Transformative Decision Rules

Foundations and Applications

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Abstract

A transformative decision rule alters the representation of a decision problem, either by changing the sets of acts and states taken into consideration, or by modifying the probability or value assignments. Examples of decision rules belonging to this class are the principle of insufficient reason, Isaac Levi’s condition of E-admissibility, Luce and Raiffa’s merger of states-rules, and the de minimis principle. In this doctoral thesis transformative decision rules are analyzed from a foundational point of view, and applied to two decision theoretical problems: (i) How should a rational decision maker model a decision problem in a formal representation (‘problem specification’, ‘formal description’)? (ii) What role can transformative decision rules play in the justification of the principle of maximizing expected utility?

The thesis consists of a summary and seven papers. In Papers I and II certain foundational issues concerning transformative decision rules are investigated, and a number of formal properties of this class of rules are proved: convergence, iterativity, and permutability. In Paper III it is argued that there is in general no unique representation of a decision problem that is strictly better than all alternative representations. In Paper IV it is shown that the principle of maximizing expected utility can be decomposed into a sequence of transformative decision rules. A set of axioms is proposed that together justify the principle of maximizing expected utility. It is shown that the suggested axiomatization provides a resolution of Allais’ paradox that cannot be obtained by Savage-style, nor by von Neumann and Morgenstern-style axiomatizations. In Paper V the axiomatization from Paper IV is further elaborated, and compared to the axiomatizations proposed by von Neumann and Morgenstern, and Savage. The main results in Paper VI are two impossibility theorems for catastrophe averse decision rules, demonstrating that given a few reasonable desiderata for such rules, there is no rule that can fulfill the proposed desiderata. In Paper VII transformative decision rules are applied to extreme risks, i.e., to a potential outcome of an act for which the probability is low, but whose (negative) value is high.

Key Words

transformative decision rule, problem specification, framing, expected utility, decision theory