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Initiative Game Theory: A New Game Theory Model in Initiating Action

Dongyang Wang

Doctor of Philosophy (PHD) Management, LimKoKwing University of Creative Technology, Cyberjaya, Selangor, 63000, Malaysia

1758856937@qq.com

Abstract

In traditional game theory, all the participants are included under reasonable situation. The Nash Equilibrium will be reached by taking some strategies, forming a strategy combination with each party's profit maximized. The article is discussing another kind of game theory: among all the participants, only one participant can maximize the profit, others' profit is minimized, at the same time, the one with maximized profit does not know the strategies of other participants. So, this kind of game theory is named: initiative game. The study and research of this game is called initiative game theory. The article discusses initiative game and the general solution methods. Finally, a new solution to Prisoners' Dilemma is obtained by initiative game theory.

Keywords

Initiative Game, Game Theory, Nash Equilibrium, Game Model.

1. Introduction

Modern game theory is established by Hungarian mathematician John von Neumann in 1920s, the Theory of Games and Economic Behavior co-authored with economist Oskar Morgetern is the commence marker of modern systematic game theory. Nash Equilibrium, and Pareto Efficiency are the foundation of development and solution of game theory.

As a branch subject studying strategic interaction, game theory is a very important concept in economic, the same to modern mathematics and operations research. In explaining the reason of economic behavior, choosing management decision, interpreting the formation and evolution of political system, establishing psychological model, mathematizing biological evolution, and designing market, the game theory all achieve success.

However, there are many actual problems that game theory cannot solve. Till 1970s, game theory has been introduced into mainstream economic books and papers. In recent decades, game theory is widely used in economy, especially the property, which economic behaviors have mutual restriction with each other. In 1994, Nobel Economics Prize was awarded 3 economists who study the game theory, in 2005, Nobel Economics Prize was awarded 2 game theory economists second time, game theory is highly recognized in economy.

However, in 2005, the Nobel economics laureate, Robert John Aumann, thought the basic problem in modern game theory study is lack of suitable rational model. One case is, all the participants do not know the action of other participants, so they cannot determine what strategy they will choose. In addition, this game is very common in human activity. For example, in United States, two candidates run for president, in the beginning of game, both of them know the winner will be the president, they also know, the final result of game is not an equilibrium, benefit of the two will not be maximized at the same time, therefore, this game will never reach a strategy combination with the characteristics of Nash Equilibrium. The solution of game

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theory is based on every kind of equilibrium, however, there are not any theory and research on the prevailing phenomenon.

Initiative game theory aims to study the above phenomenon: among all participants, we must ensure only one participant will obtain maximized benefit, and others have minimized benefit. Each participant does not know others' action and will not response to others' activity.

2. Analyzing What is Initiative Game According to Game Classification

The modern game theory is classified as followings:

Based on the cooperation among people, it is classified into cooperated and non-cooperated game.

In non-cooperated game, it is sub-classified according the sequence of participants into static game and dynamic game.

Based on the understanding of one participant to another, game is classified complete information game and non-complete information game.

However, the basic solution of the above-mentioned game theory is all based on Nash Equilibrium, and Pareto Efficiency. If we use a new classification method, lots of problems will occur.

We try to use a new classification method never appeared before, which is classified based on the maximized benefit among all participants, as followings:

Table 1. Classification based on the maximized benefit among all participants

Classification	Result of game
Type A	Each participant gets maximized benefit
Type B	Only one participant gets maximized benefit, others will not be worse, not sure to get benefit.
Type C	Only one participant gets maximized benefit, whether others will get maximized or minimized benefit is not considered.
Type D	Only one participant gets maximized benefit, others will get minimized benefit

Type A belongs to modern game theory, assuming all the participants are rational, it is a counterbalance state with everyone has maximized benefit.

Type B, the main study method is Pareto Efficiency.

Type C and type D is very common in human activity, however, in game theory study, because there is no equilibrium in human activities, so no effective solution is for these two types. Therefore, nearly all the game theory works ignore these two types. The article studies type C and D. Because the two type all emphasize only one participant gets maximized benefit, and whether others will get maximized or minimized benefit is not considered, the correct solution is the participant with maximized benefit attacks first, and gains initiative before other participants take action, meanwhile, the participant should consider all the strategies others will adopt, and take corresponding actions. Therefore, we defined this kind of game initiative game.

