DOMINANT-STATE THINKING AND STATE-DEPENDENT PREFERENCES

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ABSTARCT

In this study, dominant-state thinking was represented in the form of a dominant state or a dominant event as an individual may perceive, and issues related to state-dependent preferences with dominant-state thinking were addressed accordingly. With a dominant state or a dominant event existing in the partial information possessed by an individual, the axiom of continuity, indispensable to the establishment of the expected-utility maximization theorem, may not hold in the presence of discontinuity in the individual's state-dependent preferences with dominant-state thinking. As presented in the study, the representations of the dominated states and the states contained in the dominated events as null states may tackle not merely the problem of discontinuity in an individual's state-dependent preferences with dominant-state thinking, but also the necessity of extremely high utility levels associated with a dominant state or a state contained in a dominant event. However, to present more appropriate representations of state-dependent preferences with dominant-state thinking within various contexts, research attention may be directed as well to issues related to the posterior state-dependent preferences of an individual and his further choice in the culmination of a dominated event, given his choice made under his prior state-dependent preferences with dominant-state thinking.
Keywords: thinking; preferences; dominant state, dominant event, dominated state

1. INTRODUCTION

With regard to individual choice under uncertainty, “the decision-maker faces some uncertainty about her preferences over the available alternatives. In many cases, she may be able to improve her decision by first engaging in some form of introspection or contemplation about her preferences” (Ergin and Sarver, 2010, p. 1285). One of the issues related to the state-dependent thinking and choice which might be formed by an individual may be illuminated by the following correspondence between Aumann and Savage:

> IN A LETTER TO SAVAGE dated January, 1971, Aumann raises a conceptual difficulty with the notion of subjective probabilities as defined in Savage's Foundations of Statistics (1954). In his letter, Aumann describes a man who loves his wife very much, and whose life without her would be less attractive, less "worth living." The wife is sick and must undergo a routine but dangerous operation that only half of all

patients survive. The husband is offered a choice between betting a hundred dollars on the survival of his wife and betting the same amount on heads in a coin toss. It is not unreasonable to suppose that the man will prefer the former bet, since by betting on a coin toss he might win a hundred dollars under circumstances in which it would be worthless, namely, in the event that his wife dies. According to Aumann, this example describes a situation in which the notion of a consequence whose "value" is state independent does not exist. The preferences over outcomes are inherently state dependent so that the notions of utility and subjective probabilities may not be disentangled in a manner that would permit a meaningful definition of unique subjective probabilities.

In his response, Savage recognizes the difficulty and then proceeds to outline a way of fitting the problem into his framework. …. (Karni, 1993, p. 187)

As further mentioned by Karni (1993), the difficulty indicated in the correspondence between Aumann and Savage, is not specific merely to Savage's theory, but is also a crucial aspect of the Anscombe-Aumann definition of subjective probabilities under the assumption of state-independent preferences and embedded in subsequent versions of subjective expected utility theory. Karni asserted that there are circumstances which are more ordinary than the one described by Aumann and would be associated with the state of nature, on which the dependence of the preferences would be an indispensable ingredient of the decision problem an individual needs to solve. While it is questioned, as mentioned by (Myerson, 1991), whether any simple quantitative model may provide a sufficient and reasonable description of people's behavior, beginning with the pioneering works of Ramsey, von Neumann and Morgenstern, and Savage, a vast number of research attempts have been made on axiomatic derivations of the subjective probability and expected-utility maximization to represent the behavior of an individual under uncertainty.

2. STATE-PRIZE CORRESPONDENCE THINKING

Whereas it would be difficult to precisely represent an individual's state-dependent preferences and choice, researchers attempted to address the issue with the aid of some basic generally accepted beliefs regarding a rational individual's preferences over the correspondence between states and prizes. In their famous article, Kahneman and Tversky (1979) described a prospect $(x_1, p_1;...;x_n, p_n)$ as a contract which specifies the correspondence between an outcome x_i and the corresponding probability p_i, where $\sum_i p_i = 1$ for all outcomes, and referred to decision making under risk as a choice between prospects. Following the conventional framework used for analyzing individual preferences and choice, and beginning with a finite, nonempty, set Ω containing elements called states, a $\sigma -$ field $\Im_X$ on a nonempty set X including elements referred to as prizes, Karni (1993) identified a consequence as a probability measure on the measurable space $(X, \Im_X)$ and a roulette lottery as a consequence with finite support.

