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Hyper-Rational Choice in Game Theory



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Abstract

In this paper, a new interpretation of the rationality for modeling in the game theory has been proposed. The advantage of this concept emphasizes the importance of outcomes of other actors in game. The hyper-rationality concept focuses on preferences of actors how seek to maximize benefit or loss of other actors and or seek to maximize his benefit.

Keywords: Rational choice; Game theory; Preferences

Introduction

Game theory was for the first time recognized by Von Neumann and Morgenstern [1] in reference to human economic behavior [1]. This theory is a powerful tool for predicting and analyzing the behavior of various phenomena in different sciences and it helps us understand situations in which decision-makers interact [2,3]. Although there are many branches of game theory: cooperative and non-cooperative game theory are the most common which these two branches are analyzed in the form of dynamic or static games [4]. Recently Eshaghi & Askari [5] introduced a new concept of rational choice called hyper-rational choice. The concept of hyper-rational choice suggests that hyper-rational players have considered three classes of hyper-preferences that help determine how to behave in interactive decisions.

Hyper-rational choice

In the concept of hyper-rationality, the player thinks about profit or loss of other players in addition to his personal profit or loss and then will choose an action which is desirable to him. Here, we consider the set of possible choices of rational individual $i \in \{1, 2, \dots, n\}$ is shown with $A_i = \{a_1, a_2, \dots, a_n\}$. Given hyper-preferences, how will a hyper-rational individual behave? We assume that given a set of choices $B \subseteq A = A_1 \times A_2 \times \dots \times A_n$. We define the weak hyper-preferences of actor i' over the set B as follows:

$(a_1, a_2, \dots, a_n)_i \succ' (b_1, b_2, \dots, b_n)_i \Leftrightarrow$ either $a_1 \succ b_1$ based on actor $a_1 < b_1$ i'

preferences for actor 1 and either $a_2 \succ b_2$ or $a_2 < b_2$ based on actor i'

preferences for actor 2 and either $a_i \succ b_i$ or $a_i < b_i$ based on actor i'

preferences and either $a_n \succ b_n$ or $a_n < b_n$ based on actor i' preferences for actor n ,

where relation \succ is complete and transitive. Considering situations which the individual faces, we define hyper-rationality as follows:

Definition : (Hyper-rational)

An individual will be called hyper-rational under certainty if is a rational and their hyper-preferences (individual or for others) satisfy at least one of the following conditions:

- The actor chooses from the set of available alternatives (actions) based on individual preferences;
- The actor chooses from the set of available alternatives (actions) based on preferences for other actors.

In order to describe a game, the set of possible choices of rational individual $i \in \{1, 2, \dots, n\}$ is shown with $A_i = \{a_1, a_2, \dots, a_n\}$. So, each individual player i has a set of actions A_i available to him and a particular element in the set of actions is denoted by $a_i \in A_i$.

Now, we apply hyper-rational choice theory as a basis and main element of modeling in game theory. With help of hyper-rationality, we analyze conditions of a strategic game. In order to describe a game based on concept of hyper-rational choice, the payoff functions for each player i is given by:

$$U_i^j(a_1, a_2, \dots, a_n) = \begin{cases} U_i(a_1, a_2, \dots, a_n) & \text{if } i = j \\ U_i(a_1, a_2, \dots, a_n) & \text{if } i \neq j, \end{cases} \quad (1)$$

Where U_i^j shows that if player i considers profit (loss) of player j , he will choose an action from a set of available actions which will benefit (lose) player j , for every $i, j \in \{1, 2, \dots, n\}$. In other

words, based on player i' preferences for player j , he thinks about profit or loss of another player in addition to his personal profit or loss and then will choose an action from a set of available actions which is desirable to him.

Conclusion

The concept of hyper-rationality helps us to more clearly understand cooperation and non-cooperation in games. The hyper-rational actor is the person who has concurrently characteristics of Homo-economics actor and Homo-reciprocans actor. Hyper-rationality leads to consideration of the nonmaterial benefits. The findings of this research can help to enlarge our understanding of the psychological aspects of strategy choices in games and also provide an analysis of the decision-making process with cognitive economics approach at the same time. The concept of hyper-rational can provide a method that is as a common research language between psychologists and economists.



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