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Article

Why Does North Korea Engage in Provocations?

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Abstract

Given the increasing number and severity of North Korean provocations, this article quantitatively analyses the relationship between North Korean actions and different types of events and actions 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 1 January 2012 through 21 November 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 level of provocation. The article concludes that, despite media and academic assessments to the contrary, the notional trigger events explored in this article appear to be uncorrelated with either North Korea 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 article also finds that in these situations additional provocations may more likely be of a lower level, such as short-range missile tests or limited naval incursions. International leaders' decisions should be informed by this apparent lack of significant correlation between provocations and events such as USA–South Korean military exercises, United Nations Security Council resolutions, or a high-level US visit to the region.

Keywords

North Korea, international conflict, military/armed forces, United States of America (USA), South Korea, provocations

Introduction

Current understanding of the relationship between coercion, compellence and North Korean behaviour is limited. For instance, when the United Nations adopts

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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 USA 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 US 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 establish a good relationship with the new US administration. More broadly, are North Korean provocations statistically correlated with US 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. The consequences of miscalculation can be monumental, especially given North Korea's nuclear and growing ballistic missile capabilities.

North Korea is a desperately poor country with a population of 25 million and an estimated GDP of US $40 billion. During the Cold War, the country was subsidized by the Soviet Union and has been substantially supported by China over the past several decades. Especially after the fall of the Berlin Wall, and with few allies left, Pyongyang began focusing increasing attention on expanding its asymmetric capabilities. Pyongyang regards its advanced military weapons, in particular ballistic missiles and nuclear arms, as integral for regime survival and defence, deterrence of the USA contributing to its international prestige and enhancing its ability to engage in coercive diplomacy, a bargaining chip, a cost-effective equalizer in its competition with the ROK, and an opportunity to earn hard currency through sales of these technologies, and boost the regime's domestic legitimacy (Armstrong, 2009; Burgess, 2012; Cha, 2002, 2009; Cordesman & Hess, 2013a p. 7; 2013b, pp. 1, 36; Department of Defense [DOD], 2013; Kim, 1995; Roehrig, 2016; Weitz, 2016).

For decades, the North Korean regime has engaged in brinksmanship, engaging in a series of provocations (Armstrong, 2009; Beck, 2011; Becker, 2005; Bennett, 2009, 2012; Cha, 2009; Denmark, 2011; DOD, 2016; Kim, 1995; Klingner, 2009; Lee, 2014; McDevitt, 2011). Then, with tensions high, having gained an empowered position as well as the attention of the international community, North Korea tones down its provocations and agrees to negotiate in order to temporarily defuse the situation. This can be followed by additional brinksmanship over the negotiation itself, in which the DPRK demands more than it was promised or does less than it agreed to (Cha, 2009, p. 128).

The DPRK has engaged in an increasing number of significant military provocations, especially in the past several years under Kim Jong Un. The simplest explanation for these provocations, especially advanced missile and nuclear tests, is that they are conducted to improve North Korean capabilities; this may well be true (Cha, 2009, p. 122; Cordesman, 2006; Dempsey, 2017; Gause, 2015, p. 2; Lee, 2014, p. 93). 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)–US military exercises, the deployment of advanced US weaponry to the region, ROK or US elections, actions by the international community such as UN Security Council resolutions, and US sanctions, among many other possibilities. However, while there is much qualitative and anecdotal press literature on the causes of North Korean behaviour, only limited quantitative analysis has been carried out to determine the correlations, if any, between the putative trigger events and either the occurrence of DPRK provocations or the specific type of provocation chosen (Beyond Parallel, 2017; Cha, 2016b, 2017; Cha, Lee & Lim, 2016a, 2016b; D'Orazio, 2012; Kim & Lee, 2011; Richey, 2017; Whang et al., 2016; Yoo, 2014; Yoo & Kim, 2017). This article 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 article ultimately finds that, during the 4 years under consideration, coercion and compellence have a limited influence on North Korean behaviour.

The rest of the article is organized as follows. The first section describes the data. The second section explores the background of prior research in this area and develops the possible independent variables. The third and fourth sections examine the statistical models employed as well as the results, and the fifth section discusses and concludes.

Data

For this article, a dataset was developed covering the time period of 1 January 2012 through 21 November 2016, during which 88 DPRK provocative events as well as 257 possible trigger events occurred. Trigger events include both international and DPRK-initiated events, as appropriate. The specific date range was selected because on 21 November 2016, the DPRK foreign ministry released a memorandum listing international, USA and South Korean events and actions—trigger events in the parlance of this article—that it declared to be provocative (KCNA, 2016). This memorandum provided both a delineated time period to analyse as well as another independent variable. This time period also roughly coincides 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. The events include—but are not limited to—the event types highlighted by the DPRK foreign ministry memorandum of November 2016. All research was based on open source documents, including newspaper articles and publicly available government documents and international organization releases.[1] Event dates and types are recorded.