A roulette lottery may be viewed as first-order thinking in the form of a correspondence between prizes and states and is characterized by prizes and the probabilities associated with the states on which the prizes are determined. With regard to the two bets of a man betting a hundred dollars on the survival of his wife and betting the same amount on heads in a coin toss as mentioned in the correspondence between Aumann and Savage, in forming thinking regarding each of the two bets in the form of a roulette lottery, an individual may constitute the first-order thinking identically for each of the two bets as "it would offer a prize 100 or -100, each with probability $1/2$." However, as indicated in the correspondence, "it is not unreasonable to suppose that the man will prefer the former bet, since by betting on a coin toss he might win a hundred dollars under circumstances in which it would be worthless, namely, in the event that his wife dies. According to Aumann, this example describes a situation in which the notion of a consequence whose "value" is state independent does not exist." (Karni, 1993, p. 187). As suggested by the argument, an individual's thinking of a bet in the form of a roulette lottery would be merely one of the initial, crucial elements in his thinking formation during the whole process of decision-making.

Based on a consequence, an act is constituted by associating a space of consequence-value-relevant states with consequences to represent the higher-order thinking which may be developed by an individual with state-dependent preferences. Symbolically, with $\Delta(X)$ denoting the set of all consequences, an act is defined as a function $f:\Omega\to\Delta(X)$ which specifies a nonnegative real number $f(x/t)$ for every prize $x\in X$ and every state $t\in\Omega$ such that $\sum_{x\in X} f(x/t)=1$ for every state $t\in\Omega$ (Karni, 1993; Seo, 2009). Following Anscombe and Aumann, Karni refered to an act whose range is the set of all roulette lotteries by a horse lottery. To include the probability model and the state-variable model as special cases in analyzing decision-making under uncertainty, Myerson (1991) also defined a lottery as a function $f:\Omega\to\Delta(X)$ so that the prize may be associated with both objective unknowns and subject unknowns, which may be described respectively by such a probability measure on the measurable space $(X,\Im_X)$ and by such a state variable $t\in\Omega$, as specified above for an act. For any two acts $f(x/t)$ and $g(x/t)$, Seo (2009) referred to $\alpha f\oplus(1-\alpha)$ as a component-wise mixture, with the second-stage mixture operation defined as $(\alpha f\oplus(1-\alpha)g)(t)(\beta)=\alpha f(t)(\beta)+(1-\alpha)g(t)(\beta)$ for every $t\in\Omega$ and $\beta\in B_X$, where B_X represents the Borel $\sigma-$algebra on X, and indicated that a one-stage lottery in $\Delta(X)$ may be induced by each $f(x/t)$ and $\mu(t)\in\Delta(\Omega)$, where $\Delta(\Omega)$ is the set of all probability measures on the set of states Ω, through the mixture operation represented as $\Psi(f,\mu)=\mu(t_1)f(t_1)\oplus\mu(t_2)f(t_2)\oplus...\oplus\mu(t_{|\Omega|})f(t_{|\Omega|})$. This mixture operation facilitates inter-thinking representations of an individual's thinking of an act and his thinking of the corresponding consequence, given his prior belief regarding the measurement of the probabilities of the states, represented by $\mu(t)\in\Delta(\Omega)$.

3. DOMINANT-STATE THINKING CHARACTERIZATION

In the example described by Aumann (Karni, 1993), a man adores his wife and his life would be less attractive without her. So far as his wife is concerned, the man is confronted with two distinct states, one of his wife being surviving and the other of his wife being no longer surviving. For this man, the state of his wife being surviving would be dominant over the state of his wife being no longer surviving in that the man prefers the former state in an extreme extent to the latter state. In the present study, a state which is dominant over all the other states for an individual would be referred to as a dominant state for this individual and all the others states as dominated states. To characterize the state-dependent preferences of an individual, the importance of each of the states and the individual's evaluation of the prizes realized in each state would be crucial elements in his formation of state-related thinking and state-dependent choice.

