

# *Study on Chinese Impact on Economic Sanctions against North Korea*

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## **Study on Chinese Impact on Economic Sanctions against North Korea**

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As the U.S. and South Korea expressed solidarity in blaming North Korea for its attack on the South Korean warship Cheonan and in imposing further sanctions on North Korea, global attention is now focused on China with regard to whether it will cooperate in inflicting punitive measures on its ally. Despite the worsening cleavages between China and North Korea since October 2006 when the latter tested its nuclear weapons, this study shows that their relations has remained robust in the economic context although it has experienced a political transition. This paper begins with the Sino-DPRK relations by exploring the status of the alliance in transition in the political and military context. Further, it considers the economic context between the two nations by reviewing Chinese aid to North Korea and North Korea's trade data, using the "flow of goods" as a proxy for "flow of money." Then, this paper applies North Korea's strategic interaction with the U.S. in the game theoretic methods in order to illustrate the Chinese impact on the efficiency of economic sanctions on North Korea. The study found that China's role remains consequential as the strategies of North Korea and the U.S. depend on China's position in their strategy interaction.

## **Introduction**

The sinking of the South Korean Navy warship, Cheonan, which was attacked by North Korea in March this year, placed inter-Korean relations at its lowest since the 1980s. In response to North Korea's torpedo attack on the Cheonan, the South Korean government announced the termination of economic ties with North Korea, with the only exception of the Gaeseong industrial complex, and the U.S. and South Korea staged joint naval exercises. In response, North Korea threatened to respond with "corpses and graves" to any attempt to invade its soil. Moreover, now, the U.S. plans to issue executive orders to cut off all sources of overseas funding for North Korea's conventional weapons trade and purchase of luxury goods. The U.S. believes that this move will freeze North Korea's assets and further isolate it from the international financial system; this move will also give Pyongyang substantial warnings to stop further provocations.

It has often been said that the relations between China and North Korea have experienced deepening cleavages after Pyongyang carried out nuclear tests in October 2006. There have been certain indications that both China and North Korea, respectively, had reconsidered the nature of their alliance even before 2006, particularly after the normalization of relations between China and South Korea in 1992. However, after the recent Cheonan incident, Kim Jung Il scurried off to Beijing despite his serious health condition, and China welcomed North Korea warmly, while protesting harshly against the joint maritime drills by South Korea and the U.S. Meanwhile, there have been growing debates on China's impact on North Korean affairs. Many agree with the increasingly significant role of China in North Korea, while others argue that China may have less leverage with Pyongyang.

This study is a systematic attempt to demonstrate that China has a consequential impact on North Korea, particularly in terms of the success or failure of sanctions on North

Korea, and argues that without change in the current PRC-DPRK relations, these sanctions may not have much impact on North Korea. The study begins with reviewing PRC-DPRK relations focused on the changes in the nature of the alliance in political, military, and economic contexts. This paper, then, uses a game theoretic approach; more specifically, the authors created sequential game models that were initiated by the U.S. and responded to by North Korea.

It is noteworthy that each player's best option depends, respectively, on the degree of China and North Korea's alliance in the political, military, and economic contexts. This highlights China's significant role in North Korean affairs; if the PRC-DPRK alliance is politically and militarily strong, it will increase the U.S.'s political cost of imposing sanctions on North Korea, and the U.S. might then choose a weak sanction instead of a strong one. If the Sino-DPRK alliance is strong in the economic sense, it will enable Pyongyang to choose to "ignore" pressure from the U.S. This paper derives four possible cases and argues that the goal of the U.S. sanction will be met, indicating that North Korea will conform and stop further provocations only when the PRC-DPRK relations are weak both politically and military, as well as economically. This paper found that the PRC-DPRK relations remain strong in the economic context despite the alliance, which is in transition in the political and military contexts, and argues that as long as the Chinese and North Korean relations maintain their current stance, sanctions against North Korea have little possibility to succeed.

## **PART I: Status of North Korean and Chinese Relations**

### ***Political and Military relations in transition***

The phrase, "relationship between the lips and teeth (脣亡齒寒)," as described by Mao Ze Dong has often been used to describe the close relations between China and North Korea. This Chinese cliché implies that if the North Korean "lips" collapse, the Chinese "teeth" become sensitive. It was the Chinese leadership's mindset that North Korea was a

critical buffer state in Mao's era; and indeed, for many decades, maintaining good relations with North Korea was not simply a matter of having a good neighbor, "but is also linked with the regime's political legitimacy" for China.<sup>1</sup> The Treaty of Friendship, Cooperation, and Mutual Assistance between PRC and DPRK (1961) does exist; however, it became more and more ambiguous in the political and military context. The alliance between China and North Korea in the military context declined since the end of the Korean War, and particularly after Kim Jung Il took over. The 1961 PRC-DPRK treaty, in fact, is not like the ROK-US 1953 Mutual Defense Treaty, lacking basic components like a joint headquarters or joint planning. As a matter of fact, it is noteworthy that military exchange visits and research cooperativeness between South Korea and China became more and more frequent, and it can be an indicator for explaining the status of the PRC-DPRK alliance in a military context.