Determining what to include or exclude as a provocation was surprisingly challenging. Ultimately, provocation was defined as an intentional military or political

action taken by the DPRK for military, political or diplomatic objectives that threatens or is perceived to threaten a third country, such as the USA, causes personal damage or damage to property, and/or is a serious violation of international law (see Cha, 2017). Trigger events were generally similarly defined—actions taken by the USA, its allies or the international community writ large for military, political or diplomatic objectives that threaten or are perceived to threaten the DPRK, cause personal image or damage to property, and/or are serious violations of international law.[2] In addition, two DPRK-specific variables, DPRK holidays and DPRK diplomatic initiatives were also included, as these could lead to the DPRK engaging in a provocation. The categorization of trigger events 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 were not included in the dataset developed for this article. 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 assassination of Kim Jong Un's half-brother, Kim Jong Nam. However, assassinations of North Korean citizens seem to be more in the realm of domestic politics and not a clear-cut provocation, and so were excluded. In another example 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 to the USA, its allies and the international community and therefore was excluded.

Due to the many different types of provocations, these events were roughly categorized into three levels or types of provocation based on size and impact: small, medium and large provocations (Table 1), based on the level of 'provocativeness' that the DPRK could expect to be perceived by the USA, its allies and the international community.[3] 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 short-range missiles,[4] 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, and closing communications channels. The medium-scale provocation category included medium-range missile launches,[5] launches of three or four missiles of any size at one time, and most cyber-attacks. Large-scale provocations included tests of a long-range[6] missile; nuclear tests; launches of five or more

Table 1. DPRK Provocations, Descriptive Statistics

Level of Provocation	Number of Provocations (1 January 2012–21 November 2016)	Mean
Small provocation	31	0.352
Medium provocation	16	0.182
Large provocation	41	0.466

Source: Based on author's calculations.

missiles of any size at the same time; negative actions leading to the closing of 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.

For all statistical analyses in this article, the specific possible trigger events within a 7- or 14-day range, on either side, of the DPRK provocation were determined. While the two-week cut-off is somewhat arbitrary, a cut-off point needs to be determined in order to conduct any analysis. Recent research has shown that the DPRK under Kim Jong Un engages in a provocation within 1 or 2 weeks of a specific trigger event, which further supports the inclusion of a 7- or 14-day range (Cha, 2017). Furthermore, the idea of the 2-week timeframe has been cited previously (Cha, 2016b). Considering a longer provocation window can lead to issues of possible cause-and-effect—for instance, a large DPRK missile test that takes place 2 months after a US president enters office is less likely to be correlated with the trigger event of the president entering office. Such a test 7 days after the president enters office is likely more likely to be correlated. Data on events both before *and* after the DPRK provocation were included because in many of the events, such as regular US-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. Of the 88 total provocations during the time period under analysis, only one was not within 14 days of a putative trigger event.

Possible Provocation 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 best 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 4 July 2006; a 2014 summit among the USA, 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 behaviour. 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).

Table 2. Possible Trigger Events, Descriptive Statistics

Type of Trigger Event	Number of Trigger Events (1 January 2012–21 November 2016)	Mean
ROK negative action regarding Kaesong	2	0.008
DPRK diplomatic initiative	9	0.035
DPRK holiday or political event	27	0.105
US high-level visit	36	0.140
US or ROK political event	8	0.031
US-ROK military event	83	0.323
US negative political actions or statements	44	0.171
US or ROK diplomatic initiative	1	0.004
UN event	48	0.187
Event identified by DPRK as a provocation	107	0.416

Source: Based on author's calculations.
Note: Numbers do not total 257, as 'Identified as Provocation' covers many events.

The independent variables—the trigger event types—were chosen for inclusion in this article based primarily on the below literature review, along with several additional hypotheses developed for this article (Table 2 shows descriptive statistics). It should be emphasized that there is minimal academic literature on many of these variables; analysis of the relationship between trigger event type and DPRK provocation is primarily carried out by think tanks and in newspaper articles. 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 (Chang, 2014; Gause, 2015, pp. 15–24).

Another possible trigger event could be the ROK taking a negative action regarding Kaesong, such as 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. 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 29 February 2012. The USA 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 US 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. CSIS' 'Beyond Parallels' project found an inverse correlation between North Korean provocations and US–DPRK diplomacy, indicating that negotiations do have a restraining effect on the number of DPRK provocations (2017). However, during the time period under analysis, there was only one significant US or ROK diplomatic initiative.

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, 2016b).

An additional potential trigger event could be high-level US visits, as the DPRK may see these visits to the region as offensive or hostile actions. In the context of this article, a high-level visit is defined as a visit to the ROK, Japan and/or China by a US president, secretary of defence, or secretary of state. Also included in this variable are visits by the leaders of China, the ROK and/or Japan to the USA.