To conceptualize a dominant state perceived by an individual in his formation of state-related thinking and state-dependent choice, choice among pure lotteries will be examined in the study. With the prior information possessed by an individual regarding the states, as represented by a probability measure space $(\Omega, \ \Im, \ P)$, where $\Omega = \{1,..., N\}$, $\Im$ is a $\sigma -$field in Ω, and P is a probability measure on $\Im$, a lottery $f(x/t)$ would be referred to as a pure lottery in the study if there exists a $x_t^f \in X$ for every state $t \in \Omega$ such that $f(x_t^f \ /t) = 1$. Let the set L denote the set of all those pure lotteries available to an individual to choose from, and the set L^X represent the set $\{(x_1^f ,..., x_N^f) \big| f \in L \wedge f(x_t^f \ /t) = 1\}$, which contains the state-labeled prize combinations of all the pure lotteries in the set L. With the prior information possessed by an individual regarding the states, as represented by a probability measure space $(\Omega, \ \Im, \ P)$, the individual's thinking of the prior choice space may be represented symbolically as an expended choice space comprising the set of the pure lotteries available to the individual and the probability measure space perceived by him in the symbolic form of $\{L, \ (\Omega, \ \Im, \ P)\}$, which may be alternatively represented symbolically by $\{L^X, \ (\Omega, \ \Im, \ P)\}$. An individual's choice operations on the expanded choice space may be represented with respect to his choice operations on L, the set of pure lotteries, or on L^X, the set of state-labeled prize combinations, conditional on his prior partial information represented by the $\sigma -$field $\Im$ contained in $(\Omega, \ \Im, \ P)$.

With the choice space $\{L^X, \ (\Omega, \ \Im, \ P_\Omega)\}$ possessed by an individual, his preference relation $\succeq$ on L^X is assumed as usual to be a complete and transitive binary relation, indicating by $(x_1^f ,..., x_N^f) \succeq (x_1^g ,..., x_N^g)$ that $(x_1^f ,..., x_N^f)$ is weakly preferred to $(x_1^g ,..., x_N^g)$. As $(x_1^f ,..., x_N^f) \succeq (x_1^g ,..., x_N^g)$ and $(x_1^g ,..., x_N^g) \succeq (x_1^f ,..., x_N^f)$, the binary relation between $(x_1^f ,..., x_N^f)$ and $(x_1^g ,..., x_N^g)$ is represented by $(x_1^f ,..., x_N^f) \sim (x_1^g ,..., x_N^g)$. As $(x_1^f ,..., x_N^f)$ is strictly preferred to $(x_1^g ,..., x_N^g)$, the strict binary preference relation between the two state-labeled prize combinations would be represented symbolically by $(x_1^f ,..., x_N^f) \succ (x_1^g ,..., x_N^g)$, which indicates the relation "$(x_1^f ,..., x_N^f) \succeq (x_1^g ,..., x_N^g)$ and not $(x_1^g ,..., x_N^g) \succeq (x_1^f ,..., x_N^f)$." In this framework, the characteristics of a dominant state embedded in the dominant-state thinking of an individual would be identified for the purpose of appropriately representing his state-dependent preferences with dominant-state thinking.