In fact, there have been growing debates, at least in China, on the interpretations and future directions of the treaty, i.e., whether to keep, revise, or abandon it. As the United States Institute of Peace Working Paper pointed out, "The majority (Chinese) favors retaining the treaty.....Chinese governments welcomes its ambiguity, which leaves both Pyongyang and Washington uncertain about the extent of China's support in a conflict."<sup>2</sup> Although North Korea, so far, heavily relied on Chinese supply of food and energy due to the Chinese leadership's belief that too much push North Korea may risk the stability of the peninsula, their belief can be revised at any time if necessary as the "PRC would be serving its own interest if it acted to neuter Pyongyang."<sup>3</sup>

The traditional blood alliance of the "lips and teeth" began to change, and the shared interest between China and North Korea became blurred as they took incompatible directions since the early 1980s. A larger number of Chinese citizens now view North Korea as a "lipstick" (rather than "lips"), which is increasingly expensive, despite "questionable quality, yet looks good to a cursory glance."<sup>4</sup> North Korea, indeed, is high maintenance for China to manage good relations with. Meanwhile, North Korea often

expressed a callous attitude toward China, since China's decision to be pragmatic is almost an abandoned ideology, and later toward China's rapprochement with South Korea, and more recently, toward China's decision to support the UNSC Resolution 1874.

Despite the deepening downturn in relationships, these alliances swing back and forth within the radius; the pendulum of Sino-DPRK relations swung between "lips and teeth" and "lipsticks and teeth" on the basis of the characteristics of impending issues. For example, after Cheonan, the alliance between China and North Korea seemed to once again become consolidated as Kim Jong Il visited China last May and August despite his deteriorating health. Facing the regime's collapse from the failed currency reform and unfavorable international atmosphere, North Korea once again desperately needs China's support. Particularly, North Korea is in its critical moment since Kim Jung Il is preparing to hand over power to his son; and as such, North Korea is in need of the money to win the loyalty of the military, communist party, and government officials. Further, China also needs to backup North Korea and become wary of the U.S. and South Korea's solidarity.

### ***Economic relations***

#### *Chinese Aid to North Korea*

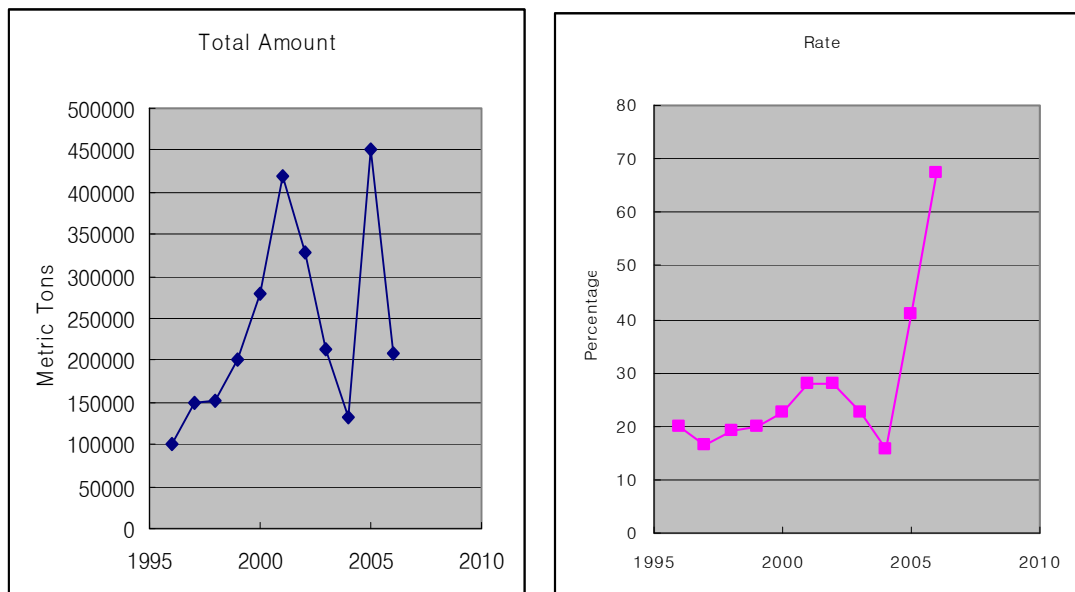
Although there is no open data<sup>5</sup> for Chinese aid to North Korea, and given that China conceals how much of its trade is really aid, it is known that North Korea receives an increasingly high share of the entire Chinese foreign assistance, particularly since the collapse of the Soviet Union. These huge volumes of aid in the form of substantial food and energy supply are directly linked to consolidate Chinese leverage on North Korea. The United States Institute of Peace Working paper cited Chinese specialists estimating that "the assistance budget has continued to expand, from an estimated one-third of China's foreign assistance five years ago to approximately 40 percent of China's foreign assistance.... This proportion likely reflects a considerable jump in Chinese foreign

assistance to the DPRK.”