Similarly, DPRK provocations could be triggered by negative US unilateral actions, including US executive orders, sanctions, designations, proclamations, laws, specific US government reports and statements made about the DPRK by a US president or secretaries of defence or state (or as identified by the DPRK Foreign Ministry in their 21 November 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 US moves. On the other hand, though much less likely, if the US actions, many of which are designed to dissuade North Korea from developing its weapons of mass destruction and ballistic missile programmes, actually achieve this goal, we could see a reduction in DPRK provocations surrounding the US action.

Some argue that US 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. Analysis has suggested that a conservative US or ROK president results in more DPRK provocations, although other work has not supported this conclusion (Kang, 2010; Yoo & Kim, 2017). A recent analysis of DPRK provocations and ROK presidential and national assembly elections found that the provocation window has narrowed from 11 weeks under Kim Il Sung to only 1–2 weeks under Kim Jong Un (Cha, 2017), although this article did not test for a correlation between these two events. One of the few quantitative analyses

of DPRK provocations found no support for a relationship between DPRK provocations and ROK presidential or general elections (Yoo & Kim, 2017). However, other analysts disagree. 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 US 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 1 week before or after a ROK legislative election (Cha, 2016a). More systematically, Victor Cha and CSIS released analysis of a dataset of US presidential and congressional elections between 1956 and 2016, and cross-tabulated this with a dataset of DPRK provocations, measuring the 'provocation window', that is, 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, 6 weeks under Kim Jong-Il, and 4 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 2017—a period of 5 months (Cha, 2016b). While this analysis seems to show that there is indeed a correlation between US elections and DPRK provocations, according to the methodology of the present article, 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.

An additional trigger event that has often been put forward in the media is US–ROK military drills in the region (Acton, 2017; Chang, 2017).[8] Other types of militarily significant events included in the dataset developed for this article were activities involving advanced US aircraft, such as B-1 and B-2 bombers flying over the peninsula; an advanced US nuclear carrier, destroyer or nuclear-powered submarine visiting the peninsula; and a transfer to the region of advanced US military technology, such as the Theater High Altitude Area Defense system (THAAD) (Associated Press, 2013; Cha et al., 2016b). It is expected that all such actions would trigger provocations by 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 to 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 by 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 objects to: 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 hostile was also included in the model. This variable is based on the DPRK Foreign Ministry memorandum, in which North Korea labels 106 US, US-instigated ROK and international actions as 'extreme', 'hostile', 'anachronistic', 'criminal', 'aggressive', 'heinous', 'frantic', 'provocative', 'reckless', 'dangerous', 'vicious' and 'abhorrent'. If DPRK provocations are in response to US, ROK and international community actions, then it would be expected that this variable would be correlated with provocations occurring.

Finally, for the second set of analyses investigating the level of provocation chosen a variable indicating whether each provocative event occurred temporally near another DPRK provocation was included.[9] 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 Pyongyang 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 USA or South Korea - which would in most cases likely be a suboptimal outcome for the DPRK. Resource constraints could also play a part in decreasing the likelihood of provocation cycles.

Unfortunately, due to lack of data, internal regime dynamics are not included in this analysis. Many authors find, through both qualitative and quantitative studies, that internal causes are an important driver of the DPRK's provocations. Instability and uncertainty over succession and consolidation, including an actual succession process, is one of these internal drivers (Armstrong, 2009; Beck, 2011; Bennett, 2012, 2014b; Gause, 2015; Han, 2012; Kim, 2013, 2014; Lee, 2012; Moon, 2012; Yoo & Kim, 2017). External shows of force engender an internal image of leadership strength and power (Bennett, 2013, 2014a). Similarly, leadership shuffles and power struggles are also considered to be an important cause of provocations (Gause, 2015; Yoo & Kim, 2017). Some authors have used the garrison state concept to explain the DPRK's provocations, meaning that the military's power and policy are of such importance in North Korea that the military engages in a provocation when it wants to consolidate its position or power in response to domestic challenges (DOD, 2014, 2016; Lasswell, 1941; Lee, 2012; Richey, 2017). Particularly, challenging economic times, such as the bite of new sanctions, are another proposed driver of provocations (Bennett, 2009; Han, 2012; Yoo, 2014). The diversionary hypothesis—in which leaders have an incentive to engage in provocations and redirect domestic attention to foreign policy in order to distract attention from internal economic and social problems and consolidate their domestic political base—is another explanation for DPRK attempts to engage in provocations and generate regional conflict (Fravel, 2010; Gent, 2009; Levy, 1989; Wright, 1965; Yoo & Kim,

2017). For instance, provocations can also quell internal dissent, unite the elites against common external adversaries or distract North Koreans from the harsh realities of life such as constant food insecurity (Bennett, 2012; Cordesman & Hess, 2013a, p. 7; DOD, 2016).