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3. Initiative Game Model

Now we study the model with two participants, here is our game model:

Assumption: for both participants, one is our part, the other is opponent. Requirements for final solution are:

1. Our part gain maximized benefit.

2. In maximizing our part's benefit, the opponent must have minimized benefit. Due to only two participants, if we get maximized benefit, the opponent minimized.

3. In pursing our part's maximized benefit, every measure could be used.

4. In pursing our part's maximized benefit, only consider when we act, the opponent will take corresponding action. After analyzing all schemes, we will adopt the scheme, by which we can get maximized benefit.

The type of game is prevailing in human society, but it is not yet mentioned in the study and research of game theory.

How the solve this game?

4. Analysis and Solution of Initiative Game Model

In this game, we don't know any information about the participants and their actions, even the strategies they will use. Thus, we cannot use Nash Equilibrium or Pareto Efficiency to solve the game. In order to get the solution, we make the following assumptions:

1. A is our part; B is the opponent.

2. In the game, A must win, and gain maximized benefit. If A gains maximized benefit, B must have minimized benefit. In addition, we will not consider what situation B will become.

Based on the above assumptions, in order to gain maximized benefit, and ensure A will win, we should attack first when B does not take any action or strategy. Therefore, the process of gaming is what strategy A will take to attack B, when A attacks first, we will not care what action B will take. After first action, when B will take corresponding action, A will consider the counterbalanced measures.

According to judgement initiative model, because we do not know the action or strategy of B, initiative action or strategy is needed. Thus, how should A take initiative action or strategy? We thinks A should take the following steps first, and then take further action or strategy.

First step: list all the people or things related to A and B.

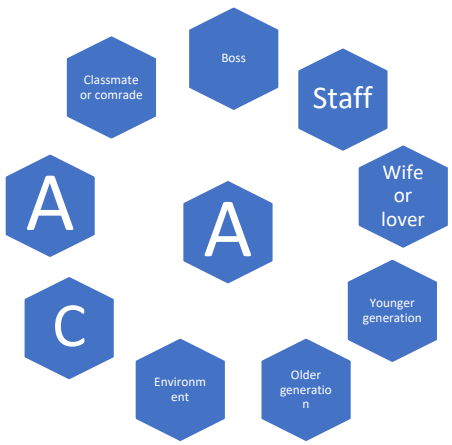

Fig. 1 Extension of boasting game

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Now, it is changed to the following:

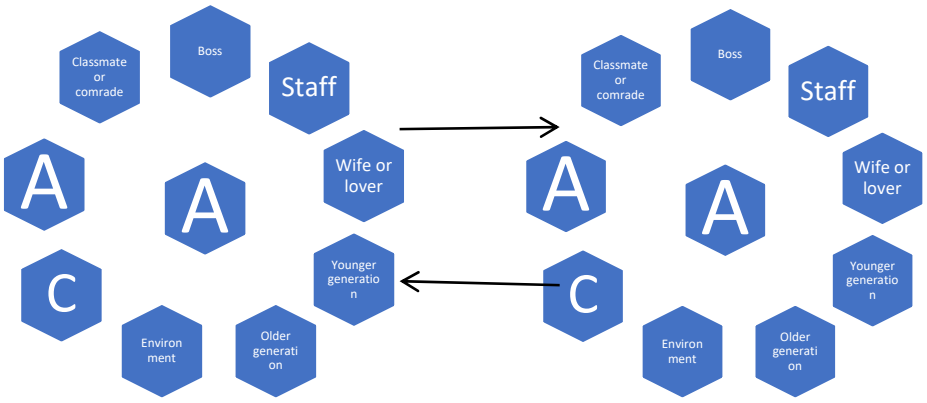

Fig. 2 State of gaming

Now the game is changing, participant of game is not only A and B, but all the elements related to A and B. That is A and B are not the participants of game, the elements related to A and B will be the participants.

Solution rules of judgment game

1. If A wants to gain maximized benefit, the best way is not gaming. That is to say, if B will quit, A will obtain the maximized benefit directly. In actual situation, we will use extra elements related to A, B and C to force B quit. The methods: due to condition change, B is willing to quit. Another case is B's death, if this happens, it is the limit of minimized benefit of B. The case will happen in official circles. Therefore, we can infer that the greatest game is no game.

