

## **Resolving St. Petersburg, Allais and Ellsberg paradoxes with the focus-based decision theory**

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Different unknown situations require different decision theories. Decision rules for situations involving ignorance include maximin, maximax, minmax regret and Hurwicz criterion. The expected utility (EU) theory of Von Neumann and Morgenstern is appropriate for the decision making under risk and the subjective expected utility (SEU) theory of Savage is appropriate for decision making under uncertainty where subjective probabilities are used to reflect an individual's belief.

There is evidence that people systematically violate EU theory while making decisions. Most criticism of the Von Neumann-Morgenstern's and Savage's axioms mainly focus on independence axiom or sure thing principle, transitivity axiom and completeness axiom.

Many theories have been proposed to react to such empirical evidence that human behavior often contradicts expected utility theory. One such theory, i.e. prospect theory developed by Kahneman and Tversky is a non-additive probability model. Regret theory uses modified utility of choosing one alternative instead of another which consists of a choiceless utility and a regret-rejoice function. Other models such as, second-order probabilities models and non-additive probability models have also been proposed in this empirical challenge.

In the existing decision theories, an alternative is regarded as a lottery so that the objects of choice are probability distributions which generally follow the Bernoullian framework of the weighted average. Guo initially proposed the one-shot decision theory (OSDT) which provides a scenario-based choice instead of the lottery-based choices as in the existing decision theories. The idea comes from a common phenomenon: when you ask some person why he/she makes such a decision under uncertainty, he/she always tells you just one scenario which is crucial to him/her and is the base for achieving his/her conclusion. In the one-shot decision theory, we argue that a person makes a decision based on some particular scenario instead of a lottery. As the applications, a duopoly market of a new product with a short life cycle and the private real estate investment were analyzed. Recently, Guo and Li proposed multistage one-shot decision making approaches and analyzed the optimal stopping problem; Guo and Ma built newsvendor models for Innovative Products with the one-shot decision theory.

In this paper, we generalize the one-shot decision theory as the focus-based decision theory. Using the focus-based decision theory, we solve three paradoxes, that is, St. Petersburg paradox, Allais paradox and Ellsberg paradox.