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 results of this analysis should determine whether each of the possible trigger event types is statistically linked with a 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 (Table 3 shows descriptive statistics). The independent variables included in both the first and in the second analyses are listed in Table 2.

Because the dependent variable is a non-negative count variable—the number of DPRK provocative events within a certain timeframe of a trigger event—the basic regression methodology was a Poisson model. This was then compared with similar regression models to determine which best fit the data, including the 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. As previously noted, it is expected that each variable will be positively correlated with the dependent variable, the number of DPRK provocations within a 7- or 14-day timeframe. Put another way, if the DPRK is reacting to trigger events, then each trigger event would logically lead to an increase in the number of DPRK provocations—a positive correlation. The results of each are reported in Table 4.

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)

Source: Based on author's calculations.
Note: * $n = 257$.

Table 4. Poisson and Negative Binomial Regressions, 7 and 14 Days

	Poisson Model		Negative Binomial Model		ZIP Model		ZIP Model - RSE		ZINB Model		ZINB Model - RSE	
Variables	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	−0.123 (0.720)	−0.269 (0.586)	−0.131 (0.863)	−0.275 (0.759)	−0.117 (0.741)	0.278 (0.586)	0.298 (0.201)	−0.278 (0.267)	0.168 (1.157)	−0.276 (0.740)	−0.132 (0.725)	−0.276 (0.267)
DPRK diplo-matic initiative	0.101 (0.344)	−0.046 (0.277)	0.092 (0.426)	−0.052 (0.377)	0.103 (0.355)	0.133 (0.298)	0.102 (0.433)	0.134 (0.379)	0.091 (0.406)	−0.053 (0.367)	0.091 (0.424)	−0.053 (0.380)
DPRK holiday	−0.327 (0.252)	−0.233 (0.186)	−0.336 (0.298)	−0.239 (0.246)	−0.344 (0.258)	−0.011 (0.202)	−0.343 (0.236)	−0.010 (0.214)	0.337 (0.287)	−0.240 (0.239)	−0.337 (0.2031)	−0.240 (0.221)
US high-level visit	−0.364 (0.229)	−0.256 (0.168)	−0.373 (0.271)	−0.261 (0.224)	−0.372 (0.234)	−0.060 (0.180)	−0.371 (0.230)	−0.060 (0.197)	−0.371 (0.260)	−0.261 (0.217)	−0.371 (0.228)	−0.261 (0.202)
US or ROK political event	−0.410 (0.430)	−0.356 (0.319)	0.418 (0.498)	−0.362 (0.408)	−0.429 (0.437)	−0.224 (0.337)	−0.427 (0.350)	−0.224 (0.409)	−0.419 (0.481)	−0.363 (0.398)	−0.420 (0.349)	−0.363 (0.405)
US-ROK military event	0.185 (0.192)	−0.014 (0.152)	0.168 (0.250)	−0.033 (0.218)	**0. 454 (0.242)** *	0.240 (0.163)	**0.461 (0.258)** *	0.241 (0.189)	0.348 (0.266)	0.058 (0.231)	0.346 (0.233)	0.058 (0.221)
US negative actions	**−0.474 (0.242)****	**−0.351 (0.183)***	−0.490 (0.303)	−0.371 (0.255)	**−0.446 (0.256)** *	−0.084 (0.196)	**−0.445 (0.257)** *	−0.084 (0.211)	−0.466 (0.294)	−0.357 (0.251)	**−0.467 (0.264)** *	−0.357 (0.226)
US or ROK diplo-matic initiative	**1.856 (0.474) ***	**1.569 (0.422) ***	**1.85 (0.846) ***	**1.569 (0.825) ***	**1.802 (0.494) ***	**1.380 (0.435) ***	**1.809 (0.436) ***	**1.380 (0.358) ***	**1.856 (0.763) **	**1.569 (0.787) **	**1.856 (0.394) ***	**1.569 (0.359) ***
UN event	*Omitted*	*Omitted*	*Omitted*	*Omitted*	*Omitted*	*Omitted*	*Omitted*	*Omitted*	*Omitted*	*Omitted*	*Omitted*	*Omitted*

(Table 4 Continued)

(Table 4 Continued)

	Poisson Model		Negative Binomial Model		ZIP Model		ZIP Model - RSE		ZINB Model		ZINB Model - RSE	
Variables	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]
Declared by the DPRK to be a hostile act	0.270 (0.166)	**0.244 (0.132)***	0.276 (0.217)	0.258 (0.190)	0.231 (0.186)	0.176 (0.143)	0.230 (0.170)	0.176 (0.161)	**0.**248 (0.218)	0.241 (0.192)	0.248 (0.181)	0.241 (0.177)

Source: Based on author's calculations.

Notes: Standard errors shown in parenthesis. Two-tailed statistical significance indicated as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$). $N = 257$.