The chief sectors are the food and energy sectors. In 2008, China reportedly provided 90% of North Korea’s oil and 45% of its food (Gordon Chang, Wall Street Journal; Oct 15, 2009). With respect to the energy sector, in 2009, China exported 519,814 metric tons of crude oil to North Korea, which has been decreased by 1.7 per cent compared to the previous year, and 50,589 tons of gasoline, which is a 17.2 per cent increase. China is not specific about how much of this trade is really aid, and it does not give separate statistics on aid. (Straits Times; May 03, 2010)

Regarding the food sector, the biggest data source is the *International Food Aid Information System (INTERFAIS)* released by the World Food Program. According to this source, as shown in Figure 1, although the total amount of Chinese food aid toward North Korea has been fluctuating, its percentage out of the total amount of aid that North Korea receives has been skyrocketing for the past 5 years, making the country the single largest donor in food aid.

**Figure 1. China’s Food Aid Toward North Korea: Total Amount and Rate**



Moreover, the INTERFAIS does not include food shipments categorized under “export” to North Korea, which is usually provided at “friendship prices.” According to the Chinese customs statistics, China exported almost 2.6 million metric tons of cereal to Pyongyang between 1996 and 2000, which is almost twice as large as all the WFP shipments (CRS Report for Congress).

*North Korea’s International Trade Pattern: Skewed to China*

Let us investigate North Korea’s International Trade Pattern to analyze the status of Sino-DPRK relations in the economic context. As mentioned above, the U.S.’s economic sanctions against North Korea proposed this time focus on blocking the “flow of money” to and from North Korea; however, there are virtually no official data on the “monetary flows,” which show North Korea’s financial transactions with foreign financial institutes. Yet, there have been several trade sanctions against North Korea, from which we can predict the effectiveness of financial sanctions proposed by the U.S. this time. For these reasons, this study uses the indirect approach by using “flow of goods” as a proxy for “flow of money.” The authors found that North Korea’s trade volume and pattern is not affected significantly by trade sanctions imposed by several countries. This is because most exported/imported goods are substitutable, and China does not participate in these sanctions. Therefore, even if country A imposes a trade sanction on North Korea, it can still import/export goods to and from China, respectively. This paper argues that a similar pattern will be observed in the financial sanctions proposed by the U.S.

The authors regard trade volume as a proxy for financial transactions due to the lack of data on North Korea’s international financial transactions. The Korea Trade Investment Promotion Agency’s (KOTRA) overseas offices collect the countries’ trade data with North Korea and release it in their annual report of North Korea’s External Trade Trend.<sup>6</sup> The U.S. trade sanctions against North Korea have risen since the beginning of the 21<sup>st</sup> century, following Bush’s “axis of evil” statement in January 2002, Pyongyang’s nuclear program reactivation in October 2002,<sup>7</sup> and its nuclear tests in October 2006<sup>8</sup> and May 2009.<sup>9</sup> In particular, imports from North Korea are absolutely prohibited. Japan



completely banned both export to and imports from North Korea since its other nuclear test in 2009. Thailand and the EU, which used to be relatively open to trading with North Korea, also participated in economic sanctions against the country following the decision of the United Nations Security Council in 2006. South Korea, which used to be well-known for its so-called Sunshine Policy during the Kim Daejung and Roh Moohyun regimes, has decreased its support since the current Lee administration. However, as shown in Figure 1, North Korea's trade does not seem to be affected by these external environments at all; on the contrary, its total trade volume has been increasing for the past two decades.

**Figure 1. Trend of North Korea's Trade Volume (1991–2008)**



Source: KOTRA

What is the reason behind this? The answer lies in the reality that not all countries enforce sanctions against North Korea. Trading goods can be substituted, so even if a country imposes embargoes against North Korea, the country can still find other nations with which to export and import goods.

Japan is a prime example. Unlike the United States, where trade sanctions have been imposed against North Korea since the Korean War, Japan has recently changed its trade policy toward North Korea. As shown in Tables 1 and 2, Japan used to be one of North Korea's top three trading partners, following China, but its trade with North Korea had dramatically decreased since 2007 after it reportedly imposed a complete ban on importing North Korea's goods in reaction to the latter's nuclear test in 2006.

**Table 1. North Korea's Top 10 Trading Partners**

	2002	2003	2004	2005	2006	2007	2008
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1	China	China	China	China	China	China	China
2	S. Korea	S. Korea	S. Korea	S. Korea	S. Korea	S. Korea	S. Korea
3	Japan	Japan	Thailand	Thailand	Thailand	Thailand	Singapore
4	Thailand	Thailand	Japan	Russia	Russia	Russia	India
5	India	India	Russia	Japan	Japan	India	Russia
6	Germany	Russia	India	Singapore	India	Brazil	Thailand
7	Singapore	Netherlands	Germany	Germany	Germany	Singapore	Brazil
8	Russia	Germany	Singapore	Netherlands	Singapore	Germany	Germany
9	Hong Kong	Singapore	France	France	Netherlands	Netherlands	Netherlands
10	Netherlands	Italy	Sweden	India	Sweden	Taiwan	Hong Kong

Source: KOTRA

Note: KOTRA's report does not count South Korea because it considers trade between the two Koreas as intra-national trade instead of international trade. This paper simply assumes that South Korea is one of North Korea's international trading partners.

