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The Logic of the Survival of North Korea

Kentaro Hirose
(Waseda University)

Shuhei Kurizaki
(Waseda University)

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The Logic of Survival of North Korea

Kentaro Hirose* Shuhei Kurizaki

(Waseda University)

ABSTRACT

Why has North Korea been able to survive up to this date, while other rogue states such as Afghanistan and Iraq have suffered military intervention by the United States? To solve the puzzle, we present a two-level game model that takes into account interactions between domestic and international conflicts. The United States and a minority group in a rogue state have a shared interest in attacking the common enemy, but each of them has an incentive to peacefully settle its dispute on its own while taking advantage of the other's attack. We find that the military contribution of one party to the other in the informal alliance is the key to overcoming the free-rider problem. In an ethnically homogenous society like North Korea, the size of a minority group, if any, is extremely small and so is its military contribution to an international war, reducing US's incentive for military intervention. On the other hand, in a heterogeneous society, the size of a minority group is relatively large and so is US's incentive to jointly attack the common enemy, leading to wars at both the domestic and international levels.

JEL Classification Codes: C730, F510

Keywords: North Korea, Conflict Resolution, Ethnicity, Repeated Prisoners' Dilemma

* *Corresponding author*: Department of Political Science and Economics, Waseda University, 1-6-1 Nishi-waseda, Shinjuku-ku, Tokyo, Japan. 169-8050. E-mail: khirose@aoni.waseda.jp

1 Introduction

North Korea's survival is an outlier to the fate of other rogue states in the recent history of world politics. In the past few decades, Iraq, Afghanistan, Libya, Syria and Yugoslavia, to name a few, have suffered destructive aggression by US-led coalitions because of the threats they had imposed to the world's stability. On the other hand, North Korea has been able to survive up to this date without suffering armed intervention despite the long-term conflict with the United States over multiple issues such as nuclear development, violation of human rights, and support for terrorism. The question is: What explains the survival of North Korea in world politics?

Some might argue that its possession of nuclear weapons have worked as a deterrent threat against U.S. aggression. In fact, there is no doubt that North Korea's nuclear armament would increase the cost of war for the United States and thus reduce its incentive to use force in the Korean Peninsula. However, this view that focuses on nuclear deterrence cannot explain the peace during nuclear development. The success of North Korea's nuclear program substantially increased its military capability, which now limits what the United States can do in East Asia but also threatens its homeland security. But if so, why did not the United States use force in the first place to prevent North Korea from developing nuclear weapons? Scholars of world politics often consider that large, rapid shifts in the distribution of power lead to war (Fearon 1995; Powell 2006), and that nuclear development is dangerous to the world's peace in this regard (Sagan and Waltz 2002). Nuclear deterrence may explain the peace in the present, but it does not help us understand the peace in the past.

As an alternative explanation, some might also argue that the balance of conventional forces between North Korea and the United States have worked as mutual deterrence. In fact, North Korea has been one of the most powerful rogue states in the world in terms of conventional material capabilities, indicating that compared to other rogue states the power of North Korea is relatively balanced in relation to the United States. However, as shown in Figure 1, a balance of power does not reduce the likelihood of war, rather it increases it (Organski 1968; Blainey 1988; Reed 2003). War is least likely between the strong and the weak (and most likely between the equals) because "the greatly stronger side need not fight