[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 US-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 US 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 US–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 US–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 US–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 US–ROK military event. The results of that model are presented here. All combinations had AICs and BICs within a small range of each other.

[7] 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 US–ROK military event. The results of that model are presented here. All combinations had AICs and BICs within a small range of each other.

[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 US–ROK military event. The results of that model are presented here. All combinations had AICs and BICs within a small range of each other.

Table 5. Goodness-of-fit Comparisons, 7 Days

Model	Pseudo R^2	AIC	BIC	Vuong
Poisson	0.0579	801.27	836.76	ZIP ≅ P
Negative binomial	0.0341	772.09	811.13	NB > ZINB
ZIP	0.0000	787.54	830.12	ZIP ≅ P
ZIP RSE	–	785.23	824.27	–
ZINB	0.0007	773.72	819.86	NB > ZINB
ZINB RSE	–	771.84	814.43	–

Source: Based on author's calculations.

Note: The Vuong test was not computed on the models with robust standard errors, as the two cannot be run together in Stata.

An initial look at the results seems to show that the *US/ROK Diplomatic Initiative* variable is statistically significant in all of the 7- and 14-day models, with the *US–ROK Military Event* variable occasionally significant in the 7 day models, the *US 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. Several goodness-of-fit tests were used to determine which of the models presented best fits the data (see Table 5 and 6). Overall, the regular negative binomial model may be a slightly better fit for the 7-day data.[10]

The negative binomial and negative binomial with robust standard errors regression models have virtually identical goodness-of-fit results for the 14-day data.[11]

Assessing the results of the 7- and 14-day negative binomial models, only the *US or ROK diplomatic initiative* explanatory variable was statistically significant, increasing the log count of a DPRK provocation. However, as there was only one actual *US or ROK diplomatic initiative* event in the dataset, these results are essentially meaningless.

Given the lack of significant relationships between the dependent and independent variables, the model was simplified by developing 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. If these trigger events are leading to DPRK provocations, the expected results of this analysis would be a significant, positive relationship between these variables. The results of the logit analyses are reported in Table 7. All trigger variables were insignificant for the 7-day model, while *DPRK holiday*, *US high-level visit, US–ROK military event*, and *US 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 ($p < 0.05$); 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 ($p < 0.05$); this is the opposite directionality as had been expected. A US–ROK military event

Table 6. Goodness-of-fit Comparisons, 14 Days

Model	Pseudo R^2	AIC	BIC	Vuong
Poisson	0.0305	1023.37	1058.86	ZIP > P
Negative Binomial	0.0152	964.25	1003.29	NB > ZINB
ZIP	0.0010	995.79	1038.38	ZIP > P
ZIP RSE	–	993.79	1032.83	–
ZINB	0.0748	967.17	1013.31	NB > ZINB
ZINB RSE	–	963.17	1002.21	–

Source: Based on author's calculations.

Note: The Vuong test was not computed on the models with robust standard errors, as the two cannot be run together in Stata.

Table 7. Logit Regression, 7 and 14 Days

Variables	7-Day (Logit)	14-Day (Logit)
ROK Kaesong actions	−0.667 (1.447)	*(Omitted)*
DPRK diplomatic initiative	−0.156 (0.7923)	−1.261 (0.970)
DPRK holiday	−0.137 (0.504)	**−1.667 (0.664) ****
US high-level visit	−0.465 (0.454)	**−1.572 (0.636)****
US or ROK political event	−0.156 (0.793)	−1.261 (0.970)
US-ROK military event	−0.184 (0.457)	**−1.524 (0.645)****
US negative actions	−0.703 (0.518)	**−1.847 (0.700)*****
US/ROK diplomatic initiative	*(Omitted)*	*(Omitted)*
UN event	*(Omitted)*	*(Omitted)*
Declared by the DPRK to be a hostile act	0.260 (0.387)	0.430 (0.438)
Pseudo R^2[1]	0.0098	0.0418
Correctly classified (Sensitivity/ Specificity)[2]	61.72% (96.86%/4.12%)	75.98% (100.00%/0.00%)
N	256	254

Source: Based on author's calculations.

Notes: Standard errors shown in parenthesis. Two-tailed statistical significance indicated as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$).

[1] The smaller the number, the better the model fit.

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

decreases the log odds of a DPRK provocation by 1.524 holding the other variables in the model constant ($p < 0.05$); this is also very surprisingly the opposite direction as hypothesized. Finally, a negative US diplomatic action also decreases the log odds of a DPRK provocation by 1.847 holding the other variables in the model constant ($p < 0.01$); and again, a positive correlation had been expected between negative US actions and DPRK provocations.

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.[12]

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. 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 simple binomial choice—provocation or no provocation. Again, it would be expected that any of these trigger events would be positively correlated with the DPRK deciding to respond with a provocation. The second stage is the decision of which level of provocation the DPRK chooses to utilize (small, medium or large), an ordered categorical choice model.

