Vuong[13]
Poisson	.0579	801.27	836.76	ZIP ≅ P
Negative Binomial	.0341	772.09	811.13	NB > ZINB
ZIP	.0000	787.54	830.12	ZIP ≅ P
ZIP RSE	--	785.23	824.27	--
ZINB	.0007	773.72	819.86	NB > ZINB
ZINB RSE	--	771.84	814.43	--

As shown in Table 6, the results of the Vuong test indicated that a zero-inflated Poisson was a better fit for the 14-day provocation data than the regular Poisson regression.[14] The Vuong test indicated that regular negative binomial was a better fit for the 14-day provocation data than the zero-inflated version.[15] Based on AIC/BIC results, the zero-inflated negative binomial regression with robust standard errors is a very slightly better fit for the 14-day provocation data. Given that the coefficient results are virtually the same – with only a slight difference in significance – it likely does not matter which of the two models is best, as they appear to be so similar in fit.

Unfortunately, Stata does not have the capability to perform the deviance goodness-of-fit and the Pearson goodness-of-fit tests for zero-inflated binomial models. However, the results of performing these tests on the non-zero-inflated Poisson models indicate that there is not a relationship between the predicted and actual outcomes,[16] meaning the regression models are not good fits for the data.

Table 6: Goodness-of-fit Comparisons, 14 days

Model	Pseudo R^2	AIC	BIC	Vuong[17]

[12] A comparatively lower AIC/BIC indicates that the model is better.
[13] The Vuong test was not computed on the models with robust standard errors, as the two cannot be run together in Stata
[14] p = .0100; when p>.05, the standard model is better.
[15] For the seven-day-provocation data p = .2102 and for the fourteen-day provocation data p = .3040; when p>.05, the standard model is better.
[16] For the seven- and 14-day data, both deviance and Pearson goodness-of-fit tests had a p = .0000, respectively; well-fitting models should have a p>.05.
[17] The Vuong test was not computed on the models with robust standard errors, as the two cannot be run together in Stata

Poisson	.0305	1023.37	1058.86	ZIP > P
Negative Binomial	.0152	964.25	1003.29	NB > ZINB
ZIP	.0010	995.79	1038.38	ZIP > P
ZIP RSE	--	993.79	1032.83	--
ZINB	.0748	967.17	1013.31	NB > ZINB
ZINB RSE	--	963.17	1002.21	--

Assessing the results of the seven-day negative binomial model, only the *U.S. or ROK diplomatic initiative* explanatory variable was statistically significant, and at a p<.01 level. In this model, a DPRK diplomatic initiative increases the log count of a DPRK provocation by 1.85, holding the other variables in the model constant; the directionality is interesting as both directions were hypothesized to be logical. Similarly, the results of the 14-day negative binomial and zero-inflated negative binomial with robust standard errors models both show that *U.S. or ROK diplomatic initiative* explanatory variable was statistically significant (at the p<.01 or p<.1 levels). Under both models, a DPRK diplomatic initiative increases the log count of a DPRK provocation by 1.569, holding the other variables in the model constant. However, as there was only one actual *U.S. or ROK diplomatic initiative* event in the dataset, the actual significance of these results is essentially meaningless.

Given the lack of significant relationships between the dependent and independent variables, I also simplified the model into a binomial dependent variable: whether a provocation occurred in 7 or 14 days, in contrast to the previous analysis looking at the number of provocations occurring within those timeframes. The results of the logit analyses are reported in Table 7. All trigger variables were insignificant for the 7-day model, while *DPRK holiday*, *U.S. high-level visit, U.S.-ROK military event*, and *U.S. negative actions* were significant in the 14-day model. In this model, a DPRK holiday decreases the log odds of a DPRK provocation by 1.667, holding the other variables in the model constant (p<.05); it was hypothesized that the directionality of this relationship could be either positive or negative. A US high-level visit decreases the log odds of a DPRK provocation by 1.572 holding the other variables in the model constant (p<.05); this is the opposite directionality as had been expected. A U.S.-ROK military event decreases the log odds of a DPRK provocation by 1.524 holding the other variables in the model constant (p<.05); this is also very surprisingly the opposite direction as hypothesized. Finally, a negative U.S. diplomatic action also decreases the log odds of a DPRK provocation by 1.847 holding the other variables in the model constant (p<.01); and again, a positive correlation had been expected between negative U.S. actions and DPRK provocations.

