

ASSESSMENT OF THE UTILITIES OF GAME THEORY IN
THE STUDY OF INTERNATIONAL RELATIONS

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Abstract

The objective of this paper is to demonstrate the significance and limitations of game theory in understanding inter-states relations. The perspective to be used describes game theoretical models as an integral part of international relations, rather than as examples of the mathematics of game theory. The paper is addressed to scholars and practitioners of international relations not particularly versed in game theory, rather than to those who are fluent in its mathematical dimension and intricacies. The paper concludes with some general clarifications on the importance and limitations of game theory in analysing international relations.

Introduction

International relations, as described, among other authors, by Ifesinachi (2014) Evans and Newnham (1998), Lake and Powell (1999) and Reynolds (1994) deals with the totality of political, economic and social interactions and processes interactions among social groups that take place across the territorial boundaries of states and other relatively autonomous political unit. In furtherance to the above, therefore, game theory whose objective is the formalized analysis of relationships among two or more actors, can assist international relations theorists in understanding the interactions among actors be it states or non-states actors, and practitioners in the field of political science as a whole and an international relations to bespecific and it influence on those interactions as it benefist the actors they represent or the entirehumanity.

As demonstrated and explained by Poundstone (1992), game theory and international relations have influenced each other almost since the emergence of the Theory of Games and Economic Behavior by von Neumann and Morgenstern (1944), as lens/model through which international relations could best be studied and understood and it considerations to be the first systematic and extensive formal analysis of social interactions. Bennett and Nicholson (1994) contended that this interaction has been both friendly and conflictive, and considered by some to be constructive and by others destructive.

Following from the above, this paper is set to demonstrate the significance and limitations of game theory in understanding inter-state relation within the purview of international relations and international relations theories. The perspective to be used describes elementary game theoretic models as an integral part of international relations, rather than as a collection of examples of the mathematics of game theory.

The Content and Scope of International Relations

As earlier stated above, the objective of the study of international relations with regards to this paper is the analysis of interactions among nation-states. These interactions involve the inter-connection

and interdependent goal-directed activities. Interdependency means that the achievement of the goals of any nation-state does not depend only upon its own actions, but also upon those of the other nation-states in and around the globe.

Lake and Powell (1994) emphasized that the subject matter of international relations is simply the study of the interactions themselves, rather than of the issues that constitute their substance and their particular form. If this point of view is adopted, the subject matter of international relations and game theory practically coincide, and international relations runs the risk of becoming an applied branch of game theory just as microeconomic theory has sometimes been said to be an applied branch of calculus. To avoid this, the special characteristics of international actors, their interactions, the issues negotiated in them, and the particular form of the interactions themselves must be emphasized. The distinctive characteristics of the international relations theory in analyzing interactions among nation-states include the attention given to their motivation and the power they use to influence each other. The rather limited contribution that game theory can make to this topic is discussed below.

Strange, (1991) emphasizes that security and economics are the two main issues considered in the theory and practice of international relations. Other important issues include education, environment, human rights and international law. Notwithstanding their relevance, the other issues mentioned above are not considered in this paper. Their game theoretic analyses are only possibilities for future research. Attention is restricted here to the interactions considered in most applications of game theory to international relations matters, that is, those that have links with defense and economic issues will be appreciated in this paper. The analysis is presented below.

In the views of Evans and Newnham (1998) and Hollis and Smith (1990), one of the basic assumptions of the realist approach to international relations is that nation-states are motivated only by their own interests. This school of thought emphasizes that nation-states consider the needs and interests of other nation-states only when the other nation-states have the capability to enforce their demands by threatening or performing damaging actions. This means that nation-states are not guided by ethical or humanitarian considerations, and that international law and even treaties and similar Game Theory as an Instrument for the study of International Relations formalized agreements do not really restrict the international activities of nation-states.

It is worthy to analyse international relations taking a clue from the standpoint of the Game Theory. This is so because the basic and much criticized assumption of this discipline when applied to social interactions is that the actors (states and non-states) involved are completely self-centered and tirelessly pursuing only their own pleasure. Game Theory finds in the nation-states as described above the closest real-life examples of its abstract constructs. This is true regardless of whether they are interacting with respect to security or to economic issues.