Therefore, a two-step Heckman ordered probit selection model was employed for this portion of the analysis.[13] This model estimates the maximum likelihood parameters of a regression model for an ordered categorical outcome, based on a non-random selected sample (De Luca & Perotti, 2011). 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.

As shown in Table 8, 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* ($p < 0.01$). 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, a one-event increase in the number of nearby DPRK provocations increases the probability of the DPRK engaging in a provocation by 0.185. There were no statistically significant variables in the 14-day first stage model.[14]

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 the DPRK choosing a more serious level of provocation—in both the 7- and 14-day models. In terms of marginal effects (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 0.015, but decreases the probability of the DPRK engaging in a medium-scale provocation by 0.010 and the probability of a large-scale provocation by 0.094. In terms of marginal effects and the 14-day model, a one-unit increase in the number of nearby DPRK

Table 8. Ordered Choice Model, with Selection, 7 and 14 Days

Variables	7 Days	14 Days[1]
FIRST STAGE: Respond with a Provocation? (Yes or No?)		
ROK Kaesong actions	−0.194 (1.038)	*Omitted*
DPRK diplomatic initiative	0.478 (0.865)	0.205 (0.765)
DPRK holiday	0.454 (0.809)	−0.279 (0.696)
US high-level visit	0.155 (0.799)	−0.154 (0.691)
US or ROK political event	0.594 (0.755)	−0.020 (0.657)
US-ROK military event	0.621 (0.800)	−0.058 (0.703)
US negative actions	0.184 (0.821)	−0.468 (0.728)
US/ROK diplomatic initiative	*Omitted*	*Omitted*
UN event	0.152 (0.799)	0.526 (0.703)
Other DPRK provocation	**0.800 (0.091)*** **	*Omitted*
Declared by the DPRK to be a hostile act	0.015 (0.194)	0.331 (0.240)
SECOND STAGE: Provocation Level (Small, Medium, Large)		
ROK Kaesong actions	5.810 (1673.77)	–
DPRK diplomatic initiative	−0.164 (0.606)	−0.980 (0.729)
DPRK holiday	−0.472 (0.566)	−0.5467 (0.640)
US high-level visit	−0.408 (0.558)	−0.455 (0.636)
US or ROK political event	0.028 (0.426)	0.1523 (0.466)
US-ROK military event	−0.328 (0.555)	−0.918 (0.663)
US negative actions	−0.681 (0.575)	−0.806 (0.661)
US/ROK diplomatic initiative	0.245 (0.466)	0.237 (0.458)
UN event	−0.350 (0.545)	−0.818 (0.695)
Other DPRK provocation	−**0.260 (0.068)*** **	−**0.137 (0.033)*** **
Declared by the DPRK to be a hostile act	0.110 (0.169)	0.101 (0.182)
Cut 1	−1.148 (0.565) **	−3.101 (0.917)***
Cut 2	−0.496 (0.564)	−1.419 (0.773)**
Cut 3	−0.126 (0.562)	−0.908 (0.743)
Rho (ρ)[2]	0.066	0.352
N	603	564

Source: Based on author's calculations.

Notes: Standard errors shown in parenthesis. Two-tailed statistical significance indicated as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$).

[1] Did not reach convergence.

[2] 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.

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

Provocation Level	7 Days	14 Days
Small-scale provocation	0.015	0.042
Medium-scale provocation	−0.010	0.008
Large-scale provocation	−0.094	−0.054

Source: Based on author's calculations.

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)[15]	0.0085	–
Likelihood ratio[16]	0.7817	0.8089

Source: Based on author's calculations.

provocations increases the probability of the DPRK choosing a small-scale provocation by 0.042 and a medium-scale provocation by 0.008, but decreases the probability of a large-scale provocation by 0.054.

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 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.[17]

Discussion and Conclusions

Based on the analyses conducted in this article, it would appear that during these first four years of Kim Jong Un's rule, neither the DPRK's choice of whether to engage in a provocation nor the level of provocation chosen are strongly correlated with any of the so-called trigger events included in the models—despite the fact that many of these triggers are often anecdotally assumed to be very strongly correlated with DPRK provocations. Furthermore, the basic numbers of events—257 trigger events and 88 provocations—indicate that many trigger events went unanswered, at least on a one-to-one basis, by any DPRK provocation, further supporting this conclusion.

For the relationship between putative trigger events and the number of DPRK provocations taking place within a 7- and 14-day period, 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 ($p < 0.01$), 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 $p < 0.01$ or $p < 0.1$ levels, respectively).

However, this independent variable has a count of only one, meaning that we do not know the real significance of this relationship. And without this variable being particularly meaningful, the results of these models show that there has been essentially no relationship between any of the trigger events and the number of DPRK provocations within 7 or 14 days, either side, during the first four years of Kim Jong Un's rule.

