

The introduction to applying game theory politics essay



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Game theory is the formal study of conflict and cooperation. Game theoretic concepts apply whenever the actions of several agents are interdependent. These agents may be individuals, groups, firms, or any combination of these. The concepts of game theory provide a language to formulate, structure, analyze, and understand strategic scenarios (Turocy, 2001).

This paper will conclude a short concept of the Game theory, introducing 2 fundamental types of the theory, an introduction to the current issue over Iran's nuclear program and applying the game theory by examining the case of a possible war over Iran's nuclear program using key information sources from academic publications, news articles, and government/non-governmental reports, which the main players are Iran and Israel, and having the United States as a secondary player.

* note that the results from the game theory is by the writer's research on the related case study and the writer's self-thoughts, thus does not exactly predict the outcomes of the case study.

Introduction to the Game theory

In real life it frequently happens that you would be faced to make a decision or to choose the best choice from several options. For instance, you might need to decide whether to invest your money for a master's degree or keep on working with your current education. Another instance could be that you wanted chocolate ice cream but the seller has only strawberry ice cream and you have to either choose it or not. In both of the examples, the results depend on your own decision based on self-minded. In the first case, it depends on your ultimate goal at the time. In the second case, it depends on

whether you really want ice cream or not, not just considering the flavor. We can model situations like these using Game theory.

The Game theory is one of the models that represent the various options and payoffs in a matrix and can then calculate the best single possible strategy or combination of strategies which simplifies real-world phenomena into a more theoretically form, so that we could easily interpret the sense of it. The mathematician Emile Borel suggested a formal theory of games in 1921, which was furthered by the mathematician John von Neumann in 1928 in a “theory of parlor games.” Game theory was established as a field in its own right after the 1944 publication of the Theory of Games and Economic Behavior by von Neumann and economist Oskar Morgenstern. This book provided much of the basic terminology and problem setup that is still in use today (Turocy, 2001).

This central concept of non-cooperative game theory turned to be the focal point of analysis. Since the 1960s, game theory was broadened theoretically and applied to problems of international relations, including war, terrorism, crisis bargaining, deterrence, and economic sanctions. Incorporated with game models, the application of game theory is to international relations give rise to a large number of important empirical questions. Game models, such as the Prisoner’s Dilemma, described later in the paper, can help illuminate important substantive issues of international affairs, including how and why actors evolve their policies, based on goals and anticipated benefits in the negotiation processes (Dougherty, 1996).

Fundamentals of the Game theory

In short, game theory deals with any problem in which each player's strategy depends on what the other players do. Game theory simply extends this concept to interdependent decisions, in which the options being evaluated are functions of the player's choices (Field, 2009).

First of all, we will have to learn about the definition of the words used in the game approach and some simple rules of the game:

- Because game theory arose from the analysis of competitive scenarios, the problems are called games and the participants are called players.

-To begin with, despite the rubric game, the object is not to win. Even for strictly competitive games, the goal is simply to identify one's optimal strategy.

-In gaming, players' actions are referred to as moves. The role of analysis is to identify the sequence of moves that you should use.

- A sequence of moves is called a strategy, so an optimal strategy is a sequence of moves that results in your best outcome.

There are a lot of theoretical approaches to the game theory, in this paper will present the use of two particular fundamentals of the theory.

The first one is the sequential-move game, the players must alternate moves; in the second one is the simultaneous game, which the players can act at the same time. These types are distinguished because they require different analytical approaches.

We will come back to apply both games to our study case: a potential war over Iran's nuclear program, in which before getting to analyze on the sequential and simultaneous games, it is very important that we get to know the background of our case study first as presented in the next section.

Iran's Nuclear Program

1. Background

Iran has pursued a nuclear program for over four decades. Throughout the history of Iran's nuclear program, there has been criticism among their neighboring countries and the Western countries, assuming that Iran's nuclear program that they claim to be a civilian nuclear power program has always been a covert military application to build nuclear weapons. Iran's first steps toward nuclear capability date back to the time of the Shah. These efforts have continued under the post-revolution Islamic Republic. In 1995, with the signing of the Non-Proliferation Treaty, Iran has a right to develop nuclear technology for peaceful, civilian purposes, excluding developing a nuclear weapon.