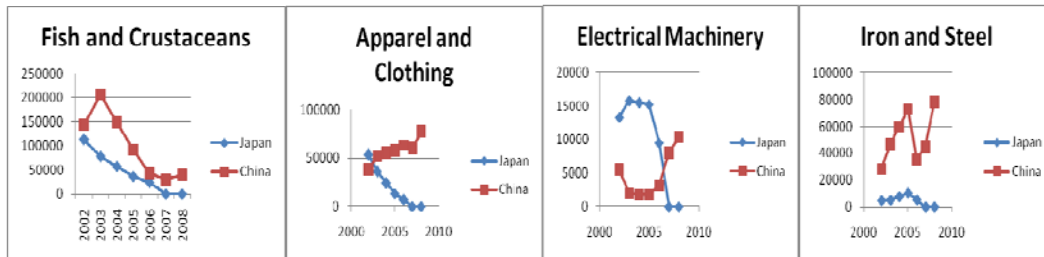
**Table 2. North Korea's Trade with Major Partners (Unit: Million USD)**

	2002	2003	2004	2005	2006	2007	2008
China(1)	738.2 (25.4%)	1,022.9 (32.8%)	1,385.2 (39%)	1,580.3 (38.9%)	1,699.6 (39.1%)	1,974.0 (42.7%)	2,787.3 (49.5%)
S. Korea(2)	641 (22.1%)	724 (23.2%)	697 (19.6%)	1,055.8 (26%)	1,349.7 (31.1%)	1,797.9 (38.9%)	1,820.3 (32.3%)
(1)+(2)	1,379.2 (47.5%)	1,746.9 (56%)	2,082.2 (55.6%)	2,636.1 (64.9%)	3,049.3 (70.2%)	3,871.9 (81.6%)	4,607.6 (81.8%)
Japan	369.5 (12.7%)	265.3 (8.5%)	252.6 (7.1%)	193.6 (4.8%)	121.6 (2.8%)	9.3 (0.2%)	7.7 (0.1%)
Thailand	216.6 (7.5%)	254.3 (8.2%)	329.9 (9.3%)	329.2 (8.1%)	374.2 (8.6%)	228.7 (4.9%)	76.8 (1.4%)
Russia	80.7 (2.8%)	118.4 (3.8%)	213.4 (6%)	232.3 (5.7%)	210.6 (4.8%)	159.6 (3.4%)	110.5 (2%)

Source: KOTRA

However, Japan's sanctions against North Korea have not been very effective, for North Korea switched partners and increased trade with China and South Korea instead of with Japan. Figure 3<sup>10</sup> displays North Korea's four major exports to China and Japan. Again, this figure generally explains the same trend; trade with Japan is getting replaced by trade with China.

**Figure 3. North Korea's Major Exports to China and Japan**



Source: KOTRA

Note: Trade volume in 2004 is an average of the volume between 2003 and 2005, as the data for this year is currently not accessible.

Apparel and Clothing (HS Code 62)<sup>11</sup> and Electrical Machinery (HS Code 85)<sup>12</sup> are obvious examples describing North Korea's trade conversion from Japan to China. The figure showing Fish and Crustaceans (HS Code 3)<sup>13</sup> is not easy to understand, as both China and Japan show a decreasing demand for these goods. A key reason for this change lies in the plummeting prices of squid, octopus, and crab—North Korea's major exports—by as much as 40~60% (KOTRA). However, KOTRA revealed that the decrease in exporting fish and crustaceans to *Japan* is due rather to its extended economic sanctions against North Korea, which include prohibiting the entry of any North Korean vessels, implementing Catch-All Rules,<sup>14</sup> and imposing stricter customs for North Korean goods (KOTRA).

In this situation, North Korea is trying to diversify its trading partners. North Korea's traditional big four trading countries used to be China, South Korea, Japan, and Thailand, but, as displayed in Table 2, Japan and Thailand were replaced by Singapore and India in 2008. Also, Brazil recently emerged as one of North Korea's top ten partners. Given that Japan's sanctions against North Korea are getting stronger, and Thailand joined the embargo club in 2007 following the decision of the UN Security Council, this trend is expected to continue in 2009 and onwards.

This result gives us an idea on the outcome of the U.S.'s financial sanctions. As in the case of trade, most of North Korea's financial transactions are with China, so, U.S.'s

