

## Decomposition of the Discount Function Into Impatience and Uncertainty Aversion. How Neurofinance Can Help to Understand Behavioral Anomalies

**Authors :** Roberta Martino, Viviana Ventre

**Abstract :** Intertemporal choices are choices under conditions of uncertainty in which the consequences are distributed over time. The Discounted Utility Model is the essential reference for describing the individual in the context of intertemporal choice. The model is based on the idea that the individual selects the alternative with the highest utility, which is calculated by multiplying the cardinal utility of the outcome, as if the reception were instantaneous, by the discount function that determines a decrease in the utility value according to how the actual reception of the outcome is far away from the moment the choice is made. Initially, the discount function was assumed to have an exponential trend, whose decrease over time is constant, in line with a profile of a rational investor described by classical economics. Instead, empirical evidence called for the formulation of alternative, hyperbolic models that better represented the actual actions of the investor. Attitudes that do not comply with the principles of classical rationality are termed anomalous, i.e., difficult to rationalize and describe through normative models. The development of behavioral finance, which describes investor behavior through cognitive psychology, has shown that deviations from rationality are due to the limited rationality condition of human beings. What this means is that when a choice is made in a very difficult and information-rich environment, the brain does a compromise job between the cognitive effort required and the selection of an alternative. Moreover, the evaluation and selection phase of the alternative, the collection and processing of information, are dynamics conditioned by systematic distortions of the decision-making process that are the behavioral biases involving the individual's emotional and cognitive system. In this paper we present an original decomposition of the discount function to investigate the psychological principles of hyperbolic discounting. It is possible to decompose the curve into two components: the first component is responsible for the smaller decrease in the outcome as time increases and is related to the individual's impatience; the second component relates to the change in the direction of the tangent vector to the curve and indicates how much the individual perceives the indeterminacy of the future indicating his or her aversion to uncertainty. This decomposition allows interesting conclusions to be drawn with respect to the concept of impatience and the emotional drives involved in decision-making. The contribution that neuroscience can make to decision theory and intertemporal choice theory is vast as it would allow the description of the decision-making process as the relationship between the individual's emotional and cognitive factors. Neurofinance is a discipline that uses a multidisciplinary approach to investigate how the brain influences decision-making. Indeed, considering that the decision-making process is linked to the activity of the prefrontal cortex and amygdala, neurofinance can help determine the extent to which abnormal attitudes respect the principles of rationality.

**Keywords :** impatience, intertemporal choice, neurofinance, rationality, uncertainty

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