Table 7: Logit regression, 7 and 14 days

Variables	7-day (logit)	14-day (logit)
ROK Kaesong actions	-.667 (1.447)	*(omitted)*
DPRK diplomatic initiative	-.156 (.7923)	-1.261 (.970)

DPRK holiday	-.137 (.504)	**-1.667 (.664) ****
U.S. high-level visit	-.465 (.454)	**-1.572 (.636)****
U.S. or ROK political event	-.156 (.793)	-1.261 (.970)
U.S.-ROK military event	-.184 (.457)	**-1.524 (.645)****
U.S. negative actions	-.703 (.518)	**-1.847 (.700)*****
US/ROK diplomatic initiative	*(omitted)*	*(omitted)*
UN event	*(omitted)*	*(omitted)*
Declared by the DPRK to be a hostile act	.260 (.387)	.430 (.438)
Pseudo R^2[18]	.0098	.0418
Correctly classified (Sensitivity / Specificity)[19]	61.72%% (96.86% / 4.12%)	75.98% (100.00% / 0.00%)
N	256	254

*Note: Standard errors shown in parenthesis. Two-tailed statistical significance indicated as follows: * p<.1, ** p<.05, *** p<.01).*

However, the goodness-of-fit tests indicated that the logit models fit the data poorly. Both models were unable to predict negative outcomes well, though they were better at predicting positive outcomes. While the variance inflation factor (VIF) test indicates that there is no excessive multicollinearity concern with the independent variables,[20] the Hosmer-Lemeshow (HL) goodness-of-fit test failed for both the 7- and 14-day models, indicating that there is not a relationship between the predicted and actual outcomes.[21]

Trigger Events and Type of DPRK Provocation

A second iteration of the database was developed to assess the correlation between trigger events and specific types of DPRK provocations, in which the unit of analysis is again the trigger event. This analysis answers the question, given a DPRK provocation, what trigger events could be correlated? It may be the case that the DPRK responds to different trigger events in different ways, with different "levels" of provocation. As previously discussed, three ordered categories of levels of provocation were developed (small, medium, and large provocations). However, the decision regarding which level of provocation to employ would only be made after an initial decision to engage in a provocation. The first decision is a

[18] Note: the smaller the number, the better the model fit

[19] Sensitivity references the number of positive outcomes correctly predicted, while specificity references the number of negative outcomes correctly predicted.

[20] Variable VIFs for both the 7- and 14-day data are in between -1 and 3. Generally, a VIF greater than 10 indicates multicollinearity.

[21] For the 7-day model, p = .1534; for the 14-day model, p = .3373; p>.05 indicates that there is *not* a relationship between the predicted and actual outcomes.

simple binomial choice – provocation or no provocation. The second stage is the decision of which level of provocation to utilize is an ordered categorical choice model.

Therefore, a two-step Heckman ordered probit selection model was employed for this portion of the analysis.[22] This model estimates the maximum likelihood parameters of a regression model for an ordered categorical outcome, based on a non-random selected sample.[23] Both dependent variables – the initial bivariate choice of whether to engage in a provocation and the second ordinal choice of provocation level – are determined by the values of linear covariate combinations and normally distributed error terms, relative to the cutpoints. The ordinal selection outcome equation is y_j (the level of provocation) is equal to the value v_h is given by the probability that $x_j\beta + u_{1j}$ falls within the κ_{h-1} and κ_h cutpoints,

$$y_j = \sum_{h=1}^{H} v_h \, I(\kappa_{h-1} < x_j\beta + u_{1j} \leq \kappa_h)$$

where x_j represents the outcome covariates, β represents the coefficients of the independent variables, and u_{1j} represents a random-error term. The observed outcome values of $v_1, v_2 \ldots v_H$ are integers such that, for $i < m$, v_i is less than v_m. κ_H is taken as $+\infty$ and κ_0 is taken as $-\infty$.