This view point above indicate that nation-states take into consideration the needs and interests of other nation-states only when these other nation-states are able, i.e., have the power, to threaten or perform damaging actions, shows that the determinants of the power of the different nation-states must be one of the main concerns of the theory of international relations.

Contrary to this, and despite the substantial agreement between the theories of games and of international relations with respect to the motivations of their actors, game theory pays little or no attention to the determinants of the actions available to the players. It's simply assumed that these actions are known and that the players can choose any one of them, guided only by their preferences, and without any restriction. The determinants of the actions available to the players are not studied in Game Theory. More explicitly, the determinants of power, one of the most important factors influencing the actions available to nation-states in the theory of international relations, receives little or no attention in Game Theory. This means that, in its present condition, this discipline is unable to contribute to all the areas of interest to scholars and practitioners of international relations.

Game Theory and Security and Defense Studies

Drawing inference from the preceding discussions, the cross-fertilization between Game Theory and international relations that began taking place after the publication of von Neumann's and

Morgenstern's (1944) pioneering book, it can be said that this crossfertilization was centered on security and defense problems. Part of the reason is that the most applicable component of the von Neumann and Morgenstern contribution deals with head-on conflicts, a topic that was of great practical interest during the Cold War. These circumstances have subsided since that time. External pressures and internal decomposition have replaced the defunct Soviet Union, Union Soviet Socialist Countries (USSR) threat with the smaller threat of Russia, and the contributions of Nash, Harsanyi and Selten and the insights of Maynard-Smith have enlarged Game Theory far beyond the area covered by von Neumann and Morgenstern. Despite this, most available applications of Game Theory to international relations are still restricted to the analysis of the interactions among nation-states based on security and defense issues. For the systematic analysis of the topic of the study, it is useful to subdivide the studies of security and defense into; defense alliances, deterrence and arms races, crises and the possibility of war, war and peace, and as well as attitudes in a war.

Defense Alliances

Gardner, (1995) presents 2 brief analyses of the formation of international alliances. The first is limited to a study of how defense costs should be distributed among 3 nation-states interested in defending themselves from a common external threat. The only basis for this distribution is the length of the boundaries of the nation-states in direct contact with the enemy's territories. The assumption is that the nation-states will benefit equally from the protection provided by the alliance, and the capabilities of the nation-states to contribute the resources needed for their collective defense are not considered. In the second analysis, he emphasized the conditions that prevailed in Bosnia around 1993, and shows that no alliance of any 2 of the 3 warring factions (Serbs, Croats and Muslims) could have led to a sustainable peace. The continuous needs for foreign armies in the area confirm Gardner's theoretical stance.

Powell, (1999) makes an extensive and systematic study of alliances by applying game theoretic stance. He analyzes the interactions of 3 nation-states, 2 of them involved in a direct confrontation that could lead to war, and a third that must decide whether to take one side or the other. The inferences reached provide suggestions on the paths that the nation-states should follow and the possible war/peace consequences that different decisions would have.

Deterrence and Arms Races

In analyzing deterrence and arms races, views of Gleditsch (1990) and Brito (1990) come into focus. Gleditsch, presents an insightful literature review of the studies available, regardless of the instruments used, and Intriligator whileas, Brito summarize the formalized analyses, paying special attention to studies using game theoretic apparatuses. Brief updates dealing with this second type of studies are presented by Bolks and Stoll (2000) and Reuveny and Maxwell (1998). In addition, these last two studies research aspects of the problem not previously investigated.

In the simplest formulations available, the case of 2 nation-states in a direct confrontation is considered. As indicated by Brams and Kilgour (1988), these actors use a policy of deterrence when each of them threatens to retaliate for a possible offense of the other as a means to prevent such an offense from occurring in the first place. In principle, an offense could involve derogatory comments, damaging economic policies, armed attacks, etc. Most of the analyses of deterrence refer to threats of using force, and only these cases are considered below. Under these situations, arms races are simply the sequences of events that take place when the nation-states in a confrontation want to increase the authenticity/reliability of their threats. The objective of the two nation-states in a direct confrontation is to protect themselves against the possibility of destruction or domination by the other. Either of the nation-states involved is likely to feel more secure if it acquires weapons, even if this is done purely from defensive reasons. On the other hand, since weapons can be used as much for defense as for attack, the other nation-state can never be sure of the intentions of the first. For this reason, it feels obliged to produce or purchase weapons to prepare itself to defend its interests. The final result is that the 2 nation-states involved adopt an armamentist strategy that benefits them less than the strategy acquiring weapons.