Iran's leadership continues to insist it adheres to these conditions. However, the general temptations nuclear weapons offer in terms of perceived prestige and security, together with Iran's pattern of deception and concealment of important elements of its program, have raised doubts about its true intentions. For example, Iran failed to disclose the existence of a large uranium enrichment facility at Natanz or a plutonium separation plant at Arak to the International Atomic Energy Agency until after a disclosure from an exile group in 2002 (Carpenter, 2006).

If Iran's real intention is to obtain and develop a nuclear weapon, we must understand of why the government is pursuing such an approach that could lead to disastrous implications among the country. Deterrence, both regional and extra-regional, is one of the most important considerations. Iran is located in a volatile region, surrounded by hostile neighbors. Russia, Israel, Pakistan, and India all have nuclear weapons already, so regional deterrence issues probably loom large for Iran (Albright, 2012). Such arms could be used to intimidate their neighbors to accept Iranian primacy or listen to their demands over those of the United States or Israel. In addition to President George W. Bush's statement during his presidency "axis of evil" speech, linking Iran to Iraq and North Korea came as a prelude to an invasion and occupation of Iraq, which comes to the assuming that Iran could be the next hit target on the United States list (Quillen, 2002).

2. Perspectives toward the program

Israel – Most of Israel’s political and security apparatus’ view Iran’s nuclear program from a unified perspective, it is one of the top priority issues for the government. There remains four points that serve as a consensus toward Iran: first, is that Iran is committed to maintain a nuclear program with the objective of developing nuclear weapons; second is that Iran seeks to become the region’s hegemon and that they see Israel as the obstacle to achieve this goal; third, Iran’s insistence on its NPT agreement of pursuing a peaceful nuclear program (if that were their main purpose); the last, as a nuclear power, Iran would exercise greater sway with its weaker Arab neighbor-states in which currently support Israel’s position to prevent Iran from acquiring nuclear weapons. If Iran could develop this capability, many Arab states could be forced to ally themselves with Iran due to strategic necessity and national security (Ben-Meir, 2010). Toward to this respect, Israel has concluded that, it is deemed necessary to prevent Iran from developing and acquiring nuclear weapons, thus leading the government’s decision to enhance their special ties with the United States which is pursuing the same policy of preventing Iran from developing nuclear weapons.

United States – Two sets of concerns toward Iran’s nuclear program are emphasized along with U. S. national security policies in the Middle East region. First, as Iran’s history of being a tribune to Islamic revolutions and sponsoring terrorist groups such as Hezbollah, U. S. government fears that such tide would enhance the possibility of the transfer of nuclear weapons to those groups, with or without official approval from Iran’s leadership. Also, the very possession of nuclear weapons by Iran which opposes to U. S. presence in the region, allies, interests, and values would alter the balance of power in the Middle East in ways that could constrain U. S. options in future regional crises (Rhodes, 2005). Second, this concern has less to do with Iran per se than the impact of an additional nuclear-capable state on the global non-proliferation regime. Cases such as the “break-out” by India and Pakistan in the late 1990s, and the rise of North Korea with its development of nuclear weapons, an obvious failure of the NPT system could produce a domino effect among countries that want to acquire such technology. This would also increase the opportunities for unauthorized or accidental use of nuclear weapons and even leading to the worst case scenario of terrorist groups or organized crime networks possessing those weapons.

3. Current newspaper articles on Iran’s nuclear program

We will take a look on the current issue from several related newspaper articles.

Iran has developed a nuclear program that it stated is for peaceful purposes and power generation in the nation. However, it is also known that any country with a well-developed peaceful nuclear program has also attained

the capability to quickly build a nuclear weapon. The International Atomic Energy Agency (IAEA) has said that medium-level uranium enrichment has begun at the Fordo plant near the Holy city of Qom, north of Tehran (Kanchanalak, 2012). The state of diplomacy between Iran, Israel, and the U.S. demonstrates on the West and Israel's attempts to use the IAEA, the United Nations, and international sanctions against Iran have failed to encourage cooperation. Apparent diplomatic road rage has set in between at least Iran and Israel, which will likely prove deleterious for peace (Riazi, 2012).