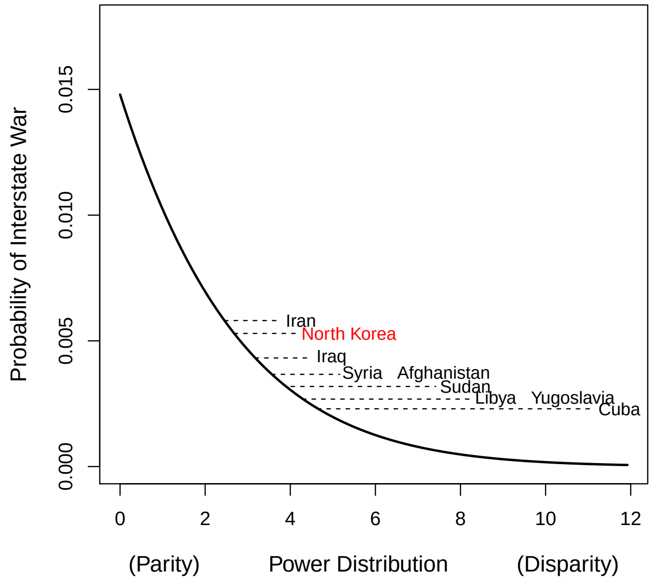

Figure 1: In terms of the distribution of conventional forces, North Korea is likely to fight with the United States. The curve represents the predicted probability of war as a function of the power distribution between two states. The unit of analysis is the non-directed politically relevant dyad, 1946-1999. The distribution of power is measured by the log ratio of the higher CINC index to the lower one in a given dyad-year, where a CINC (Composite Indicator of National Capability) index is computed as an average of the following six factors: total population, urban population, iron and steel production, energy consumption, military personnel, and military expenditure (Singer, Bremer and Stuckey 1972). Each country label expresses the relationship between the country and the United States in 1999. The data on war are derived from the Militarized Interstate Dispute data set in the Correlates of War project (Ghosn, Palmer and Bremer 2004).

at all to get what it wants, while the weaker side would be plainly foolish to attempt to battle for what it wants" (Organski 1968, *p.* 294). From the point of view of this widely accepted finding in international relations, it is difficult to see the balance of conventional forces between North Korea and the United States as the cause of North Korea's survival in world politics.

Furthermore, as a determining factor for the lack of military confrontation in the Korean Peninsula, some might also focus on the interests of U.S. allies in East Asia. It is almost for sure that a war between North Korea and the United States will have catastrophic impacts on the security and the economy of East Asian countries such as South Korea and Japan. It is, therefore, conceivable that the United States have refrained from using force as a result of responding to the call for regional stability from its East Asian allies. However, defending the interests of one's allies is merely a secondary goal in the anarchic international system; a state's ultimate goal is the pursuit of it's own national interests, and allies are just a means of it (Mearsheimer 2001). The United States has a keen interest in North Korea not because of the threats it imposes to its allies, but because of the issues, such as proliferation of weapons of mass destruction and sponsoring of terrorism, that would directly affect its security. Hence, we cannot completely deny the possibility that the United States would have attempted to resolve these problems, if necessary, with the use of force at the expense of the interests of its allies. In fact, despite the negative impacts on the security and the economy of Israel, the most important ally in the Middle East, the United States have aggressively intervened in the region. The association between the interests of allies and the peace in East Asia is merely a correlation, not a causation.

In contrast to the possible explanations described above, this paper attempts to explain the survival of North Korea by focusing on its extremely high level of ethnic homogeneity. As shown in Figure 2, North Korea is the *most* homogenous society in the world, suggesting a clear distinction from other rogue states in terms of ethnic composition. To explain how ethnic homogeneity leads to peace, we present a two-level game model in which domestic and international conflicts interact with one another.

Figure 3 illustrates the basic structure of the two-level game. Let us consider a situation where the United States and a rogue state are involved in a dispute over an issue such as support for terrorism, proliferation of weapons of mass destruction, and large-scale violation of human rights. In addition to the international dispute, the rogue state is also involved in a conflict with its minority group over a domestic issue such as political inequality, economic disparity, and ethnic discrimination. Since the rogue state is the common enemy of the United States and the minority group, they are potential allies for coordinated attack: US's attack against the rogue state increases the chance of the minority's victory in a civil war, while the minority's insurgency against the autocratic government increases the likelihood of US's victory in an international war. In this sense, the prospect for each war is endogenous to one another: the likelihood of a civil war influences that of an international war, and vice versa.