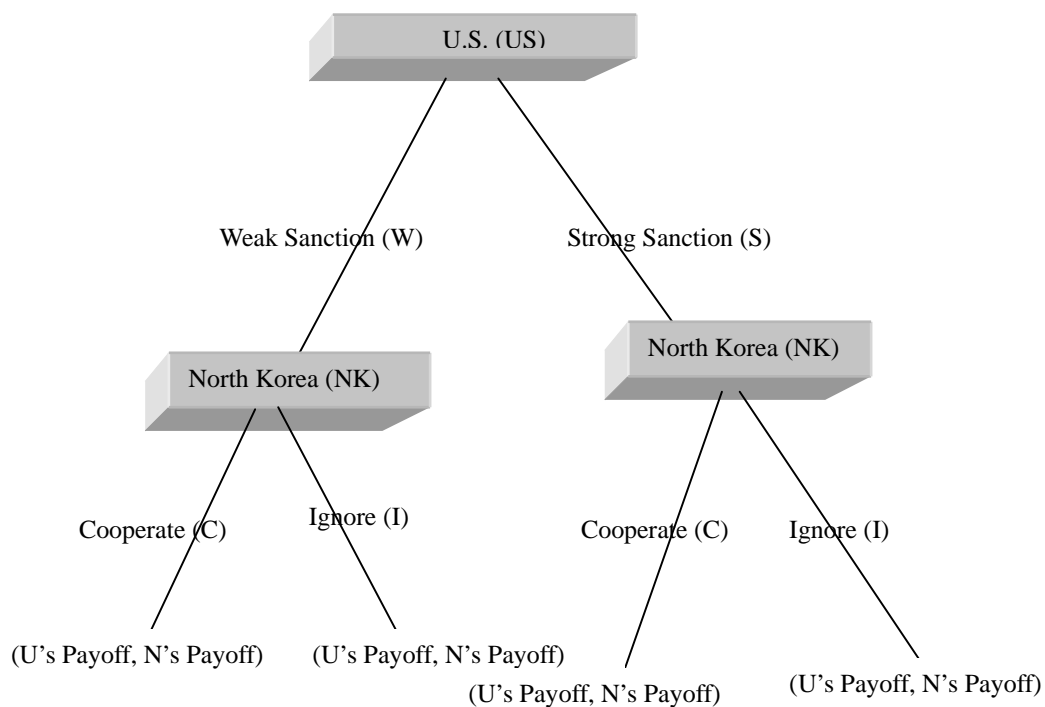
financial sanction against North Korea this time would not be effective at all without China's strong cooperation.

## **PART II: China's role in the strategic interactions of the U.S. and North Korea—A Game Theoretical Approach**

How significant is the impact of the Chinese factor in the possibility of successful outcomes by imposing sanctions on North Korea? The authors found that a game theoretic model that considers U.S.'s economic sanctions against North Korea can provide the answer. In fact, such an approach is widely used in international crises, conflict resolution, or civil military relations studies. Simon (1996) explained the U.S.'s economic sanctions against Vietnam and Haiti through similar approach. Mor (1995) also uses the so-called theory of moves to develop a general model of international crisis, and Jayakar (1997) analyzed the U.S–China copyright dispute using the “two-level games analysis.” Feaver (1998) and Hunter (1998) contributed to civil-military relations using the game-theoretic approach with an agent model. Using a method similar to that of Feaver (1998) and Hunter (1998), this study generates four different scenarios depending on each player's decision and develops an idea of finding a subgame-perfect Nash Equilibrium (SPNE, hereafter) in each scenario. Payoffs of this game are based on the assumption that ordinal preference ordering of each scenario could be transformed into cardinal numbering, which was originally adopted by Hunter (1998). This is a sequential game<sup>15</sup> initiated by the U.S. and responded to by North Korea. The most tricky and interesting aspect of this game is about how to deal with China. What we propose is a typical two-player game, even though this game involves three countries (the U.S., North Korea, and China). We solve this problem by implicitly including China in the game by assuming that China's decision affects both players' decisions. Specifically, U.S.'s decision to impose strong levels of sanction against North Korea depends on whether China considers the latter its strong political alliance. Further, Pyongyang's decision to cooperate with the U.S.'s requests depends on whether China considers providing North Korea with sufficient economic support. whether China consider North Korea as its strong political alliance affects the U.S.'s decision on whether or not strong level of

sanctions should be imposed, and whether China consider providing sufficient economic support toward North Korea affects Pyongyang's decision on whether or not it should cooperate the U.S.'s request. In this manner, China's role can be analyzed without including it in the game.

**Figure 4. A U.S.- North Korea Sequential Game**



As displayed in Figure 4, this is a game between two players—the U.S. and North Korea. The U.S. makes the first move and North Korea responds. The former can choose between two strategies—weak level of sanctions (W) or strong level of sanctions (S). Since the U.S. had already announced that it would impose further economic sanctions, “no sanction” is not considered a strategy. Whether the U.S. chooses W or S depends on China's position. If Sino-DPRK relations are strong in the political and military context, China will be against the idea of imposing a strong level of sanctions against its ally; hence, the U.S. has to face significant political burden by imposing sanctions. Therefore, the marginal cost of imposing a strong level of sanctions will be greater than the marginal benefit from compelling North Korea to come to the negotiating table—the U.S. may choose W over S. On the other hand, if the Sino-DPRK relations are weak in the political

and military context, China may not bother that much, in spite of the strong levels of sanctions imposed by the U.S. In this case, the U.S. may choose S over W.

In response to the U.S.'s choices, North Korea faces two strategies—"Cooperate (C)" or "Ignore (I)." If the U.S. chooses W, North Korea may choose I by assuming that it basically wants larger compensations before reaching the negotiating table, which indicates the end of the game. However, if the U.S. chooses S, North Korea's decision depends on China's position. If China provides strong economic support such that North Korea has enough resources to survive under the strong economic sanctions, Pyongyang will keep choosing I. However, if China's economic support is not sufficiently strong, North Korea may end up choosing S (strong sanction) for the regime's sustainability.

On the basis of the above discussion, we can make several assumptions to derive the preference ordering of each player.

(A.1) Sanctions increase the cost to the U.S., which is mainly a political burden toward China. Therefore, if all other things are equal, the U.S. would prefer<sup>16</sup> W over S.

