History-Based Choice between Consumption Streams

Aram Ghazaryan, PhD

University of Turin

Abstract

The empirical and experimental research reveals that an agent may manifest preferences which differ from the classical economics postulates. A few of such manifestations are utility from anticipation, preferences for improvement, preferences for happy endings and memorable consumptions. This paper studies those phenomena by static choices within a dynamic context. This research provides an axiomatic framework and a model which rationalises such decisions; furthermore, it shows that there is an additive utility function which represents the preferences with those specifications.

Introduction

The traditional economic models of intertemporal choice, like, exponential discounting (Koopmans 1960 [3], Samuelson 1937 [10]), hyperbolic discounting (Ainslie 1992 [1], Laibson 1997 [4]), present-biased preferences (O'Donoghue and Rabin [8]) etc. assume that given two similar rewards, people always prefer reward which arrives sooner rather than later. Even though this assumption is quite realistic and logical, there is an experimental and empirical evidence which shows that people, sometimes, prefer a reward which arrives later rather than sooner. A few of main causes for such preferences are: utility from anticipation (Loewenstein 1987 [5]), preferences for improvement (Loewenstein and Prelec [7],[6]), preferences for happy endings (Ross and Simonson 1991 [9]) and memorable consumptions (Gilboa, Postlewaite and Samuelson [2]).

According to the aforementioned literature, the decision maker (DM) could demonstrate patience or impatience. In other terms, the DM can prefer consumption sequences with the increasing, decreasing, constant, or volatile gratification tendencies. Hence, there is no unique pattern, according to which the DM will prefer any defined order of the alternatives in the sequence.

The representation result given (1) functional form justifies aforementioned behavioral phenomena.

$$U(c_1, c_2, ..., c_n) = u_1(c_1) + u_2(c_2, c_1) + ... + u_n(c_n, c_1, c_2, ..., c_{n-1}) \tag{1}$$

In this model the utility of sequence $(c_1, c_2, ..., c_n)$ is defined by the collection of the utility functions, $\{u_1, u_2, ..., u_n\}$, where each utility, u_i, is the present value from the consumption at the corresponding period, i. Moreover, in this model the DM's utility depends not only on the consumption of that period, but also the consumptions before that period.

Preliminaries

Let X be a set of all lotteries on the prize set Z. The typical elements of X, the lotteries, are denoted by $x, x_i, \bar{x}, x', y, etc.$. Let $A_i := X \times ... \times X$ be a set of all ordered sequences of length i $[= 1, ..., n]$. For notational convenience I will use A instead of A_n. Let A_i^c be the set of all constant sequences with length i, and A^c the set of all constant sequences with length n.

Assume that the DM has a preference relation on A, denoted by $\succeq$, with a symmetric $\sim$ and an asymmetric $\succ$ parts.

Axiom 1 (Preference Relation): *$\succeq$ is a complete and transitive binary relation.*

Axiom 2 (Continuity): *For all $(x_1, ..., x_n), (y_1, ..., y_n) \in A$, the sets $\{(y_1, ..., y_n) : (y_1, ..., y_n) \succeq (x_1, ..., x_n)\}$ and $\{(y_1, ..., y_n) : (x_1, ..., x_n) \succeq (y_1, ..., y_n)\}$ are closed.*

Axiom 3 (Diagonal Independence): *For every $(x, ..., x), (y, ..., y), (z, ..., z) \in A^c$ and every $\alpha \in (0, 1)$,*

$(y, ..., y) \succeq (x, ..., x)$ iff $\alpha(y, ..., y) + (1-\alpha)(z, ..., z) \succeq \alpha(x, ..., x) + (1-\alpha)(z, ..., z)$.

Axiom 4 (Constant Equivalence): *For every $(x_1, ..., x_n) \in A$, there is $(x, ..., x) \in A^c$ such that $(x_1, ..., x_n) \sim (x, ..., x)$.*

History-Based Representation

The following additive functional form defines the utility of the sequence as a sum of utilities depending on current and previous choices.

$$U(x_1, ..., x_n) = u_1(x_1) + ... + u_n(x_n, x_1, ..., x_{n-1}) \tag{2}$$

Definition: *$\{u_1, ..., u_n\}$ is called a collection generated by U if $\{u_1, ..., u_n\}$ defines U as in (2) and $u_i \geq 0$ for all $i = 1, ..., n$ and let G_U be the set of all collections generated by U.*

Definition: *Given (2) representation, a collection of nonnegative functions, $\{u_1, ..., u_n\}$, is a maximum splitter if $\{u_1, ..., u_n\} \in G_U$ and for every $i = 1, ..., n$ there is no collection $\{u_1, ..., u_{i-1}, u_i', ..., u_n'\} \in G_U$ such that $u_i'(x_i, x_1, ..., x_{i-1}) > u_i(x_i, x_1, ..., x_{i-1})$ for some $(x_1, ..., x_i) \in A_i$.*

Definition: *A history-based additive representation of $\succeq$ relation is a collection of nonnegative, continuous utility functions $\{u_1, ..., u_n\}$, where $u_i : A_i \to \mathbb{R}$ $i = 1, ..., n$, such that (a) function $U : A \to \mathbb{R}$, defined by (2), is continuous and represents $\succeq$ relation, and (b) $\{u_1, ..., u_n\}$ is a maximum splitter.*

Theorem: *A. The preference relation $\succeq$ defined on A has a history-based additive representation if and only if it satisfies Preference Relation and Continuity. B. Moreover, if $\succeq$ satisfies Diagonal Independence and Constant Equivalence as well then the functions u_i $(i = 1, ..., n)$ have the following uniqueness properties:*

Given that $\{u_1, ..., u_n\}$ collection is a history based additive representation of $\succeq$, $\{u_1', ..., u_n'\}$ collection also will be a history based additive representation of $\succeq$ if and only if there are $a > 0$, $b > 0$, such that $u_1' = au_1 + b$ and $u_i' = au_i$ for all $i \in \overline{2, n}$.

Conclusion

Utility from anticipation, preferences for improvement, preferences for happy endings and memorable consumptions are empirically and/or experimentally tested behavioral phenomena, which create a significant gap between the conventional economic models and the reality. This work rationalizes those behavioral manifestations via history-based representation model. Based on this model, the utility over the sequences is represented by the additive form of state-dependent utility functions, where each utility function depends on the consumption at that period and the consumptions before that period, a state. The state-dependent structure let us consider all previous consumptions, which form a reference point for the DM preferences, such that, her current consumption could be strongly affected by that reference point. This work improves the existing literature in this manner and provides the behavioral foundation, which fills the gap between theory and empirical ground. Thanks to the simple structure and realistic background, the history-based representation has a sound potential to be applied in various fields.

References

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Contact Information

- Web: arghaz.weebly.com
- Email: aramghazari@gmail.com
- Phone: +374 (41) 16 32 64
- WhatsApp: +39 (342) 166 43 00