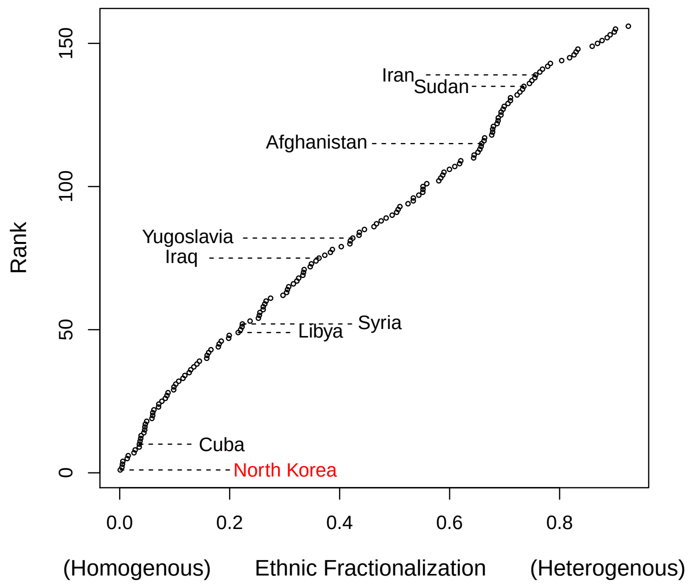

Figure 2: North Korea is the *most* homogenous society in the world. Ethnic fractionalization is measured by the ethnolinguistic fractionalization (ELF) index, which is the probability that two randomly drawn individuals in a country are from different ethnic groups. Each country label expresses the observation for the country in 1999. The data are derived from Fearon and Latin (2003).

Using the two-level game model described above, we show that despite the inefficiency of wars they can break out when the prospect for each war is endogenous to one another. Although there always exists a set of agreements both parties in a dispute prefer to a war (Fearon 1995), military confrontation can actually occur at both the domestic and international levels if the United States and the minority group can cooperate with each other to attack the rogue state. Both US and the minority may get better off it they can jointly attack their common enemy, but each of them has an incentive to peacefully reach an agreement on its own while taking advantage of the other's attack, reducing their incentive to actually use force. Unless they overcome this free-rider problem, they end up in an outcome where none of them attacks, leading to domestic and international peace. As a determining factor for the success or failure of cooperation between the potential allies, we focus on the military contribution of one party to the other in the informal alliance. If the contribution of the minority to an international war is relatively large and so is that of US to a civil war, then they can coordinate with other to jointly attack the rogue state, leading to wars at

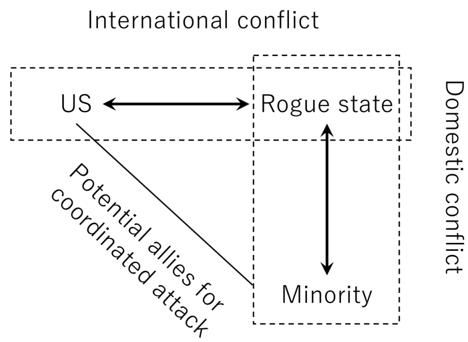

Figure 3: My enemy's enemy is my friend. A rogue state is involved in disputes not only with the United States but also with its minority group. The rogue state is, therefore, the common enemy of the United States and the minority group, suggesting the possibility of coordinated military operation between the informal allies.

both the domestic and international levels. In contrast, if at least one of the contributions is relatively small, then they fail to attack the common enemy jointly or even unilaterally, leading to domestic and international peace.

Figure 4 illustrates the causal mechanism of how ethnic composition affects domestic and international outcomes. In an ethnically homogenous society like North Korea, the size of a minority group, if any, is relatively small and so is its military contribution to an international war, reducing US's incentive for military intervention; and since US intervention is unlikely, it is too risky for the minority group to launch an insurgency against the autocratic government. On the other hand, in an ethnically heterogenous society, the size of a minority group is relatively large and so is its contribution to an international war, increasing US's incentive to fight against the common enemy; and the high likelihood of US intervention motivates the minority to launch an insurgency against the autocratic government, leading to wars at both the domestic and international levels.

In the next section, we formally analyze the two-level game described above to explain North Korea's survival in world politics. Then, we conclude the paper by discussing some implications for empirical research.