(A.2.) The U.S. wants North Korea to choose C over I and to come to the negotiating table.

(A.3.) If the U.S. chooses W, North Korea prefers I over C in order to maximize its bargaining power before coming to the negotiating table.

(A.4.) If the U.S. chooses S, North Korea will end up choosing C over I, unless China provides strong economic support.

(A.5.) North Korea wants the U.S. to choose W over S, as being sanctioned creates economic burden for North Korea.

In deriving the Nash Equilibrium, this study argues that China's relationship with North Korea plays a key role. For research purposes, let us divide the China–North Korea relationship into two parts—alliance in the political sense and that in the economic context. Depending on the degree of relations both politically and economically, let us consider two levels—politically/economically strong and politically/economically weak, and politically/economically none. This paper defines "strong" in three different contexts.

First, “strong relations in the political and military context” indicates the robust alliance that U.S. is unable to impose further sanctions due to China’s protests. Second, “strong economic support” by China implies that North Korea can fully survive, regardless of sanctions by the U.S. Whether the Sino-DPRK alliance is politically strong has an impact on the U.S.’s strategic choice, and whether China’s economic support is strong has an impact on North Korea’s strategic choice. Additionally, a “strong sanction” implies that North Korea cannot survive without China’s support.

In fact, we discussed three levels (strong, weak, and none). However, it will be argued later in this section that the second and third levels are logically no different. Therefore, this paper will focus only on the first and second cases. This scenario wherein China completely cuts its political ties with North Korea and provides no economic support is neither intuitive nor realistic.

Let us first discuss the U.S.’s preference orderings. The U.S. will prefer W over S depending on (A.1), and it will want North Korea to choose C over I depending on (A.2). Therefore, WC would be the U.S.’s most preferred scenario as it satisfies both (A.1) and (A.2), and SI would be its least preferred scenario, as it satisfies neither (A.1) nor (A.2). (A.2) also indicates that  $WC \succsim WI$  and  $SC \succsim SI$ .

In that case, which scenario, between WI and SC, would be more preferred by the U.S.? WI is the case wherein the U.S. is unable to achieve its goal to stop North Korea’s further provocations instead of a low protest from China; SC is the vice versa. If the relations between China and North Korea are strong in the political and military context, the U.S.’s marginal cost of imposing sanctions is greater than its marginal benefit from North Korea’s reaching the negotiating table, making  $WI \succsim SC$ . If a political alliance between China and North Korea is *weak*, then  $SC \succsim WI$ .

On the other hand, North Korea will want the U.S. to choose W over S on the basis of (A.5). (A.5) also indicates that North Korea would prefer WI to SI and WC to SC, whereas (A.3) implies that North Korea would prefer WI to WC. Therefore,  $WI \succsim SI$ , and,

by transitivity,  $WI \succeq WC \succeq SC$ , from this we can consider three cases—(1)  $WI \succeq SI \succeq WC \succeq SC$ , (2)  $WI \succeq WC \succeq SC \succeq SI$ , and (3)  $WI \succeq WC \succeq SI \succeq SC$ .

The first case would be the result of China providing *strong* economic support. In this case, even if the U.S. imposes strong sanctions against North Korea, North Korea would receive sufficient financial compensation to sustain its regime. Therefore, depending on (A.3) and (A.4), North Korea's marginal benefit from ignoring will be greater than its marginal cost of being sanctioned, and Pyongyang will prefer SI over WC.

The second case would be the result of China providing *weak* economic support. In this case, this support cannot cover the loss resulting from the strong economic sanctions imposed by the U.S. In other words, the marginal cost of being sanctioned is greater than the marginal benefit from being supported by China—therefore,  $WC \succeq SI$ . Additionally, depending on (A.4),  $SC \succeq SI$ , while depending on (A.5),  $WC \succeq SC$ .

The third case does not make sense. If China's economic support toward North Korea is strong,  $SI \succeq WC$ , and if China's economic support is weak,  $SC \succeq SI$  depending on (A.4). Therefore, this study does not further consider this case.

To sum up, the U.S.'s preference ordering is  $WC \succeq WI \succeq SC \succeq SI$  if the political alliance between China and North Korea is strong and  $WC \succeq SC \succeq WI \succeq SI$  if their political relations are weak. North Korea's preference ordering is  $WI \succeq SI \succeq WC \succeq SC$  if China's economic support toward North Korea is strong and  $WI \succeq WC \succeq SC \succeq SI$  if its economic support is weak.

In that case, what if the level of political alliance and economic support are both zero? To conclude first, “zero level of alliance” and “no support” are not different from “weak level of ally” and “weak support.” When the political alliance between China and North Korea is weak, the U.S.'s preference ordering is  $WC \succeq SC \succeq WI \succeq SI$ . Even if the two countries' political alliance is zero such that there is no political cost of imposing sanctions, the U.S. will not choose S. This is because if North Korea chooses C, the U.S.



will prefer WC to SC, and if Pyongyang chooses I, the U.S. will still prefer SI. Additionally, the U.S. will prefer SC to WI as there is no cost of imposing sanctions, and there *is* a benefit of compelling North Korea to come to the negotiating table.