The initial, binomial selection process is modeled by

$$s_j = 1(z_j\gamma + u_{2j} > 0)$$

where $s_j = 1$ if there is an observed y_j and 0 otherwise, z_j represents the covariates used to model the selection process, γ represents the coefficients for the selection process, $1(\cdot)$ denotes the indicator function, and u_2j represents a random-error term. (u_{1j}, u_2j) have bivariate normal distribution, with a zero mean and a variance matrix of

$$\begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix}$$

When $\rho \neq 0$, standard ordered probit regression models applied to the outcome equation can provide inconsistent results. On the other hand, the Heckman ordered probit selection model provides consistent and asymptotically efficient estimates for all the parameters in these models.

The two-step Heckman ordered probit selection model results are presented in Table 8. The initial choice of whether to engage in a provocation, given a specific trigger event, is followed by a second-stage choice of what level of provocation to employ: small, medium, or large.

Table 8: Ordered Choice Model, with Selection, 7 and 14 days

Variables	7 days	14 days[1]
FIRST STAGE (Provocation: Yes or No?)		

[22] Testing of the model indicates that several of the independent variables do not meet the parallel regression assumption. However, there is not currently a *generalized* ordered probit two-step selection model available, so a regular ordered probit two-step selection model was used instead.

[23] This model description sub-section is heavily based on the Stata documentation for the Heckoprobit command as well as De Luca and Perotti (2011).

ROK Kaesong actions	-.194 (1.038)	*Omitted*
DPRK diplomatic initiative	.478 (.865)	.205 (.765)
DPRK holiday	.454 (.809)	-.279 (.696)
U.S. high-level visit	.155 (.799)	-.154 (.691)
U.S. or ROK political event	*.594 (.755)*	-.020 (.657)
U.S.-ROK military event	.621 (.800)	-.058 (.703)
U.S. negative actions	.184 (.821)	-.468 (.728)
US/ROK diplomatic initiative	*omitted*	*Omitted*
UN event	.152 (.799)	.526 (.703)
Other DPRK provocation	**.800 (.091)*** **	*Omitted*
Declared by the DPRK to be a hostile act	.015 (.194)	.331 (.240)
SECOND STAGE: Provocation Level (Small, Medium, Large)		
ROK Kaesong actions	5.810 (1673.77)	--
DPRK diplomatic initiative	-.164 (.606)	-.980 (.729)
DPRK holiday	-.472 (.566)	-.5467 (.640)
U.S. high-level visit	-.408 (.558)	-.455 (.636)
U.S. or ROK political event	*.028 (.426)*	.1523 (.466)
U.S.-ROK military event	-.328 (.555	-.918 (.663)
U.S. negative actions	-.681 (.575)	-.806 (.661)
US/ROK diplomatic initiative	.245 (.466)	.237 (.458)
UN event	-.350 (.545)	-.818 (.695)
Other DPRK provocation	**-.260 (.068)*** **	**-.137 (.033)*** **
Declared by the DPRK to be a hostile act	.110 (.169)	.101 (.182)
Cut 1	-1.148 (.565) **	-3.101 (.917)***
Cut 2	-.496 (.564)	-1.419 (.773)**

Cut 3	-.126 (.562)	-.908 (.743)
Rho (ρ)[24]	.066	.352
N	603	564

*Note: Standard errors shown in parenthesis. Two-tailed statistical significance indicated as follows: * p<.1, ** p<.05, *** p<.01).*

[1] Did not reach convergence

Based on the results of the model, the only statistically significant variable for either the first or the second choices, for both the 7- and 14-day models, was *Other DPRK provocation* (p<.01). This indicates that, for the first stage of the 7-day model, an increase in the number of temporally nearby provocations results in an increase in the likelihood of the DPRK choosing to engage in a provocation. In terms of marginal effects, holding all other variables at their means, one-event increase in the number of nearby DPRK provocations increases the probability of the DPRK engaging in a provocation by .185. There were no statistically significant variables in the 14-day first stage model.[25]