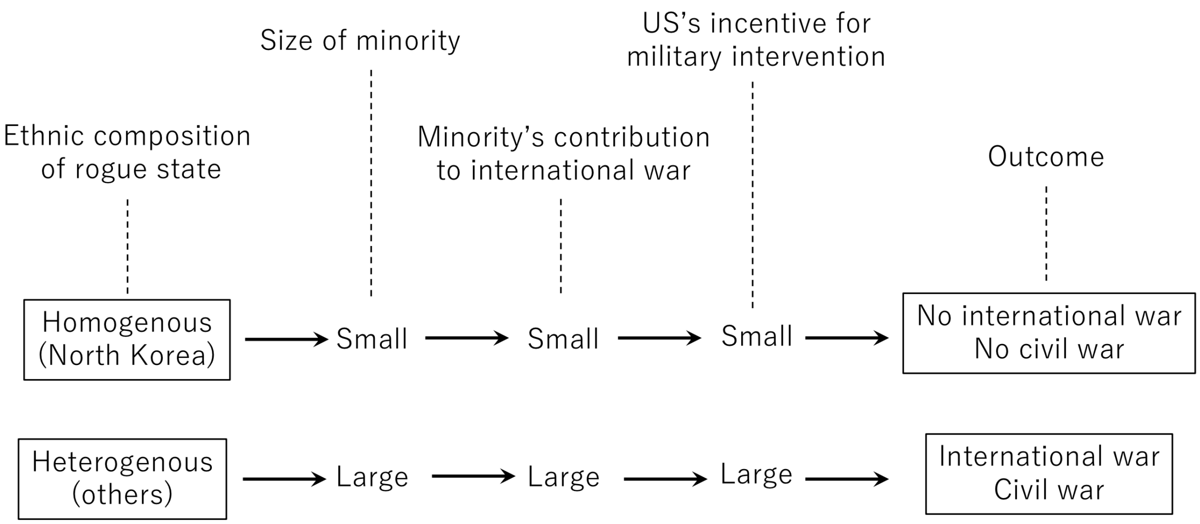

Figure 4: Causal mechanism of how ethnic homogeneity (heterogeneity) in a rogue state leads to domestic and international peace (wars).

2 Theory

Suppose there are two states, A (the United States) and B (a rogue state), that have conflicting interests over an international issue. In addition to the dispute at the international level, state B is also involved in a conflict with its minority group b over a domestic issue. We assume that the international issue is represented by the interval between 0 and 1, and that state A (B) prefers outcomes closer to 1 (0). Similarly, we assume that the domestic issue is expressed by the interval between 0 and 1 with larger (smaller) values indicating b's (B's) favorite outcomes.

Each player simultaneously decides whether to attack its opponent(s). That is, state A decides whether to attack state B; minority b decides whether to attack state B; and state B decides whether to attack both state A and minority b, or only state A or minority b, or none. We consider two outcomes for each dispute: war and peace. If at least one of states A and B attacks the other side, then an international war breaks out; a peaceful resolution is achieved when and only when both of them refrain from using violence against one another. Similarly, if at least one of minority b and state B attacks the other side, then a civil war

State B \ State A	Attack A	Not Attack A	State B \ Minority b	Attack b	Not Attack b
Attack B	Int'l War	Int'l War	Attack B	Civil War	Civil War
Not Attack B	Int'l War	Peaceful Settlement	Not Attack B	Civil War	Peaceful Settlement

Table 1: Outcomes of domestic and international conflicts.

breaks out; the dispute is settled peacefully when and only when none of them resorts to force. There are four possible combinations of domestic and international outcomes: wars at both the domestic and international levels; a peaceful settlement only for international actors; a peaceful settlement only for domestic actors; and peaceful settlements at both levels. Table 1 displays the outcomes of this game as a function of the players' strategies.

The utility of state A depends on the outcome at the international level, whereas that of minority b varies depending on the outcome of the domestic dispute. On the other hand, since state B is involved in domestic and international disputes, its utility is a sum of the payoffs it obtains from both outcomes.

We first describe the payoffs derived from an international war. If it breaks out, state A prevails with probability $p \in [0, 1]$, and the winner takes everything — i.e., each state gets the whole pie of size 1 if it wins and nothing otherwise. The expected payoffs of an international war are thus expressed as $p(1 - c_A) + (1 - p)(0 - c_A)$ or $p - c_A$ for state A, and $p(0 - c_B) + (1 - p)(1 - c_B)$ or $1 - p - c_B$ for state B, where $c_i > 0$ is the cost of an international war for state $i \in \{A, B\}$. We assume that the probability of state A's winning an international war varies as a function of the outcome at the domestic level:

$$p = \begin{cases} p_H & \text{if} \quad \text{a civil war breaks out in state } B \\ p_L & \text{if} \quad \text{a civil war does not break out in state } B \end{cases} \tag{1}$$

where $p_L < p_H$. That is, state A is more likely to win an international war if a civil war breaks out in state B; the outbreak of a civil war forces state B to fight against not only state A but also minority b at the same time, and thus reduces the amount of resources it can utilize for an international war. The relationship between p_H and p_L can be specified as the following equality:

$$p_H = p_L + \theta_b, \tag{2}$$

where $\theta_b \in (0, 1 - p_L]$ represents the *military contribution of minority* b *to an international war* — i.e., the increment of state A's chance of winning an international war due to minority b's attack against state B at the domestic level.