Looking upon Israel, it is a country that lives in perpetual existential fear for its security. Israel is known for its track record of pre-emptive strikes against nuclear targets in the region. In 1981, it bombed the Osirak reactor in Iraq, and recently in 2007, it attacked a facility in Syria that it believed was intended to be a nuclear reactor. However, Iran, unlike those two countries, presents a much more challenging military and economic question (Kanchanalak, 2012).

For Iran, it would likely not back down off the nuclear program and would definitely use self-defense tactics against any attacks from Israel and countries abroad. Evidently if Israel decides to attack, it would leverage non-state assets, such as its relationships with Hezbollah, the Hamas, and other Palestinian actors, to pummel Israel, and its populace would unite behind it. It would also likely use IRGC-Quds Force hit squads to target Israeli interests abroad. The US would face a complex dilemma if Iran uses the Quds Force in such a manner, as well as if Iran counter-attacked by striking Israel overtly (Riazi, 2012).

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Iran's supreme leader, Ayatollah Ali Khamenei, countered on a televised program stated that Iran will respond in kind when appropriate, and that sanctions will not alter Iran's nuclear ambitions. Khamenei furthered that sanctions, in fact, have encouraged Iran's military to become more self-reliant. The Iranian navy could also lay mines to close off the Strait of Hormuz - a vital oil artery - and send the oil price to over US\$200 a barrel (Cordesman, 2006). As proud people Iranians would face humiliation if they responded weakly. However, there is one thing that they really do not want, that is domestic interference and military assaults from the United States.

Applying Game Theory

By reading and examining the key information sources on the background, perspectives, and news articles above, we now apply the Game theory to the current issues over Iran's nuclear program, which in this paper will focus on two game approaches, the sequential-move game, and the simultaneous game.

1. The Sequential-move game

To analyze a sequential-move game, first construct a game tree mapping out all of the possibilities. Then follow the basic rule: look ahead and reason back (Field, 2009):

1. Look ahead to the very last decision, and assume that if it comes to that point, the deciding player will choose his/her optimal outcome (the highest payoff, or otherwise most desirable result).
2. Back up to the second-to-last decision, and assume the next player would choose his/her best outcome, treating the following decision as fixed

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(because we have already decided what that player will pick if it should come to that).

3. Continue reasoning back in this way until all decisions have been fixed.

Now let's apply the game approach to our study case. Iran has decided whether to continue on or stop their current nuclear program. By attaining the information from the previous section (Iran's nuclear program) we should be able to conclude the game as follow:

à, à, ²à, žà, TMà, 'à¹^à, ‡1

Now we can look ahead and reason back. Looking ahead, if Iran continues on with the nuclear program and follows until the last path, it will be that either Iran has to downplay the situation and surrender or choose to use self-defense tactics, thus worsening the scenario. More than likely, if Iran continues on with their nuclear program, a regional conflict will spark up. Reasoning back, we now know that if Iran chooses to stop the program at first or face downplay and losses at the last choice, the issue would likely not turn to be regional but at least controllable around the area.

We end this section with a few observations before moving on to simultaneous games. First, notice that looking ahead and reasoning back determines not just one player's optimal strategy, but those for all players. It is called the solution to the game. Once it has been determined, it is irrelevant whether or not the game is actually played, as no one can possibly do better than the solution dictates (Field, 2009).

That is why the concept of winning does not really apply. Sequential games are determined, so ultimately, there are only two choices: either the player with the last decision gets his/her best outcome, or the game is not played.

2. The Simultaneous game

For this game approach we will take a look at the simplest but most famous example set called the Prisoner's dilemma. For this paper the writer will assume that readers have a small knowledge about this game set already, thus this section will begin analyzing and adapting the game to the study case without going through the intro of the dilemma.