For the second stage of the model, the choice of provocation level, an increase in the number of nearby provocations decreases the overall likelihood of a DPRK choosing a more serious level of provocation – in both the 7- and 14-day models. In terms of marginal effects (see Table 9) and the 7-day model, a one-event increase in the number of nearby DPRK provocations increases the probability of the DPRK choosing a small-scale provocation by .015, but decreases the probability of the DPRK engaging in a medium-scale provocation by .010 and the probability of a large-scale provocation by .094. In terms of marginal effects and the 14-day model, a one-unit increase in the number of nearby DPRK provocations increases the probability of the DPRK choosing a small-scale provocation by .042 and a medium-scale provocation by .008, but decreases the probability of a large-scale provocation by .054.

Table 9: Marginal Effects for Nearby DPRK Provocation*, 7 and 14 Days*

Provocation Level	7 days	14 days
Small-scale provocation	.015	.042
Medium-scale provocation	-.010	.008
Large-scale provocation	-.094	-.054

Goodness of fit tests provide limited assistance in evaluating the fit of the models, as shown in Table 10. For the 7-day model, the results of the Wald test indicate that the model provides a good fit. However, the likelihood ratio test results indicate that a simple ordered probit model may be a better fit for the data than the ordered probit sample selection model. For the 14-day model, due to a lack of convergence, there

[24] The ρ value indicates that unobservables that increase/decrease the second-stage choice regarding size of provocation tend to occur with unobservables that increase the likelihood of the decision to engage in a provocation.
[25] Although *Other DPRK provocation* was omitted in the 14-day first stage model

is no Wald test score produced. Similar with the 7-day model, the likelihood ratio indicates that the regular ordered probit model may be a better fit for the data.[26]

Table 10: Goodness-of-Fit Testing for Ordered Sample Selection Model, 7 and 14 Days

Measure	7 days	14 days
Wald Test (Pr>chi^2)[27]	.0085	--
Likelihood ratio[28]	.7817	.8089

Discussion and Conclusions

It is clear, based on the analyses conducted in this paper, that neither the DPRK's choice of whether to engage in a provocation nor the level of provocation chosen are particularly correlated with any of the so-called trigger events included in the models – despite the fact that many of these triggers are anecdotally assumed to be very strongly correlated with DPRK provocations, according to the media or academics.

For the relationship between putative trigger events and the number of DPRK provocations taking place within a 7- and 14-day period, either side, of the trigger event, the negative binomial model for the 7-day data shows that a US or ROK diplomatic initiative increases the log count of DPRK provocations by 1.85 ($p<.01$), holding the other variables constant. Similarly, the results of both the 14-day negative binomial and zero-inflated negative binomial with robust standard errors models both show that a US or ROK diplomatic initiative increases the log count of DPRK provocations by 1.569 (at the $p<.01$ or $p<.1$ levels, respectively). However, this independent variable has a count of only 1 – meaning that the real significance of this relationship is virtually nonexistent. And without this variable being particularly meaningful, the results of these models show that there is essentially *no* relationship between any of the trigger events and the number of DPRK provocations within 7 or 14 days, either side.

The results of the basic logit analysis – assessing whether a provocation occurred in 7 or 14 days – were similar for the 7-day model, in that none of the trigger variables showed significant relationships with the dependent variable. Conversely, in the 14-day model, a DPRK holiday, U.S. high-level visit, US-ROK military event, and negative US diplomatic action all decrease the log odds of a DPRK provocation. These results are quite interesting. A DPRK holiday was theorized to have either a positive or a negative relationship, as the DPRK could engage in a provocation as a celebration, or be busy celebrating the holiday and not engage in any provocation. The expected directionality for the US high-level visit, US-ROK military event, and negative US diplomatic action variables had all been positive. Therefore, the results indicate that these four types of trigger events actually decrease the likelihood of a DPRK provocation taking place. On the other hand, the goodness-of-fit tests showed that the logit models fit the data poorly, again meaning that the results of the analyses have only limited value.

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[26] See Appendix 2 for the results of a generalized ordered logit model representing only the second-stage selection (level of provocation). Unfortunately, while theoretically a good model to explore, the generalized ordered logit does not produce particularly logical or valid results.