Next, we define the payoffs of a peaceful settlement at the international level. If each state does not attack one another, they peacefully divide the pie of size 1 in proportion to their relative power measured by the probability of winning an international war: state A receives p, while state B obtains $1 - p$. The assumption that $p = p_H$ if a civil war breaks out makes it possible for state A to take advantage of domestic turmoil and get more concessions from the adversary.

The payoffs of a civil war and a peaceful settlement at the domestic level can be described just like the ones at the international level. If a civil war breaks out in state B, minority b prevails with probability $q \in [0, 1]$. Under the winner-take-all assumption, the expected payoffs of a civil war are expressed as $q(1 - k_b) + (1 - q)(0 - k_b)$ or $q - k_b$ for minority b, and $(1 - q)(0 - k_B) + (1 - q)(1 - k_B)$ or $1 - q - k_B$ for state B, where $k_j > 0$ is the cost of a civil war for player $j \in \{b, B\}$. On the other hand, if neither minority b nor state B uses force to settle the dispute, the pie of size 1 is divided between them in proportion to their relative power: minority b receives q, while state B obtains $1 - q$. The probability that minority b wins a civil war varies depending on the outcome at the international level:

$$q = \begin{cases} q_H & \text{if} \quad \text{an international war breaks out between states } A \text{ and } B \\ q_L & \text{if} \quad \text{an international war does not break out between states } A \text{ and } B \end{cases} \tag{3}$$

where $q_L < q_H$. That is, the outbreak of an international war deprives state B of its resources that can be used to fight against minority b, reducing its chance of winning a civil war. The following equality specifies the relationship between q_H and q_L:

$$q_H = q_L + \theta_A, \tag{4}$$

where $\theta_A \in (0, 1 - q_L]$ expresses the *military contribution of state A to a civil war* — i.e., the increase of minority b's chance of winning a civil war due to state A's attack against state B at the international level.

Given the game structure described above, we first show that state B's best response strategy is not to attack state A and minority b regardless of which strategies they choose. At the international level, a war gives it a payoff of $1 - p - c_B$, whereas a peaceful settlement delivers a payoff of $1 - p$. Similarly, at the domestic level, a war gives it a payoff of $1 - q - k_B$, whereas a peaceful settlement delivers a payoff of $1 - q$. Since it prefers a peaceful settlement to a war in either dispute, its best response is not to attack state A and minority b regardless of which strategies they choose. A dispute escalates into a war once it attacks the other side in the dispute, but if it does not attack then there is a chance that the dispute is settled peacefully depending on the strategy chosen by the other side. Thus, its strategy to attack none of state A and minority b (weakly) dominates its other strategies. In fact, as shown in Table 3 in Appendix A, its strategy to attack none of the two players is the unique dominant strategy in this game.

Next, we show that not only state B but also state A and minority b choose not to use force in their disputes. To investigate their best response strategies, Table 2 displays their payoffs given state B's optimal strategy to attack none of them. As easily can be seen, each player gets better off by not attacking state B regardless of the strategy chosen by the other side. State A obtains a payoff of $p - c_A$ if it attacks state B, but if it chooses not to attack then it receives a payoff of p. Similarly, minority b obtains a payoff of $q - k_b$ if attacks state B, but if it chooses not to attack then it receives a payoff of q. Since both players prefer not to attack state B, the equilibrium outcome in this game is a pair of peaceful settlements at both the domestic and international levels; no war breaks out in either dispute.

In sum, the model has a unique Nash equilibrium, where no player attacks its opponent(s): state A does not attack state B, minority b does not attack state B, and state B does not

Minority b / State A	Attack B	Not Attack B
Attack B	$p_H - c_A$, $q_H - k_b$	$p_L - c_A$, q_H
Not Attack B	p_H, $q_L - k_b$	p_L, q_L

Table 2: Payoffs for state A and minority b given state B's optimal strategy {Not Attack A, Not Attack b }.

attack state A and minority b.