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 during the four-year period under study. Conversely, in the 14-day model, a DPRK holiday, US high-level visit, US–ROK military event, and negative US diplomatic action all decreased 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 analysis have only limited value.

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, during the first four years of Kim Jong Un's rule. 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 model, 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: during the first four years of Kim Jong Un's rule, there were few correlations between the trigger events under investigation and DPRK provocations. First, most of the exogenous trigger events are not significantly correlated with DPRK provocations. Namely, ROK negative actions at Kaesong City, high-level visit by a US leader to Northeast Asia or by one of these leaders to the USA, US or ROK

political events such as an election, US negative actions such as sanctions, US–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. Based on these findings, international leaders perhaps should consider reassessing 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 international community 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 USA or South Korea.

It is also interesting that the variable representing whether the DPRK had labelled the trigger event as provocative, according to the DPRK Foreign Ministry's 21 November 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 analysed in this article. The international community may need to consider this when weighing their actions.

There are significant limitations to this analysis, starting with the difficulty involved with putting together a fully comprehensive and complete dataset covering all possible trigger events and provocations during the period under evaluation. Certain categories of likely important variables were not able to be included in the model for various reasons. One theory not tested in this article 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, or 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 (Armstrong, 2009, p. 31; Cha & Kang, 2003, p. 21; Lee, 2011, pp. 8–9). Similarly, it has been argued that failure in negotiations can precipitate DPRK provocations (Cha, 2009, p. 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. Yet, these theories cannot be tested as there was only one negotiation conducted during the period under review in this article.[18]

North Korean actions could be motivated by not only outside stimulus such as many of the trigger events studied in this article, but also by domestic considerations such as establishment of domestic legitimacy and internal prestige-seeking. However, independent variables representing these and other domestic-level factors in the DPRK could not be included in this analysis due to the general lack of information about the internal workings of North Korea. 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 (Armstrong, 2009; Gause, 2015, pp. 2–7; 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). 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, which could be due to either actual food shortages or to an imperative from the regime to increase catches (Kim & Lee, 2011). 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 analysed here.

Some types of DPRK provocations are not often reported or are vastly underreported in the public press, which was the primary source used in putting together the dataset—making these provocation types significantly underrepresented in the 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, 2016). However, almost all of these incidents were not reported in the news. In another example, from 2000 to 2010, there were an average of about 30 maritime border violations per year (Kim & Lee, 2011, p. 59); yet, only a handful of these are reported in the Western media. Furthermore, many visits of US ships and aircraft, as well as

US–ROK military exercises, especially those on a small scale, are not reported or underreported publically, presumably for national security reasons—and are therefore are not able to be included in the dataset. Nevertheless, it is likely that the DPRK is aware of many of these and may be reacting to these trigger events.

Government officials, academics, and the media continue to speculate on expected DPRK provocations. For instance, the ROK Prime Minister stated on 9 December 2016 that there was a high possibility of a DPRK provocation in response to the ROK's presidential impeachment crisis (*Reuters*, 2016). On the other hand, just one day before, a North Korean diplomat stated that the country does not plan any missile or nuclear provocations until US President Donald Trump had made his DPRK policy plans clear (Shim, 2016). Hopefully, the results of the analysis conducted in this article 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 lesson seems to be that exogenous trigger events assessed appear 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 (1 January 2012–21 November 2016)	Mean	Variance
Large missile test[1]	L	4	0.045	0.044
Extra-large missile test[2]	L	11	0.125	0.111
5 or more missiles	L	5	0.057	0.054
10 or more missiles	L	3	0.034	0.033
Nuclear test	L	3	0.034	0.033
DPRK negative action – Kaesong	L	4	0.045	0.044
DPRK detention of US, Canadian or Australian citizen**	L	10	0.113	0.102
Medium missile test[3]	M	6	0.068	0.064
3 or 4 missiles of any size at one time	M	7	0.080	0.074
Cyber-attacks***	M	5	0.057	0.054
Small missile test[4]	S	31	0.352	0.231
1 or 2 missiles	S	32	0.364	0.234

(Appendix 1 Continued)

(Appendix 1 Continued)

Provocation Type	Level: Small (S), Medium (M), Large (L)	Number of Provocations (1 January 2012–21 November 2016)	Mean	Variance
1 or more missiles of unknown size at the same time	S	1	0.011	0.011
Unknown missile type	S	1	0.011	0.011
Naval incursions over the Northern Limit Line (NLL)	S	6	0.068	0.064
DPRK military exercises	S	1	0.011	0.011
Provocations at the Demilitarized Zone (DMZ)	S	4	0.045	0.044
Reported GPS jamming	S	2	0.023	0.022
Closing communications channels	S	1	0.011	0.011

Source: Based on author's calculations.

Notes: * 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.

[1] Musudan/Hwasong-10.

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

[3] Nodong-1 and Taepodong-1 missiles.