Same as the sequential-move game, we attain the same information for analyzing. For an easier way of interpreting the information to create the dilemma, you first need to breakdown the facts from the information:

Iran – Priority is to continue with the nuclear program without interference from abroad (esp. Israel)

Israel – Priority is to get Iran to stop the nuclear program without military action.

Now as the case has been simplified, we can demonstrate the game set. Iran shall have two basic choices: (1) to stop the program, or (2) continue on the program. Israel will also have two choices: (1) to attack, or (2) not attack.

à, à, ²à, žà, TMà, 'à¹^à, ‡2

The choices are illustrated in the diagram above. The numbers in the boxes refer to the consequences of the decisions. Iran's gains and losses are represented by numbers in the lower left corners of the boxes, and Israel's gains and losses are represented by numbers in the upper right corners. Look at the box labeled " B". The scenario portrayed in box B is that Iran stops the nuclear program and Israel does not attack. If this happens, Iran would not achieve its main objective but Israel, as the result of Iran stopping the program, thus not attacking, does achieve their primary objective. For this scenario Iran loses, receiving "-1" and Israel gains, receiving " 1". Meanwhile taking another look at box " C", Iran would continue on the program and Israel decides to attack. If this happens, Iran will achieve an objective, which is to continue on the program, but only at the cost of having Israel to interfere by attacking. Iran's gains and losses cancel each other out, and this results is represented by a " 0". Israel, in box C scenario, decides to attack since Iran continued on the program, thus does not accomplish the objective of having Iran stop the program and not attack Iran. In this case Israel loses both its objective so receives a "-1" in the box. Looking at all the boxes one at a time, the whole pattern of possible choices and consequences becomes clear.

We could also expand the game, instead of having only 2 variables, let's try using 5 variables. The game theory matrix would now have twenty-five boxes (5×5) instead of four (2×2).

à, à, ²à, žà, TMà, 'à¹^à, ‡3

For this game we also attain more information for analyzing:

Iran – Priority is to continue with the nuclear program without interference from abroad (esp. Israel)

- Will comply with IAEA if given permission to continue with the nuclear program**
- Would use self-defense tactics if Israel or countries abroad attacks**
- Would close out the Strait of Hormuz if being attacked and the international sanctions are lifted up.**

Israel – Priority is to get Iran to stop the nuclear program without military action.

- A diplomatic resolution is desired if Iran stops the nuclear program**
- U. S. government/military has no intentions of getting involved if Iran stops the nuclear program**
- International sanctions will be lifted up if Iran continues on with the nuclear program.**

Many more consequences are now possible as shown in the diagram above. We now see that game theory helps political scientists analyze and think thoroughly all the possibilities of combination as of decisions and the possible costs and consequences of those decisions.

Conclusion

International relations and politics in general are complex. The events we observe at the macro-level (e. g., wars, trade, and terrorism) are driven by many events and decisions that occur at the micro-level (e. g., in war: elite

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decision-making, domestic politics, culture). The tool that political scientists use to make sense of this complexity is modeling. One of the populist models is the game theory. Game theory can be used to design credible commitments, threats, or promises, or to assess propositions and statements offered by others.

In using the game theory on predicting possible consequences for our study case, we can see clearly the possible outcomes on which the players (Iran and Israel) decide to choose. This paper has attempted, through using two game theory models, to look into the current conflict between the two countries over Iran's nuclear program. As per examining the provided key information sources, it is clearly seen that the main problem is the absence of mutual trust between the two countries, high prestige and different views of national security, which had forced both of them to opt for a decision in their nuclear game with the highest cost for the other side. Definitely that a nuclear-armed Iran would spur proliferation in the Middle East region, increase regional instability, and increase the chance of nuclear war. If Iran chooses to continue on with the nuclear program, it will have to face consequences in which both Iran and Israel tend on avoiding. And if Iran continues on with the program, it could also trigger the possible conflict to a wider arena which would be disastrous to all players. While at every step of the game it may be favorable for either party to insist on its claims, the long-term resolution may be somewhat different.

In anyway, this is only a tool for analytical and to interpret information to a theoretical approach which leads to a more simplified way of studying the possible outcomes and the consequences of the study case.

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