For an individual who is confronted with the expanded choice space, $\{(L^X, (\Omega, \Im, P_\Omega)\}$, the representation of a state $s \in \Omega$ as a dominant state for an individual may be such that for any two state-labeled prize combinations $(x_1^f, ..., x_N^f)$ and $(x_1^g, ..., x_N^g) \in L^X$, $(x_1^f, ..., x_N^f) \succ (x_1^g, ..., x_N^g)$ as $x_s^f > x_s^g$. As indicated by such representation, the state-labeled prize combination $(x_1^f, ..., x_N^f)$ associated with the pure lottery $f(x/t)$ would be strictly preferred by an individual to the state-labeled prize combinations $(x_1^g, ..., x_N^g)$ associated with the pure lottery $g(x/t)$ if the prize level associated with $f(x/t)$ in the dominant state is higher than the prize level associated with $g(x/t)$ in the dominant state. However, the representation of an individual's dominant-state thinking as such may be subject to the undesirable preference properties of the existence of discontinuity in his state-dependent preferences and the necessity of extremely high utility levels associated with a dominant state.

By the expected-utility maximization theorem, an individual's choice among a set of pure lotteries L would be equivalent to his choice among the state-labeled prize combinations associated with the pure lotteries with respect to the expected utility levels derived from the state-labeled prize combinations. With the individual's state-dependent utility function represented symbolically as $u(x,t)$, the expected utility derived from $(x_1^f, ..., x_N^f)$ would be $\sum_{t \in \Omega} P(t/\Omega) \sum_{x \in X} u(x,t) f(x/t)$, which would be equal to $\sum_{t \in \Omega} P(t/\Omega) u(x_t^f, t)$ for the pure lottery $f(x/t)$, while the expected utility derived from $(x_1^g, ..., x_N^g)$ would be $\sum_{t \in \Omega} P(t/\Omega) \sum_{x \in X} u(x,t) g(x/t)$, which would be equal to $\sum_{t \in \Omega} P(t/\Omega) u(x_t^g, t)$ for the pure lottery $g(x/t)$. In the study, it is assumed as usual that $u(0,t) = 0$ for every $t \in \Omega$.

If the representation of a dominant state $s \in \Omega$ is such that for any two pure lotteries $f(x/t)$ and $g(x/t)$, $(x_1^f, ..., x_N^f) \succ (x_1^g, ..., x_N^g)$ as $x_s^f > x_s^g$, the representation of a dominant state as such would imply that $\sum_{t \in \Omega} P(t/\Omega) u(x_t^f, t) > \sum_{t \in \Omega} P(t/\Omega) u(x_t^g, t)$ as $x_s^f > x_s^g$ even though $x_t^g > x_t^f$ for every $t \in T$, where $T = \Omega - \{s\}$. For two pure lotteries $f(x/t)$ and $g(x/t)$, suppose that $x_s^f = x_s^g + k$, $k > 0$, and for every $t \in T$, $x_t^g > x_t^f$. As k approaches zero, x_s^f would approaches x_s^g, and it would turn out to hold that $P(s/\Omega)[u(x_s^f, s) - u(x_s^g, s)] < \sum_{t \in T} P(t/\Omega)[u(x_t^g, t) - u(x_t^f, t)]$, which would suggest the reversal of the preference ordering of $f(x/t)$ and $g(x/t)$ as indicated by $\sum_{t \in \Omega} P(t/\Omega) u(x_t^f, t) < \sum_{t \in \Omega} P(t/\Omega) u(x_t^g, t)$. The pure lottery $g(x/t)$ would turn out to be strictly referred to $f(x/t)$. Then it would be

$(g(x/t), f(x/t),)$ instead of $(f(x/t), g(x/t))$, which would belong to the graph of the binary state-dependent preference relation $\succ$ in the set of pure lotteries, L, as h approaches zero. This implies the existence of inconsistency in an individual's dominant-state preferences as a result of the existence of discontinuity in his state-dependent preferences.