The same logic can be applied to North Korea. When China's economic support toward North Korea is weak, Pyongyang's preference ordering is  $WI \succsim WC \succsim SC \succsim SI$ . If China's economic support toward North Korea is zero, North Korea will prefer WI to WC, as it can endure a weak level of sanctions but will prefer SC to SI to survive the strong level of sanctions imposed by the U.S. Further, if North Korea decides to choose C, WC will be preferred over SC. Given this, North Korea's preference ordering is actually the same irrespective of whether the economic support is weak or zero.

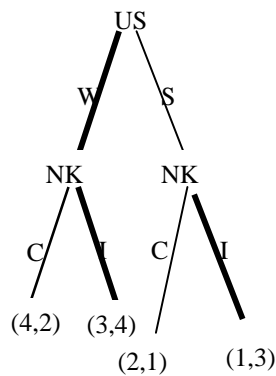
To sum up, depending on the strength of the political alliance and economic support, we can consider the following four cases.

**Table 3. Preference orderings in Each Scenario**

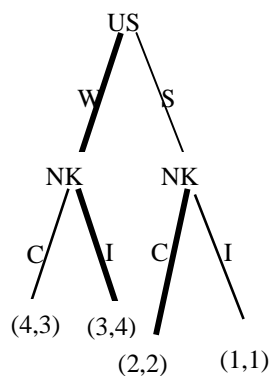
	Economically Strong (3)	Economically weak (4)
Politically/Militarily strong(1)	U.S.: $WC \succsim WI \succsim SC \succsim SI$ N.K.: $WI \succsim SI \succsim WC \succsim SC$	U.S.: $WC \succsim WI \succsim SC \succsim SI$ N.K.: $WI \succsim WC \succsim SC \succsim SI$
Politically/Militarily weak(2)	U.S.: $WC \succsim SC \succsim WI \succsim SI$ N.K.: $WI \succsim SI \succsim WC \succsim SC$	U.S.: $WC \succsim WI \succsim SC \succsim SI$ N.K.: $WI \succsim WC \succsim SC \succsim SI$

Now, using Hunter (1998)'s method, we can assign the numbers 1 to 4 in the order of the least preferred to the most preferred. In fact, these preferences are ordinal, and the numbers themselves do not mean anything<sup>17</sup>. However, we can easily derive the equilibrium by assigning numbers. The game trees in Figure 5 summarizes the payoffs in each case.

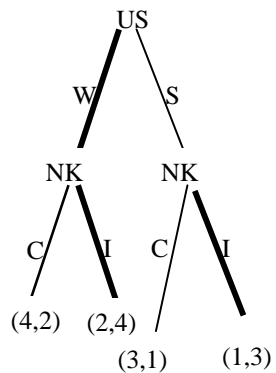
**Figure 5. Payoffs in Game Trees**



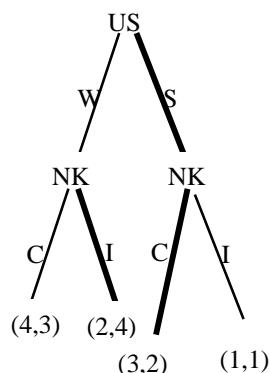
(1) & (3)



(1) & (4)



(2) & (3)



(2) & (4)

Let us use the concept of backward induction to derive the subgame perfect Nash Equilibrium (SPNE). This SPNE is “perfect” when an empty threat is ignored. For example, in game trees (2) & (4), suppose that North Korea threatens the U.S. by saying that it will choose I over S irrespective of what the U.S.’s chooses. In response, the U.S. will choose W, because then, it will get 2, but if it chooses S, it will get 1. Therefore, (U.S, N.K.) = (W, I) is one of the Nash Equilibria. However, this equilibrium is not perfect, because North Korea’s strategy I is an empty threat.<sup>18</sup>

Starting from the latter subgames where the North Korean plays are considered first, North Korea chooses either C or I based on its payoff. Assuming that North Korea is

rational and chooses a strategy that maximizes its payoffs, the U.S. chooses either W or S in the upper game. According to Figure 5, the SPNE is (U.S., North Korea) = (W, I), except in the last case where both political alliance and economic support are weak.

In sum, this can be interpreted as follows: SPNE is (S, C) only when the Sino-DPRK relation is politically and militarily weak such that it serves as a lesser burden for the U.S. in imposing sanctions on North Korea; at the same time, the relations are economically weak as well, such that it is hard for North Korea to endure insufficient supplies from China; otherwise, SPNE is (W, I) in all other cases. In other words, this highlights China's significant role in the strategic choices of both the U.S. and North Korea.

## **Conclusion**

Hitherto, we have seen that there has been a transition in the Sino-DPRK relations in terms of political and military contexts, and it swings back and forth within the radius of “lips and teeth” and “lipstick and teeth” relations depending on the characteristics of impending issues. This is precisely why South Korea and the U.S. have been frequently confused about whether China is a credible partner in stopping North Korean provocations or a partner with a duplicitous character. On the contrary, we have also seen that the economic aspect of China and North Korean relations have been increasingly stable and robust. It is useful to separately analyze the political, military, and economic contexts of the relations; however, at the same time, the authors believe that maintaining strong economic ties between the two countries eventually has political and military aims. As the findings from the above game theoretic approach between the U.S. and North Korea suggest, China is the pivotal factor in dealing with North Korean affairs; it is the key to the success or failure of sanctions on North Korea.