[27] if Pr>chi^2 is less than .05, the test indicates good model fit.

[28] If Pr>chi^2 is less than .05, we can reject the null hypothesis that the errors for the outcome and the selection are uncorrelated, meaning that the ordered probit sample-selection model should be used instead of the simple ordered probit model.

The two-stage ordered probit selection model also showed minimal correlation between trigger events and either the choice to engage in a provocation as well as the level of provocation chosen in the second stage. The only significant variable for the first stage was *Other DPRK provocation* (in the 7-day model); this was also the only significant variable in the second stage as well (7- and 14-day models). However, the directionality between the first and second stages is different. For the first stage (7-day model), an increase in the number of other provocations temporally nearby increases the probability of an additional provocation. For the second stage, 7-day model, an increase in the number of other provocations increases the probability of a small-scale provocation but decreases the probability of a medium- or large-scale provocation. For the 14-day second stage, an increase in the number of other provocations increases the probability of a small- or medium-scale provocation but decreases the probability of a large-scale provocation. This indicates that, while the DPRK is more likely to engage in additional provocations within a short period of time (a provocation cycle), each additional provocation is more likely to be of a smaller scale, and less likely to be a larger scale provocation. Goodness-of-fit testing provided mixed results for the two-stage ordered probit selection model.

There are several potential policy lessons from these results. First, most of the exogenous trigger events are not significantly correlated with DPRK provocations: ROK negative actions at Kaesong City, high-level visit by a U.S. leader to Northeast Asia or by an Asian leader to the U.S., U.S. or ROK political event such as an election, U.S. negative actions such as sanctions, U.S.-ROK military exercises and transfer or visits of advanced technology or equipment in the region, or UN events such as UN Security Council resolutions do *not* seem to be systematically correlated with DPRK reactions. Internal trigger events, including a DPRK diplomatic initiative or holiday also do not seem to be correlated with DPRK provocations. International leaders perhaps need to reassess the public analysis about possible provocative effects of any of these activities. Similarly, the initial first-stage logit analysis, despite the poor model fit, indicated that a US high-level visit, US-ROK military event, and negative US diplomatic action all *decrease* the probability of a DPRK reaction within 14 days. Furthermore, this model also indicated that a DPRK holiday is associated with a decreased probability of a provocation within 14 days, meaning that perhaps the US and its allies can relax a bit during these periods. The ordered selection model showed that DPRK events are significantly correlated with taking place in clusters – which means that once one provocation has taken place, we can expect others to take place as well. The silver lining of this finding is that an additional provocation is more likely to be of a lower provocation level. Perhaps this is a matter of resource limitations, an indication of either the DPRK balancing its desire to engage in provocations with domestic spending imperatives or of the DPRK's limited resources to continue a provocation cycle while remaining prepared for any possible larger-scale military engagement. Alternatively, the DPRK may decide to de-escalate such cycles to avoid actually provoking a military reaction by the United States or South Korea.

It is also interesting that the variable representing whether the DPRK had labeled the trigger event as provocative, according to the DPRK Foreign Ministry's November 21, 2016 memorandum, was not statistically significant in any of the models. This indicates that DPRK provocations may, in fact, not often be related to actual external trigger events, such as those included in the models analyzed in this paper. The international community may need to consider this when weighing their actions.

There are significant limitations to this analysis, including variables that were not able to be included in the model for various reasons. One theory not tested in this paper is the correlation between negotiations and provocative actions, in that the DPRK may engage in a provocation to invite negotiations from which the DPRK hopes to benefit, when denuclearization talks break down, near the end of a negotiation in order to gain attention and increase the perceived urgency in reaching an agreement – and

ideally on better terms for the DPRK (Lee 2011, 8-9; Armstrong 2009, 31; Cha and Kang 2003, 21). Similarly, it has been argued that failure in negotiations can precipitate DPRK provocations (Cha 2009, 128). However, the Six Party Talks – the key negotiation framework since the end of the Cold War – broke down in 2009 and has not re-started since. Essentially, there was only one negotiation, leading to the 2012 Leap Day Agreement[29] conducted during the period under review in this paper.

