論文の内容の要旨

論文題目　Behavioral Decision Theory: An Axiomatic Approach

（行動意思決定理論: 公理的アプローチ）

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Abstract

This dissertation contains three essays in decision theory. Each topic is related to various behavioral regularities that cannot be identified by rational choice theory in economics. Chapter 1 studies choices with attribute-based inferences. Chapter 2 studies choices with social image that stems from the trade-off under altruism and selfishness. Chapter 3 studies stochastic choices that stems from deliberate randomization such as tossing a coin in mind.

In this dissertation, we take the framework of *preferences over menus*, i.e., the framework of subjective state spaces (Kreps (1979)/Dekel et al. (2001)). In the theory of decisions under uncertainty such as Savage (1954) and Anscombe and Aumann (1963), state spaces are exogenously given. This implies that decision analysts can observe what kind of uncertainty an decision maker faces in one' s mind. On the other hand, interestingly, Kreps (1979) axiomatically elicits a state space endogenously, and Dekel et al. (2001) uniquely identifies an endogenous state space, by using preferences over menus as primitives. This type of state spaces are interpreted as *subjective uncertainty* the decision maker perceives in one's mind.

We apply the framework of preferences over menus into the three topics in behavioral economics and decision theory. Chapter 1 presents a theory of attribute-based inferences. In Chapter 1, we investigate the trade-off across attributes as a type of *subjective uncertainty* in terms of preferences over menus. Chapter 2 presents a theory of reference-dependent social-image. In Chapter 2, we consider the trade-off between the subjective criterion of altruism and selfishness in mind, in terms of preferences over menus. Chapter 3 presents a theory of preferences for randomization, especially, "deliberate randomization." In Chapter 3, we investigate the attitude toward the effect of deliberate randomization such as a coin toss in mind that is not directly observable. We study the subjective belief of deliberate randomization in terms of preferences over menus.

CHAPTER 1

Attribute-based inferences are often used in real-life decision-making. Classically, Krantz et al. (1971) provide an axiomatic characterization of separably additive attribute-based utility representations. Krantz et al. (1971) show that, given an attribute space, there exists a set of attribute functions that represents attribute-wise rankings, and preferences are represented by a separably additive utility

representation. Keeney and Raiffa (1976) refer to the importance of how decision makers determine the optimal weight on the attribute space. In general, there exists trade-offs across attributes. The trade-offs are closely related to the resulting choice behaviors. Moreover, such a trade-off makes it difficult to determine the optimal weight on the attribute space, as well as to make a choice.

In the literature of marketing, for example, attribute-based inferences often lead to preferences reversals, i.e., violations of WARP (*Weak Axiom of Revealed Preference*). That is, an irrelevant third alternative affect a decision-making between two alternatives. For example, the Attraction Effect (Huber et al. (1982)) and the Compromise Effect (Simonson (1989)) are well-known behavioral regularities as violations of WARP.

Chapter 1 presents a theory of attribute-based inferences. In Chapter 1, we consider the trade-off across attributes as a type of *subjective uncertainty* in terms of preferences over menus. We explore plausible axioms for attribute-based inferences about preferences over menus: *Dominance*, *Dissatisfaction*, and *Contemplation*. We have considered the new axioms to capture how the trade-off across attributes affects decision-making, and how the decision maker contemplate the weight on the attribute space. We find that the trade-off across attributes is related to a class of preferences for commitment (preferring smaller menus).

These key axioms, *Dominance*, *Dissatisfaction*, and *Contemplation*, along with other basic axioms, characterize a dissatisficing-averse utility representation in attribute-based inferences. The utility representation depicts the decision maker who determines the optimal weight on the objective attribute space to minimize the deviation from each attribute-best option. We apply the dulaity result into the utility representation, by showing that exploring the *best* option on the Pareto frontier in each menu on the attribute-based utility space is equivalent to exploring the *optimal* weight on the attribute space. In terms of attribute-based inferences, a relationship between raw preferences and reasoned choices is discussed. Moreover, Chapter 1 considers a pair of preferences over menus and choice correspondences to characterize ex-post choices of the dissatisficing-averse utility representation. Finally, Chapter 1 characterizes the ex-post choice, by relaxing WARP (*Weak Axiom of Revealed Preference*).