Similarly, for two pure lotteries $f(x/t)$ and $g(x/t)$, suppose that $x_s^f = x_s^g + k$, $k > 0$, and for every $t \in T$ $x_t^g > x_t^f$. If the representation of a dominant state $s \in \Omega$ is such that for any two pure lotteries $f(x/t)$ and $g(x/t)$, $(x_1^f,...,x_N^f) \succ (x_1^g,...,x_N^g)$ as $x_s^f > x_s^g$, with $x_s^f > x_s^g$, it should hold under such representation of a dominant-state that $P(s/\Omega)[u(x_s^f, s) - u(x_s^g, s)] > \sum_{t \in T} P(t/\Omega)[u(x_t^g, t) - u(x_t^f, t)]$, which may be further expressed as $[u(x_s^f, s) - u(x_s^g, s)] > \sum_{t \in T} [P(t/\Omega)/P(s/\Omega)][u(x_t^g, t) - u(x_t^f, t)]$. For the case that $x_s^g = 0$, $u(x_s^f, s) > \sum_{t \in T} [P(t/\Omega)/P(s/\Omega)][u(x_t^g, t) - u(x_t^f, t)]$. Since for such representation of a dominant state to hold, the relation should be true for any positive value which $P(t/\Omega)/P(s/\Omega)$ or $u(x_t^g, t) - u(x_t^f, t)$, $t \in T$, may take, the utility level $u(x_t^f, s)$, derived in the culmination of the dominant state , may need to be extremely high, in particular as the probability $P(s/\Omega)$, associated with the dominant state, is extremely small. Moreover, as indicated by the relation that $[u(x_s^f, s) - u(x_s^g, s)] > \sum_{t \in T} [P(t/\Omega)/P(s/\Omega)][u(x_t^g, t) - u(x_t^f, t)]$, for $x_s^g > 0$, the increase of $u(x_s^f, s) - u(x_s^g, s)$ in the state-dependent utility level associated with the dominant state would need to be extremely high as there is an increase in x_s from x_s^f to x_s^g.

4. DOMINATED STATES AND DOMINANT-STATE THINKING

As tentatively represented previously, a state $s \in \Omega$ may be referred to as a dominant state for an individual, if for any two state-labeled prize combinations $(x_1^f,...,x_N^f)$ and $(x_1^g,...,x_N^g) \in L^X$, $(x_1^f,...,x_N^f) \succ (x_1^g,...,x_N^g)$ as $x_s^f > x_s^g$. However, such representation of a dominant state would give rise not only to inconsistency in an individual's state-dependent preferences as a result of the existence of discontinuity in his state-dependent preferences, but also to the necessity of extremely high utility levels associated with the dominant state. It appears that the difficulties arise as a result of the representation of a dominant state with a focus on the dominant state rather than on the dominated states. In the example presented by Aumann, "Aumann describes a man who loves his wife very much, and whose life without her would be less attractive, less 'worth living.' The wife is sick and must undergo a routine but dangerous operation that only half of all patients survive." (Karni, 1993, p. 187) To the man in the example, the state of his wife being no longer surviving is dominated by the state of his wife being surviving, and an extremely low utility level would be associated with his utility derived in the state of his wife being no longer surviving.