It is important to note, however, that this peace equilibrium is sub-optimal for both state A and minority b if they can coordinate with each other to attack state B. Joint attack delivers payoffs of $p_H - c_A$ and $q_H - k_b$ to state A and minority b, respectively, which are greater than the payoffs they obtain in the peace equilibrium if $p_L < p_H - c_A$ and $q_L < q_H - k_b$, or

$$c_A < \theta_b \quad \text{and} \quad k_b < \theta_A. \tag{5}$$

That is, coordinated attack makes both of them better off than the equilibrium outcome if the following two conditions are simultaneously satisfied: the military contribution of minority b to an international war is relatively large and so is that of state A to a civil war.

Under these conditions, the game turns into a Prisoners' dilemma between state A and minority b. Both players get better off if they jointly attack state B, but each of them has an incentive to take advantage of the other's attack while it attempts to settle its dispute peacefully. Since both players attempt to free ride, they end up in a sub-optimal outcome where none of them attacks state B — i.e., each player settles its dispute without the support from the potential ally.

State A and minority b cannot achieve cooperation in this model because it assumes away the possibility of reciprocity and punishment. If each of them can make both a credible promise to reciprocate the help from the other and a credible threat to punish the other's free ride, then they might be able to coordinate with each other to attack state B. However, since the model assumes that the interactions among the players occur only once, it excludes the possibility of "tit-for-tat" strategies such that one's help will be reciprocated by the other's help, while one's free ride will be punished by the termination of the informal alliance. To examine the conditions for coordinated attack in a more realistic setting, we next introduce the shadow of the future into the basic model.

Suppose that the three players repeatedly play the stage game described above. Each player's valuation (U_i) of the repeated game is represented by the sum of the payoffs (u_{it}) it receives in each period $t = 0, 1, 2, ...$ — that is, $U_i = \sum_{t=0}^{\infty} \delta^t u_{it}$, where $\delta \in (0, 1)$ represents a common discount factor.

We can interpret the new game as follows. At the beginning of the game, states A and B have conflicting interests over an international issue (e.g., denuclearization), and after they settle the dispute peacefully or violently a new issue (e.g., violation of human rights) pops up with probability δ, and again after they settle the dispute another new issue (e.g., democratization) comes to the surface with probability δ, and the game continues on and on in this manner. Similarly, at the beginning of the game, minority b and state B are involved in a dispute over a domestic issue (e.g., political inequality), and after they resolve the dispute peacefully or violently a new issue (e.g., economic inequality) appears with probability δ, and again after they settle the dispute another new issue (e.g., cultural discrimination) arises with probability δ, and the game continues on and on in this manner. Hence, the discount factor δ can be viewed as the probability that a new issue emerges after settling an old issue, which is more or less proportional to the degree of differences between states A and B and between minority b and state B — i.e., the number of potential issues between them.

Now, we examine the determinants of cooperation between state A and minority b by considering the following strategies:

- In period 0, A attacks B, and thereafter $t = 1, 2, ...$, it attacks B if both A and b attacked B in period $t - 1$; if at least one of them did not attack B in period $t - 1$, then it does not attack B ever after.

- In period 0, b attacks B, and thereafter $t = 1, 2, ...$, it attacks B if both A and b attacked B in period $t - 1$; if at least one of them did not attack B in period $t - 1$, then it does not attack B ever after.

- B always refrain from using force against A and b regardless of the strategies they choose.

To exclude incredible promises of reciprocity and incredible threats of punishment, we use the subgame perfect equilibrium as the equilibrium concept.

The equilibrium analysis derives the following two requirements for coordinated attack (see Appendix B for proof):

$$\underbrace{\frac{c_A}{\delta} < \theta_b}_{\text{Condition for } A \text{ to attack}} \quad \text{and} \quad \underbrace{\frac{k_b}{\delta} < \theta_A}_{\text{Condition for } b \text{ to attack}} \quad . \tag{6}$$

If the two inequalities are simultaneously satisfied, wars break out both at the domestic and international levels. That is, state A and minority b jointly attack state B when the military contribution of minority b to an international war is relatively large and so is that of state A to a civil war. In contrast, both domestic and international disputes are resolved peacefully if at least one of the following two conditions is met:

(i) Minority b is so weak that its insurgency against the autocratic government does not substantially increase state A's chance of winning an international war;

(ii) State A is so weak that its military intervention does not substantially increase minority b's chance of winning a civil war.

To put it differently, we should observe peace both at the domestic and international levels if at least one of state A and minority b is not powerful enough to be able to provide large-scale military assistance to its potential ally. Figure 5 summarizes the results of the equilibrium analysis.