[4] 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	−0.427 (1.219)	38.315 (19750.39)
US high-level visit	−2.170 (1.403)	37.309 (19001.01)
US or ROK political event	*Omitted*	*Omitted*
US-ROK military event	−0.407 (1.112)	−32.035 (17018.07)
US negative actions	−0.576 (1.344)	−64.205 (29768.98)
UN event	−0.686 (1.006)	18.727 (6924.085)
Other DPRK provocation	0.156 (0.213)	17.209 (17.209)
Declared by the DPRK to be a hostile act	0.026 (0.741)	68.466 (19399.03)
Intercept	0.394 (0.911)	−16.904 (4530.388)

Variables	7-Day	14-Day
Medium provocations		
DPRK holiday	−0.932 (1.204)	0.6284 (1.309)
US high-level visit	−18.607 (3685.699)	−19.535 (8120.685)
US or ROK political event	*Omitted*	*Omitted*
US-ROK military event	−0.465 (1.162)	0.015 (1.145)
US negative actions	−0223 (1.417)	1.098 (1.482)
UN event	−1.453 (1.032)	0.678 (1.071)
Other DPRK provocation	−0.135 (0.229)	−0.270 (0.140)*
Declared by the DPRK to be a hostile act	−0.382 (0.906)	0.230 (0.727)
Intercept	0.228 (0.867)	0.767 (0.939)
Large provocations		
DPRK holiday	2.089 (1.965)	1.868 (1.441)
US high-level visit	20.569 (7882.667)	20.651 (4896.756)
US or ROK political event	19.087 (5573.887)	19.970 (8172.91)
US-ROK military event	−14.335 (1675.837)	1.043 (1.325)
US 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 (0.480)**	−0.277 (0.145)*
Declared by the DPRK to be a hostile act	14.601 (1675.836)	0.347 (0.733)
Intercept	−1.045 (1.116)	−1.124 (1.130)

Source: Based on author's calculations.

Notes: $N = 87$. Standard errors shown in parenthesis. Two-tailed statistical significance indicated as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$). 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 $p < 0.05$ level, but only for the Large Provocations category).

Notes

1. Much of this research was carried out over the time period under investigation, as the events happened—meaning a large number of news reports were used to put together the database. Additional open source data were combined from the DPRK Foreign Ministry's 21 November 2016 memorandum; CSIS publications of trigger events and provocations 'DPRK Provocations and US-ROK Military Exercises', 'North Korean Provocations Are Likely Around U.S. Presidential Elections', and 'DPRK Provocations Possible Around South Korean Elections'; lists of DOD ship visits to the region such as those maintained by www.uscarriers.net; US Department of Treasury press releases on sanctions; UN websites on sanctions, reports, meetings, and Council statements; IAEA websites on resolutions on the DPRK; US, Japanese and ROK governmental websites on election dates and leader entries into/exits from office; and US government websites on secretary and presidential travel.

2. It should be emphasized that North Korea may perceive actions taken by others as provocations, just as the USA and international community may perceive actions taken by the DPRK as provocations. However, this article will utilize the terminology 'trigger events' and 'provocations' for easier understanding, as calling both types of events 'provocations' would be needlessly confusing.
3. Also see the 2 October 2017 Beyond Parallels analysis, which breaks DPRK provocations into five categories, roughly similar to the categorization used in this article.
4. Scud, Hwasong-5, Hwasong-6, Toksa, KN-01, KN-02, KN-06 and Frog missiles.
5. Nodong-1 and Taepodong-1 missiles.
6. Musudan/Hwasong-10, Taepodong-2, Taepodong-3/Kwangmyongsong/Unha-3, SLBM (Polaris).
7. However, the sample size for the Kim Jong Un period was only two elections.
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 USA and ROK participate.
9. Assessing the correlation between trigger events and the type of DPRK provocation.
10. 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. The Vuong test indicated that regular negative binomial was a better fit for the 7-day provocation data than the zero-inflated version. Based on the AIC/BIC criterion, 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.
11. 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. The Vuong test indicated that regular negative binomial was a better fit for the 14-day provocation data than the zero-inflated version. 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. 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-zeroinflated Poisson models indicate that there is not a relationship between the predicted and actual outcomes, meaning the regression models are not good fits for the data.
12. While the variance inflation factor (VIF) test indicates that there is no excessive multicollinearity concern with the independent variables,16 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.
13. 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.
14. Although *Other DPRK provocation* was omitted in the 14-day first stage model.
15. If Pr > chi^2 is less than 0.05, the test indicates good model fit.
16. If Pr > chi^2 is less than 0.05, 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.
17. See Appendix 2 for the results of a generalized ordered logit model representing only the second-stage selection (level of provocation) (Williams 2006). Unfortunately, while theoretically a good model to explore, the generalized ordered logit does not produce particularly logical or valid results.
18. This negotiation, as previously noted, fell apart quickly after a tentative deal was reached.

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