CHAPTER 2

Social preference is one of the key topics in behavioral economics. In experiments on social preferences, subjects often exhibit pro-social behaviors. In a recent experimental study, Dana et al. (2006) consider an extended version of dictator games. They provide a two-stage decision problem for dictators. At the first stage, dictators have two options. The one is to proceed to the standard dictator games to share \$10 between a dictator and a recipient. The other is to exit with \$9 for dictators and nothing for recipients. The key point in this experiment is that recipients do not know about dictators' choices at the first stage. Dana et al. (2006) find that about one-third of subjects were willing to "exit" a \$10-dictator game, and they take \$9 instead. This type of behaviors is not consistent with behavioral economic models such as inequality aversion.

Dillenberger and Sadowski (2012) is the first literature to apply the framework of preferences over menus to the study of social image. The trade-off between altruism and selfishness in mind is related to *subjective uncertainty*. The key point in their study is that, compared with the choice at the ex-ante stage, the choice at the ex-post stage, i.e., choosing an allocation from the menu chosen at the ex-ante stage is more altruistic, since that choice is publicly observed. In general, however,

the subjective criterion of social image is *opportunity-dependent*. Different situations might exhibit different attitudes toward social image.

In Chapter 2, we develop a unified model in other-regarding preferences and reference-dependent preferences, by eliciting an endogenous reference point as a criterion of social-image. The objective of Chapter 2 is to identify underlying criterion of altruism and selfishness, in terms of preferences over menus. Chapter 2 presents a theory of reference-dependent utilitarian, by anticipating self-image in altruism and selfishness in one's mind. To do so, Chapter 2 relaxes the axiom of *Strategic Rationality* in Kreps (1979), and to capture reactions from reference points, Chapter 2 also relaxes the axiom of *Independence*. We have considered how the trade-off between the subjective criterion of altruism and selfishness affects choice behaviors. In Chapter 2, we uniquely identify the attitude toward pure altruism, reference-dependent criterion of social image, and parameters for reference points, respectively. Moreover, we provide a comparative attitude toward reference points as self-image in altruism and selfishness.

CHAPTER 3

Recently, the study of stochastic choices has been rapidly developing. One might have the following question: "why do human behaviors seem to be stochastic?" In decision theory, the reasons for this question are categorized into the following three topics. Note that the intersections between the topics are non-empty.

1. Learning
2. Limited Attention
3. Deliberate Randomization

In the first topic of learning, decision makers privately obtain some information that is not observed by decision analysts. As a result, the resulting choice behaviors seem to be stochastic. In the second topic of attention, decision makers might randomly change the focus for each decision problem. In fact, the attention itself is subjective. As a result, the resulting choice behaviors seem to be stochastic.

In this dissertation, we focus on the study of the third topic: *deliberate randomization*. By using the framework of preferences over menus, we elicit an attitude toward the effect of subjective randomization in one's mind.

Chapter 3 presents a theory of preferences for randomization, especially, "deliberate randomization." The contribution of Chapter 3 is threefold. First, we elicit a subjective belief of deliberate randomization from deterministic preferences. The key axiom in our axiomatic analysis is a *monotonic* condition for deliberate randomization, stated as *Randomization*. We show that *Randomization*, along with other axioms, axiomatically characterizes a random anticipated utility representation in which the decision maker's subjective belief for deliberate randomization is identified. Second, we identify a class of *preferences for randomization* ranging from the *desire to randomization* to the *aversion to randomization*. Third, we show that the subjective belief for the effect of randomization in one's mind is closely related to several cognitive or psychological effects. Especially, we apply preferences for randomization into subjective partitional learning to capture preferences for delay. We also provide an axiomatic analysis for costs of thinking to identify the attitude toward randomization uniquely.

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