2. A is able to make full use of all related elements to weaken the elements related to B, so B will not gain maximized benefit.

3. A is able to make full use of all related elements to strengthen the elements related to A, so A will gain maximized benefit.

4. A is able to alienate all participants in order to gain maximized benefit. Alienation is one strategy of A to arouse contradiction between B and C.

5. Establish new game model. There are many ways to build a new game model, we can ask C to participate or ask all the elements without any relations to A, B and C to participate the game.

5. Case Analysis: Prisoner's Dilemma under Judgement Game

Prisoner's dilemma is a game model proposed by Land Company in 1950. The conspirators are put into prison. Any communication is forbidden. If the two conspirators do not confess, due to lack of evidence, they will be imprisoned for only one-year. If one person confesses, and the other keeps silence, the confessor will be set free, and the other will have a five-year prison life. If they confess at the same time, they will be imprisoned for two years due to solid evidence. Because they will not trust each other, they are prone to accuse each other, not keep silence simultaneously.

One of the basic situations of Prisoner's dilemma is we have already set up rules for the game, that is the result for both confessing and refusing. The man who sets up the rules are the judge. Under judgement game, we assume the two prisoners are A and B, A is our part, B is the opponent. According to the rules of judgement game, all the solutions are as following:

1. The best game is no game. To realize this, we should use all the elements related to A, B and C (police), and force B to quit. There are two ways to force B to quit: prove B is not guilty, B dies, B has opposite identity. If the police can prove B is not guilty, it is way for B to quit. If we can

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kill B, B will quit directly. The third method is there existing a fourth party to prove that B is the hero, then B will not participate crime game, and he will hold his identity.

2. Weaken the elements related to B. The method is: we should let B know if he accuses, the people he loved will be hurt, or B will lose more benefit.

3. Strengthen the elements related to A. The method is: the element related to A may directly control the element related to B, so to weaken this element. Or the element related to A is able to control another maximized benefit of B.

4. Alienation method. Arouse contradiction between B and C. For example, A will report some actions of B to damage the benefit of police (C).

5. Establish a new game. Ask the fourth party to participate the game against B. For example, after D appears, if B chooses to report, D causes much more benefit lose to B.

References

[1] Schelling, T. C., The Strategy of Conflict [M]. Harvard University Press, 1960.

[2] Yong, H. P., Individual Strategy and Social Structure: An evolutionary theory of institutions [M]. Princeton University Press, 1998.

[3] Avinash K. Dixit, Susan Skeath, David H. Reiley. Games of Strategy[M]. WW Norton & Co; 3rd Revised edition, 2009.

[4] Roger B. Myerson. Game Theory: Analysis of Conflict[M]. Harvard University Press, Reprint, 1997.

[5] Joseph Harington. Games, Strategies and Decision Making[M]. Worth Publishers Inc., U.S., 2008.

[6] Zhang Weiying, Game Theory and Information Economics [M], Shanghai, SDX Joint Publishing Company, 1996.

[7] Hou Jingchuan, Jiang Yanfu, Comparative Advantage and Overtaking Strategy [J], Journal of Public Management. 2004 (04).

[8] Wei Guanming, Application Limitation and Future Analysis of Game Theory in Management [J], Journal of Shandong Academy of Governance. 2011 (05).

[9] Liu Dehai, Wang Weiguo, Sun Kang. Scenario Prognostics Model and Prevention and Control Measure of Major Sudden Public Health Events Based on Evolutionary Game [J]. System Engineering Theory and Practice. 2012, (05).

[10] Drew Fudenberg, Jean Tirole, Huang Tao Translation. Game Theory [M]. China Renmin University Press, 2002.

[11] Li Zijiang. Study on Nash Equilibrium Point —— Achievements review of Nobel Economics Prize in 1994 [J]. Academic Study. 1995 (02).

[12] John Nash, Jr, Zhang Liangqiao, Wang Xiaogang translation. Proceedings of Nash Game Theory [M]. Capital University of Economics and Business Press, 2000.

[13] Liang Decui, Decision-making Method Research on Decision-Theoretic Rough Sets under Fuzzy Environment [D]. Southwest Jiaotong University, 2014.

[14] Wang Jiaxian, Quan Ji, Liu Weibing, Research on Evolutionary Game and Cooperation Mechanism under Bounded Rationality [J]. System Engineering Theory and Practice. 2011 (S1).