As suggested by the example presented by Aumann, a dominated state $t \in T$ may be represented as a null state in the strict sense that for any state-labeled prize combination $(x_1^h,..., x_N^h) \in L^X$, $u(x_t^h, t) = 0$. With the representation of a dominated state as a null state, a state $s \in \Omega$ may be referred to as a dominant state for an individual, if for any state-labeled prize combination $(x_1^h,..., x_N^h) \in L^X$, $u(x_t^h, t) = 0$ for every $t \in T$, where $T = \Omega - \{s\}$, and $u(x_s^h, s) > 0$ as $x_s^h > 0$. Under such representation of a dominant state with dominated states represented as null states in the strict sense, for any two state-labeled prize combinations $(x_1^f,..., x_N^f)$ and $(x_1^g,..., x_N^g) \in L^X$, it would follow as a result that $(x_1^f,..., x_N^f) \succ (x_1^g,..., x_N^g)$ as $x_s^f > x_s^g$. For a dominant state $s \in \Omega$ and any two pure lotteries $f(x/t)$ and $g(x/t)$ with $x_s^f = x_s^g + k$, $k > 0$, and $x_t^g > x_t^f$ for every $t \in T$, $\sum_{t \in T} P(t/\Omega)[u(x_t^g, t) - u(x_t^f, t)] = 0$ under the representation of a dominated state as a null state. As k approaches zero and the state-labeled prize x_s^f approaches x_s^g, $P(s/\Omega)[u(x_s^f, s) - u(x_s^g, s)] = \sum_{t \in T} P(t/\Omega)[u(x_t^g, t) - u(x_t^f, t)] = 0$, and the expected utility levels associated with the two pure lotteries would be equal; that is, $\sum_{t \in \Omega} P(t/\Omega)u(x_t^f, t) = \sum_{t \in \Omega} P(t/\Omega)u(x_t^g, t)$. By including the characterization of a dominated state as a null state in the representation of a dominant state, an individual's state-dependent preferences with dominant-state thinking may be more appropriately represented without the undesirable property of the existence of discontinuity in the individual's state-dependent preferences. Moreover, for the case that $k > 0$ and $x_s^g = 0$, it would hold for any positive value which $u(x_s^f, s)$ may take that $u(x_s^f, s) > \sum_{t \in T} [P(t/\Omega)/P(s/\Omega)][u(x_t^g, t) - u(x_t^f, t)]$. Furthermore, with $x_s^g > 0$, for it to hold that $[u(x_s^f, s) - u(x_s^g, s)] > \sum_{t \in T} [P(t/\Omega)/P(s/\Omega)][u(x_t^g, t) - u(x_t^f, t)]$, the increase of $u(x_s^f, s) - u(x_s^g, s)$ in the state-dependent utility level associated with the dominant state as a result of an increase in the dominant-state-labeled prize from x_s^f to x_s^g may take any positive value. Thus, the necessity of extremely high utility levels associated with the dominant state would be avoided by including the characterization of a dominated state as a null state in the representation of a dominant state.

5. DOMINANT-EVENT THINKING

While an individual may possess state-dependent preferences with a perceived dominant state included in the whole set of states and all the other dominated states perceived as null states, an individual may need to make choice with the information that a certain event $R \subset \Omega$ has occurred. For the example presented by Aumann, the prior state space confronting the man may be represented by a product state space $\Omega = \Omega_1 \times \Omega_2$, where Ω_1 includes the state ω_1 of his wife being surviving and the other state ω_2 of his wife being no longer surviving. With a product state space $\Omega_1 \times \Omega_2$, an individual's dominant-state thinking may be represented more generally in the form of dominant-event thinking. Let the product state space be represented by $\Omega = \Omega_1 \times \Omega_2$, where $\Omega_1 = \{1,..., M\}$ and $\Omega_2 = \{1,..., N\}$. A lottery $f(x/t)$ may be referred to as pure lottery if there exists a $x_t^f \in X$ for every state $t \in \Omega_1 \times \Omega_2$ such that $f(x_t^f / t) = 1$. Let the set L^X represent the set $\{(x_{11}^f,..., x_{MN}^f) \big| f \in L \wedge f(x_t^f / t) = 1\}$, which is the set of the state-labeled prize combinations of all the pure lotteries in the set L. Let the event $\{s\} \times \Omega_2$ for $s \in \Omega_1$ be represented by Ω_s, and the set $\{\Omega_1 - \{s\}\} \times \Omega_2$ by Ω_{-s} . The event $\{s\} \times \Omega_2$ may be referred to as a dominant event for an individual, if for any state-labeled prize combination $(x_{11}^h,..., x_{MN}^h)$ $\in L^X$, $u(x_t^h, t) = 0$ for every $t \in \Omega_{-s}$, and for every $d \in \Omega_s$, $u(x_d^h, d) > 0$ as $x_d^h > 0$. For every $v_{-s} \in \Omega_1 - \{s\}$, an event $\{v_{-s}\} \times \Omega_2 \subset \Omega_{-s}$ would be referred to as a dominated event. With the representation of every state contained in a dominated event as a null state, $\sum_{t \in \Omega_{-s}} P(t/\Omega) u(x_t^f, t) = 0$ for a pure lottery $f(x/t)$ with $x_t^f > 0$, $t \in \Omega_1 \times \Omega_2$, and it holds that $\sum_{t \in \Omega_s} P(t/\Omega) u(x_t^f, t) > \sum_{t \in \Omega_{-s}} P(t/\Omega) u(x_t^f, t)$.