Crises and the Possibility of War

Crises may likely lead to war as described, for instance, by Evans and Newnham (1998), can be characterized by the events that take place when one or more nation-states perceive that their security is suddenly, immediately and seriously threatened by actions proposed or performed by other nation-states or by events accidentally taking place in them. This is so because cooperations among nation-states affected by uncontrollable events is much more likely than when nation-states feel the need to defend themselves from others.

From the above understanding, it follows that international crises can be considered, at a conceptual level, as sharpening of arms races. In both cases, each set of nation-states in a Game Theory as an Instrument for the Analysis of International Relations confrontation feels the need to defend itself from actions of the other. However, in a crisis, in view of the suddenness, immediacy and magnitude of the threat, the threatened nation-states show their willingness to use mainly military sanctions to force the threatening nation-states to reverse actions already taken or desist in those planned. This suggests that there should be a substantial similarity between the game theoretic analysis of arms races and of international crises. It is shown below that, to a certain extent, this is the case.

At the most elementary level, it can be assumed that each of the two nation-states involved in a confrontational crisis has two strategies: confrontation and cooperation. With the first strategy, the threatening nation-state attempts to force the other to accommodate to its wishes, and the threatened nation-state attempts to force the other to halt its demands. It should be clear that threatening words can escalate to actions and finally to war. This suggests that a Prisoners' Dilemma game and its extensions can be used for a simplified analysis of a crisis. However, it will be seen below that, at least in some cases, the game called "Chicken" is a better representation of the phenomenon.

The Cuban Missile Crisis is probably the most frequently used example of a game theoretic analysis of an international crisis. One reason for this is its rather clear definition of the actions that the nation-states involved were able to take, the possible outcomes of those actions, and the time period in which the whole crisis developed.

War and Peace

The analysis of war and peace is one of the main concerns of international relations studies. For instance, Evans and Newnham (1998), indicate that "the idea that violence and war are intrinsic parts of the international system is the distinctive hallmark of realism", that is, of one of the conceptual bases available for the study of international relations. Mitchell (1985) indicates that the investigations available of its causes, initiation, process, and consequences in its economic, political, social and military aspects reflect the great complexity of the phenomenon. Possibly as a consequence of this, a generally accepted overall theory of war is unavailable.

O'Neil, (1994) summarizes numerous game-theoretic studies of many different aspects of war and peace. On this basis, game theory may even be said to assist in the development of a general theory of the phenomenon. However, taking into cognisance the complexity of war, international relations studies will not be able to relinquish their leading role in the development of such a theory.

In the game theoretical analysis of war, attention has been concentrated only on its military aspects. Simplifying even this restricted area, the assumption here is that 2 nation-states are involved in a conflict. The object of each of them is to attack the other while at the same time shielding itself from the other's attacks. On this basis, 2 types of game theoretical analyses have been developed.

The decision of whether to attack first or only respond when attacked is studied in the first type. Poundstone, (1992) points that this analysis was particularly relevant during the Cold War, in view of the progressive development of nuclear weapons and their delivery. Particularly at the time when the U.S. had the monopoly on these weapons and systems, a first strike against the defunct Soviet Union (USSR) was considered, at least by several distinguished and influential personalities, to be the most recommendable policy. The validity of this recommendation became questionable once the USSR developed the capability to survive a first strike and respond with an equally damaging second strike.

Taylor (1995) formalizes the description above in a simplified model in which each of the two nation-states involved in a conflict have two (2) strategies: first and second strike.

The conclusions obtained with this model represent an important example of the limitations of game theory as a viable and veritable instrument through which international relations and international relations theories can best be studied and understood in foreign policy decisions. The results of the model recommend a first or a second strike depending on the assumptions made with respect to the valuations of the results of the nation-states involved, and, in practice, these valuations are not known and cannot be known. From this it follows that the main use of game theoretical perspective is as a basis for systematic analysis, not as a generator of rules for actual behavior.

