Essays in games and decisions

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Valorization

Article 23 of the "Regulation governing the attainment of doctoral degrees" at Maastricht University states:

"Knowledge valorization refers to the 'process of creating value from knowledge, by making knowledge suitable and / or available for social (and / or economic) use and by making knowledge suitable for translation into competitive products, services, processes and new commercial activities' (adapted definition based on the National Valorization Committee 2011:8)."

Introduction

In this dissertation, I study certain relations between uncertainties in games and decision problems. Furthermore, I propose an alternative solution that arguably gives additional insights in some strategic decision making situations, which are not captured by the standard tools.

As I will give details below, in this dissertation I propose models that make testable and falsifiable predictions—which are indispensable for scientific research—about actual human behavior. This dissertation presents basic research rather than applied research. My findings in this dissertation are mainly relevant for (pure and applied) academic research; hence, they do not generally create immediate valorization opportunities in the short run.

Chapter 2: Two-person symmetric games and decision problems

In this chapter, I explored some interrelations between games and decision problems. I observed that some games could be framed as if a decision maker plays them against her dual-self, which led me study the links between some game and decision theoretical concepts. For example, I showed that a decision problem satisfies the von Neumann-Morgenstern utility if and only if its equivalent symmetric game is a potential game. This chapters belongs to the category of basic research. Hence, its societal impact may be achieved indirectly and / or in the long run.

Chapter 3: Existence of pure equilibrium in two-person symmetric zero-sum games

In this chapter, I introduced three sufficient conditions for the existence of a pure Nash equilibrium in two-person symmetric zero-sum games including the so-called sign-quasiconcavity notion, which is a generalization of quasiconcavity in Duersch et al. (2012a). It seems that the new sufficient condition is easier to check than generalized ordinal potentials and quasiconcave games. This chapter, too, belongs to the category of basic research.

Chapter 4: Optimin equilibrium: An extension of maximin strategies

In this chapter, I developed a solution concept that extends the maximin principle to non-zero-sum games by incorporating an individual rationality constraint whereby players do not harm themselves for the sake

	Rock	Scissors	Paper
Rock	$0,0$	$1,0$	$0,1$
Scissors	$0,1$	$0,0$	$1,0$
Paper	$1,0$	$0,1$	$0,0$

Figure 5.3: Rock-Paper-Scissors game

of harming others. A maximin strategist chooses an action to maximize the minimum utility he might receive under any conceivable play by the other player, "even assuming that his opponent is guided by the desire to inflict a loss rather than to achieve a gain" (von Neumann and Morgenstern, 1944, p. 555). Because the classical maximin strategies disregard mutual gains and losses in these interactive situations, the optimin concept better captures many economically relevant interactions that are not zero-sum.

Optimin equilibrium makes predictions about human behavior in every strategic decision making environment. Thus, it may be interesting to test the theory in various game situations. For example, Figure 5.3 illustrates the Rock-Paper-Scissors game, in which the unique optimin solution is that each player uniformly randomizes over the actions Rock, Paper, and Scissors. By doing so, he or she cannot be outguessed by his or her opponent. This prediction coincides with the prediction of Nash equilibrium—the benchmark solution concept in game theory.

It may be especially informative to test the optimin prediction in the game shown in Figure 5.4, because the unique optimin prediction differs from the unique benchmark solution, Nash equilibrium. Another game in which optimin solution differs from Nash equilibrium is the well-known finitely repeated prisoner's dilemma. To illustrate the difference, consider the finitely repeated prisoner's dilemma with the following stage game:

	Top	Middle	Bottom
Top	$100, 100$	$100, 105$	$0, 0$
Middle	$105, 100$	$95, 95$	$0, 210$
Bottom	$0, 0$	$210, 0$	$5, 5$

Figure 5.4: A game in which the unique optimin equilibrium is (Top, Top), and the unique Nash equilibrium is (Bottom, Bottom).

	Cooperate	Defect
Cooperate	3,3	0,5
Defect	5,0	1,1

As is well-kwown, the Tit-for-Tat strategy—in which a player begins by cooperating in the first round and then does what the opponent did in the previous round—is not a Nash equilibrium. However, it turns out to be an optimin equilibrium solution.

Chapter 5: Is rationality a personal trait? A paradox

In this chapter, I focused on the concept of rationality to answer the following question: 'Is it possible for an economic agent to be simultaneously rational in every situation she faces?' I observed that there are games and decision problems in which an agent cannot be simultaneously rational (à la von Neumann-Morgenstern) in both of them. Accordingly, I provided a unique social preference condition for an agent that makes her rational in these situations. It turns out that this condition rules out social preferences including inequality aversion and altruism.

Rationality or (expected) utility maximization has been one of the main assumptions in Economics for more than a half-century. Thus, to be able to better predict human behavior, it is important to understand the limitations of this concept in decision making situations. It would be interesting to test empirically or experimentally the predictions that are provided in this chapter.