3 Conclusion

Why has North Korea been able to survive up to this date, while other rogue states have suffered military intervention by the United States? To solve the puzzle, we presented a two-level game model that takes into account interactions between domestic and international

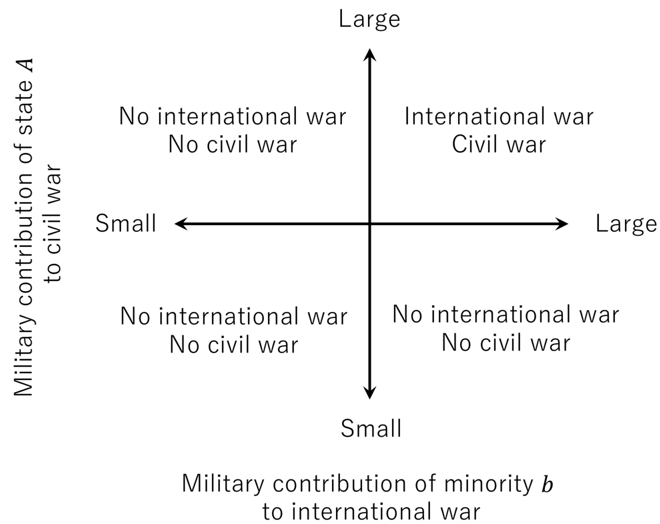

Figure 5: Wars can break out if the military contribution of minority b to an international war is relatively large and so is that of state A to a civil war. On the other hand, if at least one of the two contributions is relatively small, wars do not occur both at the domestic and international levels.

conflicts. The United States and a minority group in a rogue state have a shared interest in attacking the common enemy, but each of them has an incentive to peacefully settle its dispute on its own while taking advantage of the other's attack. We find that the military contribution of one party to the other in the informal alliance is the key to overcoming the free-rider problem.

The distinguished feature of North Korea lies in its extremely high level of ethnic homogeneity. In such a homogenous society, the size of a minority group, if any, should be very small since almost every individual in the country belongs to the same group, i.e., the majority. Hence, even if the minority group launches an insurgency against the autocratic government, it would not increase US's chance of winning an international war, reducing its incentive to intervene in the Korean Peninsula. Moreover, the low likelihood of US intervention would reduce the minority's incentive for insurgency in the first place, leading to peace at both the domestic and international levels. The upper-left corner in Figure 5 corresponds to the case of North Korea and possibly other rogue states with relatively homogenous ethnic composition such as Cuba.

In contrast, most rogue states have relatively heterogenous ethnic composition. In such a heterogenous society, the size of a minority group should be much larger than the one in North Korea. Hence, its military contribution to an international war would be relatively large, increasing US's incentive for military intervention. Furthermore, the high likelihood of US intervention would motivate the minority to launch an insurgency against the autocratic government, leading to wars at both the domestic and international levels. The upper-right corner in Figure 5 demonstrates the fate of most rogue states.

We conclude the paper by discussing some implications for empirical research. In the literature of civil war, it is often argued that ethnic composition of a country does not help us predict insurgency in the country (Fearon and Latin 2003; Collier and Hoeffler 2004). However, the insignificant association between ethnicity and civil war in existing studies might be due to the violation of unit homogeneity; they include in their data sets all the countries in the world without taking into account possible interactions between domestic and international conflicts. The theory we introduced in the paper suggests that if we narrow down our focus on the states that are involved in serious disputes both at the domestic and international levels, then we should observe a clear association between ethnic fractionalization and the likelihood of civil war; the effect of ethnicity on the likelihood of insurgency should be conditional upon the risk of military intervention by an external actor such as the United States.

Similarly, the literature of interstate war pays little attention to the possibility that a country's ethnic composition can be used to predict the risk of military intervention. As demonstrated in the paper, what is important to the outbreak of an international war is not only the distribution of power between the aggressor and the target state, but also the distribution of power between the target state and its domestic opposition group. Even if the aggressor is much stronger than the target state, if the domestic opposition group is much weaker than the autocratic government, then military intervention should not occur. It is only when both the aggressor and the domestic opposition group have enough military capability to wage wars that we should observe armed intervention.