If every state contained in a dominated event is represented as a null state, the undesirable property of the existence of discontinuity in an individual's state-dependent preferences would be also avoided in the presence of a dominant event. By similar arguments as presented previously, for any two pure lotteries $f(x/t)$ and $g(x/t)$, suppose that $x_d^g = 0$ and $x_d^f = x_d^g + k$, $k > 0$, for every $d \in \Omega_s$, and $x_t^g > x_t^f$ for every $t \in \Omega_{-s}$. With the event $\{s\} \times \Omega_2$ represented as a dominant event and every state contained in a dominated event as a null state, it would hold that $\sum_{t \in \Omega} P(t/\Omega) u(x_t^f, t) > \sum_{t \in \Omega} P(t/\Omega) u(x_t^g, t)$, even as $x_t^g > x_t^f$ for every $t \in \Omega_{-s}$. Moreover, as k approaches zero, x_d^f would approaches x_d^g uniformly for every $d \in \Omega_s$, and $\sum_{t \in \Omega} P(t/\Omega) u(x_t^f, t) = \sum_{t \in \Omega} P(t/\Omega) u(x_t^g, t)$. Furthermore, as $x_d^g = 0$ for every $d \in \Omega_s$, $x_c^f = x_c^g + k$, $k > 0$, for $c \in \Omega_s$, $x_e^f = x_e^g$ for every $e \in \Omega_s - \{c\}$, and $x_t^g > x_t^f$ for every $t \in \Omega_{-s}$, it would hold that

$u(x_c^f, c) > \sum_{t \in \Omega_{-s}} [P(t/\Omega)/P(c/\Omega)][u(x_t^g, t) - u(x_t^f, t)]$, for any positive value which $u(x_c^f, c)$ may take. In the presence of a dominant event, the representation of the states contained in the dominated events as null states would exclude the existence of discontinuity in an individual's state-dependent preferences and the necessity of extremely high utility levels associated with a state contained in the dominant event.

While a dominant event contains merely a single element would turn out to be a dominant state and there may exist issues associated with both dominant-state thinking and dominant-event thinking, which may be dealt with in a consistent way, the representation of a dominant event would be associated with a product state space and would enable dominant-state thinking to be represented in a more general context. Moreover, so far as a dominant state or a dominant event is concerned, if an individual learns that a certain event $R \in \Im$, containing the domain state or dominant event perceived by the individual, has occurred, the conditional probability $P(t/\Omega)$ in the previous analysis may be replaced by $P(t/R)$, and the preference relations $\sim$, $\succ$, and $\succeq$ by the preference relations $\sim_s$, $\succ_s$, and $\succeq_s$, respectively.

6. CONCLUDING REMARKS

As mentioned by Myerson (1991) with regard to the establishment of the expected-utility maximization theorem, the axiom of continuity, based on the axiom of monotonicity, asserts that a lottery ranked by an individual between a better lottery and a worse lottery under the culmination of a certain event would be as good as some randomization between these two lotteries under the individual’s state-dependent preferences with respect to this event. With a dominant state or a dominant event existing in the partial information possessed by an individual, the axiom of continuity may not hold in the presence of discontinuity in the individual's state-dependent preferences with dominant-state thinking. While the representation of the dominated states and the states contained in the dominated events as null states may tackle not merely the problem of discontinuity in an individual's state-dependent preferences with dominant-state thinking, but also the necessity of extremely high utility levels associated with a dominant state or a state contained in the dominant event, questions may be raised with regard to the posterior state-dependent preferences of an individual and his further choice in the culmination of a dominated event, given his choice made under his prior state-dependent preferences with dominant-state thinking. This suggests that there still exist a vast number of issues related to state-dependent preferences with dominant-state thinking, which need to be addressed to present more appropriate representations of state-dependent preferences with dominant-state thinking within various contexts.

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