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Math 89S: Game Theory and Democracy

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### Game Theory and North Korea

How is it that many scholars and great minds are considering the threat of all out nuclear war, and therefore the lives of millions and millions of people, in the context of “game” theory? To many who don’t know the seemingly never-ending applications of this theory, it could even seem offensive to consider their safety with the same theory that can be applied to rock, paper, scissors. In this strange phenomenon lies part of the beauty of game theory---it can be applied to so many different problems because it is no more than “a field that involves reasoning mathematically about what happens when you have different actors that are strategic, who have different objectives, and what might happen when you have those actors in the same environment” (Roughgarden). Within the North Korea situation, there exist all of these requirements to apply game theory. Our actors are the United States and North Korea. For simplification, we can say that Donald Trump will be the main actor for the United States and Kim Jung Un will be the main actor for North Korea. Obviously, these two actors have different objectives and they have been put into the same environment where their decisions will oppose each other.

It is also important to note that this is certainly not the first time that game theory has been applied to military tactics. A book published in 1944 by John Von Neumann and Oskar Morgenstern called “Theory of Games and Economic Behavior” is often thought of as the beginning of the field as an independent subject. Ever since it became an independent field, it has been used to think about military issues. As Tom Roughgarden evidences in his interview with the Washington Post, “Von Nuemann also worked for US think tanks in the context of Cold War strategy in the 40’s and 50’s, so game theory has really been used to think about military issues since the beginning of the field in the 1940’s.”

Some people in the United States may be tentative to view the North Korea situation in terms of game theory due to the last time it was famously applied to an unsettled situation in Asia. The year was 1969, and Richard Nixon was also in his first term as president. The conflict he faced was the war in Vietnam, and the fact that he had promised to end it. Nixon decided to play what he called the “madman” strategy. In this strategy, “the idea was not actually to attack anybody, but to convince Russia that [he] was unstable enough that he would risk a ‘first use’ of nuclear weapons to finally decide the conflict” (Garver). In turn, he hoped that the Soviets would pressure the North Vietnamese to bargain for the end of the war. In this particular case, the strategy employed by Nixon did not work exactly as planned, shown by the fact that the war continued on for 6 more years. This

particular case of failure in game theory applied to military tactics may make some Americans skeptical of its plausibility in the realm.

This skepticism can be opposed by those who interpret the implementation of game theory into military tactics in an educated way. The fact of the matter is that these international affair tactics do not have one equilibrium, or a dominant strategy. To be completely realistic, does anyone even know what “winning” the game would be? I think it is fair to say that most Americans would consider no ongoing threat of nuclear war a victory. On the other hand, we have no idea what the North Koreans would consider their victory. Usually in a game, the actors on each side at least know the end goal of the other side. Even in this strange case where we do not know the motive of the other actor, examination of the situation through game theory still allows insight into what our tactics should be. I do not claim that game theory will allow for the correct answer or tactic every time in foreign affairs. I claim that it is a useful tool. Those who are skeptical to use game theory in the topic of military affairs look at game theory for a definitive answer, rather than as a tool, and when it fails, become skeptical of further use.

The reasons game theory is a useful tool in helping to shape decisions in foreign affairs are that it is,

“useful for providing very clean mathematical examples, parables almost, that help you articulate and reason about real-world situations in a logical way. They help you think through who the actors are, what their preferences are, which actions they can take, and what possible outcomes could occur.”

(Roughgarden)

Clearly, game theory can be used to help reason through the problem in the real world, since these military situations include two different strategic actors, with different objectives, in the same environment. These three characteristics are the necessities for applying game theory to a situation, and the current North Korea situation has all of them. Therefore, using game theory will help us reason through possible actions and repercussions, even though it may not mathematically solve a perfect solution.

Now that we can see how game theory applies to military tactics and foreign affairs in general, we can see how it would be helpful in helping us reason through our potential courses of action in the current North Korea situation. First, it is important to identify what each of the actor's goals are in the conflict or “game.” Our goal in the game is “to stop North Korea from developing the means of our destruction” (Kotlikoff), and to not have them launched at us if they have created them. North Korea's goal in the conflict is to create these means of destruction, and potentially use them. The aspect of this specific conflict that has people on

edge is that, “Neither side has a very good understanding of the other. Kim is young, there’s not been a lot of interaction between him and the U.S. government and not a lot of confidence in understanding how he will act in different situations. And given the things Trump has been saying, North Korea might not be sure how the U.S. will react either” (Roughgarden). Since neither side really knows how the other side will act, it is hard to make decisions based on how to get to the end goal that each side wants. Game theory, by assuming different potential reactions of North Korea by our different strategies can help to weigh the pros and cons of our different possible courses of action. So far, Donald Trump and the United States have “played” two main strategies in the conflict with North Korea.