Independent variables representing domestic-level factors in the DPRK could not be included, for obvious reasons. For instance, one argument not included in this model is instability within the DPRK, including over leadership succession and political transition issues, as a driver of provocations (Gause 2015, 2-7; Armstrong 2009, 31; Lee 2011). The DPRK is likely, at least on occasion, engaging in external provocations due to reasons of domestic politics – whether in the context of a power struggle, the leadership (or a subordinate faction) trying to burnish their hardline credentials, distracting domestic attention from internal problems such as famine and economic problems, and other issues. For instance, analysts expected to see provocations surrounding the late 2013 purge of Kim Jong Un's uncle Jang Song Taek, as this appeared to be a strong example of domestic political instability within the regime. Others argued that the military had won this power struggle and would install a hardline provocation policy. However, neither of these predications really came true (Armstrong 2009, 25). As this example shows, it is unfortunately almost impossible to know, from the outside, what domestic political considerations may or may not be leading to a provocation in the hermit kingdom. Similarly, Kim and Lee argue that the DPRK engages in increased violations of the de facto maritime border due to the domestic need for food (Kim and Lee 2011), which could be due to either actual food shortages or to an imperative from the regime to increase catches. However, again, the ability to discern from outside whether either – or both – of these circumstances are in effect is limited. Therefore, unfortunately, domestic explanations could not be included in this analysis – and likely this results in a significant loss of explanatory power of the models analyzed here.

Some types of DPRK provocations are not often reported or are vastly underreported in the public press, the primary source used in putting together the dataset – making these provocation types significantly underrepresented in my dataset. For instance, long-running DPRK cyber campaigns have infected more than 100,000 private, company, and ROK government computers (Kim 2016). This hacking is reportedly often not discovered until later, and often goes unreported; furthermore, on the rare instances when such hacking is reported, it is very difficult to associate a date with the provocation. Similarly, from 2010 through July 2015, there were reportedly 2,143 incidents of the DPRK jamming GPS signals in the South – which can potentially disrupt commercial and military aircraft flying over South Korea as well as ship and car navigation (Shim 2016b). However, almost all of these incidents were not reported in the news. In another example, from 2000-2010, there were an average of about 30 maritime border violations per year (Kim and Lee 2011, 59); yet, only a handful of these are reported in the Western media. Furthermore, many U.S.-ROK military exercises, especially those on a small scale, are not reported publically, presumably for national security reasons – and are therefore are not included in the dataset. Nevertheless, it is likely that the DPRK is aware of many of these and may therefore consider them to be trigger events.

Government officials, academics, and the media continue to speculate on expected DPRK provocations based on various events. For instance, the ROK Prime Minister stated on December 9, 2016 that there was a high possibility of a DPRK provocation in response to the ROK's presidential impeachment

[29] This negotiation, as previously noted, fell apart quickly after a tentative deal was reached.

crisis (*Reuters* 2016). On the other hand, the day before a North Korean diplomat stated that the country does not plan any missile or nuclear provocations until U.S. President-elect Donald Trump had made his DPRK policy plans clear (Shim 2016). Hopefully, the results of the analysis conducted in this paper as well as possible future expansions of the dataset should provide additional clarity regarding which trigger events are more likely to cause DPRK provocations. For the time period under analysis, the overall takeaway is that exogenous trigger events seem be uncorrelated with DPRK provocations taking place or with the level of provocation. The clearest predictor of a provocation is instead whether or not another provocation has recently taken place.