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<sup>1</sup> Andrew Scobell, China and North Korea: From Comrades-in-Arms to Allies at Arm's Length, p. 2, March 2004, available at <http://www.carlisle.army/ssi>

<sup>2</sup> Glaser, Bonnie, et al, Keeping an Eye on an Unruly Neighbor, Chinese Views of Economic Reform and Stability in North Korea, January 3, 2008, United States Institute of Peace Working Paper, p.9. available at [www.usip.org](http://www.usip.org).

<sup>3</sup> Doug Bandow, Confronting North Korea: Who's in Charge?, The Daily Caller, June, 9, 2010, Cato Institute, available at [www.cato.org](http://www.cato.org)

<sup>4</sup> Andrew Scobell, China and North Korea: From Comrades-in-Arms to Allies at Arm's Length, p. 18-19, March 2004, available at <http://www.carlisle.army/ssi>

<sup>5</sup> The decision on China's aid toward North Korea is usually made in two countries' summit meetings or high level officers' meetings. Oftentimes, the aid is provided as a form of 'gift'. (Cho Myung Cheol, China's Role and Aid toward North Korea, KIEP, in Korean. 중국의 역할과 대북경제지원 방안)

<sup>6</sup> in Korean, 북한의 대외무역동향

<sup>7</sup> The crisis in October 2002 peaked when North Korea expelled International Atomic Energy Agency (IAEA) agents and declared that it would withdraw from the Non-Proliferation Treaty (NPT) (Rennack).

<sup>8</sup> Specifically, North Korea's account in Banco Delta Asia (BDA) was frozen, and the North Korean Nonproliferation Act was passed to minimize the country's contact with companies related with weapons of mass destruction (WMD). Not only the United States but also the United Nations Security Council imposed sanctions, including blocking trade on military and technological materials and luxury goods. These sanctions (1695 and 1718) were the first two sanctions imposed by the UN.

<sup>9</sup> The third UN sanction was imposed after North Korea's second nuclear test, confirming the implementation of Sanction 1718. The contents of the bilateral sanction imposed by the United States are not yet reported. One reason for this may be that since there are almost no contact between the two countries, including exports and imports, some people are skeptical about the effect of the sanction. Another reason that can be considered is that the current Obama regime is more open to dialogue with North Korea than was the Bush administration.

<sup>10</sup> Korea was excluded in this figure because the South Korean government does not categorize trade between South and North Korea as 'international' trade, and it uses different way of categorizing export and import goods. Total amount in "international" trade is categorized into goods-specific volume using the HS Code system, but trade between South and North Korea is categorized in a broader way. For example, one of North Korea's major exports is classified as "fish and crustaceans," but its counterpart in South and North Korea is "goods in agriculture, forest, and fishery," which makes direct comparison very difficult.

<sup>11</sup> The official title of HS Code 62 is "Articles of apparel and clothing accessories, not knitted or crocheted."

<sup>12</sup> The official title of HS Code 85 is "Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sounds recorders and reproducers, and parts and accessories of such articles."

<sup>13</sup> The official title of HS Code 3 is "Fish and crustaceans, mollusks and other aquatic invertebrates."

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<sup>14</sup> This rule, proposed by the U.S. Department of Commerce, Bureau of Industry and Security (BIS), would require exporters to obtain licenses for certain goods, software, and technology that are related to military use (KOTRA).

<sup>15</sup> The sequential game is generically a game with perfect information. This is a reasonable assumption, as government's action is easily revealed by military. Technically, games with imperfect information can be shown by drawing the so-called information set. In this case, the second player (military) does not know which strategy was chosen by the first player (civilian government), and this game is functionally the same as simultaneous game. This case is not considered in this study.

<sup>16</sup> Strictly speaking, choice and preference is different. In microeconomic theory, choice is an arbitrary observation, whereas preference is a well-organized theory with six axioms (complete, transitive, reflexive, monotone, convex, and continuous). However, these two concepts are closely related (I choose A over B because I prefer A to B), so this paper interchangeably use this two words. Moreover, this paper assumes that choices (or preferences) made by the U.S. and North Korea satisfy those six axioms.

<sup>17</sup> Ordinal property is fundamentally different from cardinal property. For example, temperature is ordinal. We know that 20 degrees (Celsius) is warmer than 10 degrees (Celsius). However, we do not say that weather in 20 degrees is twice warmer than that in 10 degrees. In other words, we know the order of warmness from the temperature, but we do not compare the numbers themselves. On the other hand, length is cardinal. We can clearly compare 100cm with 50 cm and say that 100 cm is twice longer than 50cm.

<sup>18</sup> To figure out whether a strategy is an empty threat or not, we can look at the payoff. When the U.S. chooses S, North Korea will choose C to maximize its payoff (North Korea will get 3 if it chooses C, m but will get 1 if it chooses I). This is nothing more than an empty threat because North Korea will end up choosing C even though it declares it will choose I. This paper does not take this kind of imperfect equilibrium into consideration.