The first strategy that the Donald Trump has employed is the “madman method.” Steven Brams describes this method as, “an argument that there’s a kind of method in the madness---that there’s a rationality to appearing mad to force another player to back down in a confrontational situation” (Garver). This method is not unfamiliar to Trump, as it is a common strategy in the business world. It becomes clear that Trump knows the strategy that he is pursuing when he says that he values appearing “unpredictable” in negotiations. Scholars have questioned this approach to the North Korea situation for more than one reason. The first being that Trump’s background on playing this madman game has been in the business world, where threats were blowing up business enterprises---not the world---and he

did manage to run businesses into bankruptcy with this approach. So, would he take the madman theory just as far in this case, with the result being millions of lives and nuclear war? Another worry for scholars is that this approach hinges upon the fact that you want the enemy to think you are crazier than you really are, and some people think Trump really is as crazy as he seems. One scholar says about Trump's madman approach, "The main point is that its feigned...Now, I think in Trump's case, he may be as crazy as he seems" (Garver). So, is Trump doing a really good job of playing the madman role, or is he actually just crazy? We don't know for sure, which is another worry that scholars have about this approach. Finally, many political thinkers worry because Kim Jung Un seems to be playing the same game...or is he actually crazy too? The fact that we have two actors trying to both appear crazier than the enemy (or both are actually crazy) frightens people because "they both could escalate to the point of no return" (Garvey). The madman theory is one strategy being applied to the North Korea situation because it shifts the goal of the other party from "winning the competition to placating the crazy person sitting across the table" (Garvey). Since North Korea knows we have the technology to strike them, Trump hopes that his madman approach will scare them into placating him and his "fire and fury" rather than continuing to build their nuclear arsenal.

Another strategy that the United States has employed in the North Korea conflict is an economic strategy. Laurence Kotlikoff calls this approach the “appeasement game.” This approach has not worked. Even though we have inflicted immense economic pain on North Korea, they have considered our strategy and optimized against it, as they have still been able to develop nuclear weapons, miniaturize them, and are now building ballistic missiles that could be delivered anywhere in the United States, South Korea, or Japan. North Korea knows that they are beating our “appeasement” or economic strategy too. We know this because if they did not know they were winning, they would know that they would cave later, and instead would just save the time and cave now. Losing this game has implications beyond just North Korea having the ability to threaten the United States---it will also show other nations that they could have the ability to develop a nuclear arsenal and have the ability to threaten us. Clearly, this economic strategy against North Korea is not working, as they have still been able to develop weapons to threaten our country.

To see an example of how scholars use game theory to gather and organize their thoughts on this conflict, I will outline the thoughts of Laurence Kotlikoff, an American scholar and former politician. Kotlikoff observes that many Americans seem willing to live under the threat of the ability for North Korea to nuke us because they think that the “Supreme Leader” is not suicidal. This strategy worries

Kotlikoff because Kim Jung Un could be crazier than we know. Also, since this conflict could go on for many years, who is to say that Kim Jung Un could not become reckless on his death bed? Using game theory to rationalize his thoughts, Kotlikoff offers his proposal:

“ Here's my proposal. We issue a clear warning to North Korea that any attempt to continue developing missiles or launch missiles of any size or type will be treated as an act of war and will lead to the destruction of all missiles, missile development and production facilities, all nuclear facilities, and the targeting of Kim Jong-Un. At the same time, we would declare our willingness to recognize North Korea, establish full commercial and diplomatic ties with North Korea, and assist, together with China, Russia, the UK, and the EU, North Korean development. This proposed peace treaty would include one condition -- that North Korea verifiably destroy all existing nuclear weapons and means of producing such weapons.”

This proposal allows us to see what the other side is thinking because If Kim Jung Un wants to keep his nuclear arsenal and is not suicidal, then he will not cross the line. If he is suicidal, then he will attack us, but our military will be prepared.

Kotlikoff claims that any losses endured will surely be smaller than a future war.

This example of a scholar using game theory in this application not only demonstrates a potential solution to our problem, but also shows why game theory

is a powerful tool in helping us reach conclusions. It can help us to think about potential repercussions of different actions by thinking about the other actor, and developing potentially dominant strategies that help place us in the driver's seat of the conflict.

It is clear to everyone that the conflict with North Korea is more than a game, but by identifying the basic aspects of the situation---the actors, their goals, and the fact that they are in the same situation or arena---we can use the theory that helps to pick dominant strategies in games. The part that makes game theory's application to the North Korea conflict more abstract is that there are no rules by which the conflict is played...anything goes. Because of the lack of rules, game theory has to be used as a tool for understanding and rationalizing the motives, potential strategies, and repercussions of both sides, and it will not provide a definitive answer. By using game theory, we can create models and potential dominant strategies for these models by thinking about the goals and strategies of the other side in advance, and not just reacting. Creating these models can help to put us in the driver's seat of the situation by creating dominant strategies through anticipation, rather than constantly reacting to North Korea's actions.

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