Appendix 1: Descriptive Statistics for DPRK provocations by type

Provocation Type	Level: small (S), medium (M), large (L)	Number of Provocations (January 1, 2012 – November 21, 2016)	Mean	Variance
Large missile test[30]	L	4	.045	.044
Extra-large missile test[31]	L	11	.125	.111
5 or more missiles	L	5	.057	.054
10 or more missiles	L	3	.034	.033
Nuclear test	L	3	.034	.033
DPRK negative action – Kaesong	L	4	.045	.044
DPRK detention of US, Canadian, or Australian citizen**	L	10	.113	.102
Medium missile test[32]	M	6	.068	.064
3 or 4 missiles of any size at one time	M	7	.080	.074
Cyber attacks***	M	5	.057	.054
Small missile test[33]	S	31	.352	.231
1 or 2 missiles	S	32	.364	.234
1 or more missiles of unknown size at the same time	S	1	.011	.011
Unknown missile type	S	1	.011	.011
Naval incursions over the Northern Limit Line (NLL)	S	6	.068	.064
DPRK military exercises	S	1	.011	.011
Provocations at the Demilitarized Zone (DMZ)	S	4	.045	.044
Reported GPS jamming	S	2	.023	.022
Negative diplomatic actions	S	0	0	0
Closing communications channels	S	1	.011	.011

** Note: Numbers do not total 88, as some provocations were placed in multiple categories – such as a test of 5 small missiles would be in both the "small missile test" and "5+ missile test" categories. In this example, such a provocation would have been placed in the "large provocation" category, due to the number of missiles tested.*
*** During the time period under analysis, these were the only foreign citizens publically listed as having been detained by the DPRK.*
**** The cyber attack on Sony was categorized as a "large" provocation.*

[30] Musudan/Hwasong-10

[31] Taepodong-2, Taepodong-3/Kwangmyongsong/Unha-3, SLBM (KN-11)

[32] Nodong-1 and Taepodong-1 missiles

[33] Scud, Hwasong-5, Hwasong-6, Toksa, KN-01, KN-02, KN-06, and Frog missiles

Appendix 2: Generalized Ordered Logit – Results for Second-Stage Choice (Provocation Level)

Variables	7-day	14-day
Small provocations		
DPRK holiday	-.427 (1.219)	38.315 (19750.39)
U.S. high-level visit	-2.170 (1.403)	37.309 (19001.01)
U.S. or ROK political event	*Omitted*	*Omitted*
U.S.-ROK military event	-.407 (1.112)	-32.035 (17018.07)
U.S. negative actions	-.576 (1.344)	-64.205 (29768.98)
UN event	-.686 (1.006)	18.727 (6924.085)
Other DPRK provocation	.156 (.213)	17.209 (17.209)
Declared by the DPRK to be a hostile act	.026 (.741)	68.466 (19399.03)
Intercept	.394 (.911)	-16.904 (4530.388)
Medium provocations		
DPRK holiday	-.932 (1.204)	.6284 (1.309)
U.S. high-level visit	-18.607 (3685.699)	-19.535 (8120.685)
U.S. or ROK political event	*Omitted*	*Omitted*
U.S.-ROK military event	-.465 (1.162)	.015 (1.145)
U.S. negative actions	-.223 (1.417)	1.098 (1.482)
UN event	-1.453 (1.032)	.678 (1.071)
Other DPRK provocation	-.135 (.229)	-.270 (.140)*
Declared by the DPRK to be a hostile act	-.382 (.906)	.230 (.727)
Intercept	.228 (.867)	.767 (.939)
Large provocations		
DPRK holiday	2.089 (1.965)	1.868 (1.441)
U.S. high-level visit	20.569 (7882.667)	20.651 (4896.756)
U.S. or ROK political event	19.087 (5573.887)	19.970 (8172.91)
U.S.-ROK military event	-14.335 (1675.837)	1.043 (1.325)
U.S. negative actions	-13.619 (1675.837)	1.783 (1.575)
UN event	2.083 (1.609)	1.580 (1.237)
Other DPRK provocation	-1.036 (.480)**	-.277 (.145)*
Declared by the DPRK to be a hostile act	14.601 (1675.836)	.347 (.733)
Intercept	-1.045 (1.116)	-1.124 (1.130)

*Note: N=87. Standard errors shown in parenthesis. Two-tailed statistical significance indicated as follows: * p<.1, ** p<.05, *** p<.01). The test with "ROK Kaesong," "US/ROK diplomatic initiative," and "DPRK diplomatic initiative" did not achieve convergence for the 14 day dataset; the test did reach convergence for the 7 day dataset, but the results had even more abnormal standard errors, coefficients, and statistical significance ("Other DPRK provocation" was still significant at the p<.05 level, but only for the Large Provocations category).*

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