Battles within a War

The analysis of battles is easier than that of war because these events are much better defined in time and space. As evidence of this facility, the first applications of game theory to international relations included the study of battles. The Battle of the Bismark Sea that took place during War World II and involved Japanese and American naval and air forces is a frequently used example. It is discussed, for instance, by Davis (1970), Brams (1975), Dixit and Skeath (1999,). Extensions of this model are presented by Drescher (1981) and Dixit and Nalebuff (1991). An interesting aspect of these analyses is that they are basically reformulations of Colonel Blotto games. Another example is the analysis presented by Brams (1975) and Zagare (1984) of the battle of Avranches that took place during the Allied invasion of Normandy during World War II. This approach is particularly interesting because it includes strategic decisions such as troop movements that are not considered in the war or battle.

Game Theory and the Economic Relations among Nation-States

The economic relations among nation-states are part of the subject matter of international relations and have the manifestation of the game theory. As observed by Reynolds (1994), the ability of nation-states to defend themselves and survive depends to a large extent on their economic capabilities. Even a superficial remark shows that a substantial part of relations among nation-states has an economic focus.

Sequel to the above, It will be seen that at least some of the game theoretic instruments used for the analysis of security and defense issues can be applied to the study of the different aspects of international economics.

Agreements for Economic Cooperation

Agreements for economic cooperation among nation-states can be in many folds and can pursue more substantial and far-reaching economic and political objectives than those pursued by security alliances. Cartels among nation-states such as Organization of Petroleum Exporting Countries (OPEC) have the most limited goals, and can be characterized by the fact that the main objective of the member nation-states is to present a common front to the rest of the world, without modifying the interactions among themselves. On the other hand, there are several economic-political agreements whose main objective is to increase the interdependence and inter-connectedness of the nation-states involved in them. This type of accord, ordered by increasing comprehensiveness, includes most favored nation agreements, trade blocks, free trade associations, custom unions, common markets, and integrations or unifications. In principle, each of these agreements contains and expands the previous one. In unification, separate nation-states decide to become one.

Drawing from the above may lead to the conclusion that the game theoretic analyses of economic agreements should proceed along lines similar to those followed in the study of security alliances. The investigations of security alliances deal with the problems of their formation and the distribution of costs. Game Theory as an Instrument for the Analysis of International Relations and power within them. These issues, at least in principle, can be studied in agreements for international economic cooperation, but this has not happened so far.

International Trade

The study of international trade by Economists in the past years saw the development of game theory. Despite this, as indicated by Jepma, Jager and Kamphuis (1996), even mercantilism, which can be considered to be the first formal theory of international trade, analyzes the relationships among trading nation-states with clearly game theoretic approaches. A simplified formal model of this point of view in which only two (2) nation-states are considered leads to the conclusion that what one of them gains, the other loses. From this it follows that the zero-sum games used to study battles and war could be applied to the analysis of the mercantilist theory of international trade. This is seen as a situation where the winner takes all the advantages.

It is currently accepted that unrestricted trade benefits all the nation-states involved, since each of them can specialize in the production of the goods in which it has a comparative advantage over the others. This leads to the conclusion that free trade should be the rule in international economic relations; however, this is not the case. Morrow (1994) presents a clear game theoretic explanation of this fact. If one of two trading partners imposes a tariff, it will increase its benefits above the free trade level. This reduces the benefits of the other trading partner, who, as a consequence, attempts to correct the imbalance by also imposing a tariff. It should be clear that this struggle is the trade counterpart of the arms races as discussed earlier.

International financial interactions

The game theoretical approach analyzing trade and tariffs clearly do not deal with all aspects of the economic relations among nation-states. In particular, it is clear that the restriction of imports by means of tariffs is not the only way a nation-state can attempt to improve its balance of trade with other nation-states. This can also be achieved with modifications of the value of a nation-state's currency in relation to an international currency such as the dollar; that is, with modifications of its exchange rate. Devaluation of a nation-state's currency, that is, an increase in its exchange rate, lowers the price of its exports and, as a consequence, improves the competitiveness of its goods and services in the international markets.