Appendix A

	(A) Attack B (b) Attack B	Attack B Not Attack B	Not Attack B Attack B	Not Attack B Not Attack B
Attack A Attack b	$(1-p_H-c_B)$ $+(1-q_H-k_B)$$\blacktriangle$	$(1-p_L-c_B)$ $+(1-q_H-k_B)$	$(1-p_H-c_B)$ $+(1-q_L-k_B)$	$(1-p_L-c_B)$ $+(1-q_L-k_B)$
Attack A Not Attack b	$(1-p_H-c_B)$ $+(1-q_H-k_B)$$\blacktriangle$	$(1-p_L-c_B)$ $+(1-q_H)$$\blacktriangle$	$(1-p_H-c_B)$ $+(1-q_L-k_B)$	$(1-p_L-c_B)$ $+(1-q_L)$
Not Attack A Attack b	$(1-p_H-c_B)$ $+(1-q_H-k_B)$$\blacktriangle$	$(1-p_L-c_B)$ $+(1-q_H-k_B)$	$(1-p_H)$ $+(1-q_L-k_B)$$\blacktriangle$	$(1-p_L)$ $+(1-q_L-k_B)$
Not Attack A Not Attack b	$(1-p_H-c_B)$ $+(1-q_H-k_B)$$\blacktriangle$	$(1-p_L-c_B)$ $+(1-q_H)$$\blacktriangle$	$(1-p_H)$ $+(1-q_L-k_B)$$\blacktriangle$	$(1-p_L)$ $+(1-q_L)$$\blacktriangle$

Table 3: State B's payoffs in the stage game. The symbol $\blacktriangle$ indicates state B's best response to the strategies of state A and minority B. State B's strategy to attack none of them is the unique dominant strategy in this game.

Appendix B

Although the repeated game presented in this paper involves three players, since we consider the situation where state B does not attack state A and minority b regardless of the strategies they choose, we can directly apply the well-known solution for infinitely repeated Prisoners' dilemma games with two players (see Mailath and Samuelson 2006, ch.2).

To see this, we first examine the equilibrium condition for state A. To check subgame perfection of its strategy, we need to investigate the following two incentives: (i) its one-shot deviation incentive in the subgame right after an outcome other than {Attack B, Attack B} occurred at $t = T$, where the first (second) element indicates state A's (minority b's) action; and (ii) its one-shot deviation incentive in the subgame right after the outcome of {Attack B, Attack B} occurred.

Let us consider the first scenario. Since at least one of A and b did not attack B in $t = T$, both of them do not attack state B ever after if they follow their strategies, implying that A receives $p_L + \delta p_L + \delta^2 p_L \cdots$. On the other hand, if only A deviates from its strategy only once at $t = T + 1$, then the outcome of {Attack B, Not Attack B} appears at $t = T + 1$ and then that of {Not Attack B, Not Attack B} continues ever after, implying that A obtains $p_L - c_A + \delta p_L + \delta^2 p_L + \cdots$. Clearly, A has no incentive to unilaterally deviate from its strategy in this scenario.

Let us next consider the second case. Since both A and b attacked B in $t = T$, they continue to attack B ever after if they follow their strategies, implying that A receives $p_H - c_A + \delta(p_H - c_A) + \delta^2(p_H - c_A) + \cdots$. On the other hand, if only A deviates from its strategy only once at $t = T + 1$, then the outcome of {Not Attack B, Attack B} occurs at $t = T + 1$ and then that of {Not Attack B, Not Attack B} continues ever after, implying that A obtains $p_H + \delta p_L + \delta^2 p_L + \cdots$. Hence, A follows its strategy if

$$p_H + \frac{\delta p_L}{1 - \delta} < \frac{p_H - c_A}{1 - \delta}. \tag{7}$$

Since the game structure is symmetric for A and b, we can derive the condition for b to stick to its strategy as follows:

$$q_H + \frac{\delta q_L}{1-\delta} < \frac{q_H - k_b}{1-\delta} \tag{8}$$

Lastly, we examine B's one-shot deviation incentive. As shown in Table 3, given that A and b follows their strategies, B receives $(1 - p_H - c_B) + (1 - q_H - k_B)$ for each period regardless of which strategy it chooses. Hence, there is no incentive for B to unilaterally deviate from the designated strategy.

Notice that inserting the equations $p_H = p_L + \theta_b$ and $q_H = q_L + \theta_A$ into the above two inequalities generates the conditions described in the text: $c_A/\delta < \theta_b$ and $k_b/\delta < \theta_A$. □

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