The above understanding can be used as the basis for an analysis of the economic relations between two (2) nation-states. One shot devaluations can be studied with Prisoners' Dilemma games, and the devaluation wars that they sometimes originate, with Dollar Auction games. This possibility is interesting due to the real-life importance of this phenomenon. A devaluation by one nation-state can initiate a devaluation war, in which nation-states alternate in devaluating their currencies. In the end, this could damage not only their trade relations, but also their internal economies. Jepma, Jager and Kamphuis (1996), describe the international efforts made to avoid these confrontations. These efforts have culminated in the formation of the International Monetary Fund (IMF) and the use of its Special Drawing Funds to make it possible for nation-states with temporary financial problems to obtain hard currency loans. On the other hand, the role of the IMF as an unregulated international economic authority is begrudged and resisted by the population and governments of many nation-states.

Game Theory and Diplomacy

Looking at diplomacy from a wider perspective, it synonymous to international relations. This is because the study of international relations can be said to cover the same ground as the study of diplomacy. On the other Game Theory as a viable Instrument in understanding Inter-state Relations. It is more helpful to distinguish between the substance of the interactions among nation-states, that is, defense and security, economic or cultural and social issues, than with the form of these interactions, that is, with their diplomatic aspects.

Reynolds (1994), opined that a negotiation between two (2) dissenting nation-states, to be called Y and Z, consists by a sequence initiated by a proposal presented by Y to resolve their disagreement. Nation-state Z now has 3 alternatives: (i) Settle the disagreement under the terms included in the proposal, (ii) present a counter proposal, or (iii) break off the negotiations. If a counter-proposal is presented by Z, Y is in a situation equivalent to that of Z, where Y now has to choose between settling, counter-proposing or breaking off. These alternative steps can be repeated for as long as the two (2) nation-states are willing to present counter-proposals and to consider them, that is, until one of them

decides to settle or to break off negotiations. The bases for the decisions each nation-state has to make at its turn to move are the present values of the payoffs that it expects to receive in the future.

Once the elements of a negotiation described above, that is, the sequence of steps to be taken, available options at each step and payoffs' present values, are available, a well defined game is specified. This type of game is extensively studied in game theory. Some of its analysis preceded by several decades Von Neumann's and Morgenstern's (1944) famous book. The initial results have been extended to consider the possibility that the game can be played without having a well-defined expectation about when it will end, a condition that can be exemplified with the negotiations to end the Korean War, and when the payoffs of the players for settling their disagreement or for breaking off the negotiation are not known with certainty.

Dixit and Skeath (1999), cited an example of the above Game model to the study of U.S.-Japan trade negotiations. This analysis is particularly interesting in that it is especially attentive to the promises and threats that the actors can make to each other, and the impact that these pledges can have on the interacting nation-states. Another example of this model to understanding international relations is presented by Dupont (1994), who uses a game theoretic model to study the negotiations between Switzerland and the League of Nations and those between the European Community and the European Free Trade Association.

An obstacle to the application of the approach above to actual negotiation processes is raised as a consequence of what can be called a structural defect of game theory: it provides, at best, very limited guidance for the specification of the payoffs that the negotiating nation-states should receive when they select each of the strategies they have available. It is simply assumed that certain or uncertain information about payoffs is available. However, as mentioned by Reynolds (1994) important determinants of a nation-state's payoffs are the promises and threats that its counterpart can make and the military, economic and cultural and social instruments that the promising or threatening nation-state can use to implement its pledges. It should be clear that this limitation restricts the applicability of game theory to international negotiations.

Conclusion

The paper on the utilities of Game Theory in understanding inter-state relations concludes that game theoretical stances/assumptions can be used:

- i) to concentrate attention on the core elements of interactions among nation-states and
- (ii) to specify the ways these interactions are likely to proceed. The discussion also show the manifestation of game theory in every aspect of human endeavors and thereby drawing attention to the contribution that game theory can make as a useful and viable instrument for theoreticians and practitioners of international relations, and also to the limitations of this contribution. Finally, game theory is quite significant in studying, analysing and understanding Inter-state Relations at a basic level, the sticks used by game theoreticians are the number of players, their strategies, and the payoffs that each player will receive with each combination of strategies used. The final fence takes the form of mathematical theorems indicating the strategies that players interested only in themselves should adopt, or that there is no combination of strategies that would generate outcomes that are simultaneously considered acceptable by all the players.

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