

HYPERBOLIC DISCOUNTING AND BEYOND

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Hyperbolic discounting has been enthusiastically accepted by environmental/ecological economists. We examine the behavioral and neurological evidence for hyperbolic discounting and for other approaches. We then discuss the neurological and behavioral evolution of discounting. Finally, we discuss the implications of the neurological evidence on discounting for environmental valuation, in particular the implications for very long-run decisions such as those involved in climate change mitigation and biodiversity preservation policies.

Abstract Detail

There is considerable evidence that people discount the value of delayed consumption more in the immediate as opposed to the distant future. But does this imply that individuals employ a continuously declining discounted utility function as implied by hyperbolic discounting? Ariel Rubenstein argues that the same evidence from behavioral experiments used to reject straight line discounting can also be used to reject hyperbolic discounting. He points out that hyperbolic discounting, like straight line discounting, assumes that people maximize a single-valued utility function with a specific mathematical structure. Hyperbolic discounting is “safe” because it can be incorporated in the standard welfare model. It is essentially only a minor modification of the standard expected utility welfare framework.

The standard welfare model of conventional economics is essentially a private, self-regarding financial investment model applied to everything. The standard economic model of environmental valuation assumes that society also should seek to maximize the weighted sum of present and future economic welfare (the expected utility of net present value). The welfare effects of changes in some environmental attribute are evaluated based on the gain or loss of social welfare with or without the environmental attribute. In the expected utility model, the weight attached to future welfare is constant percent per year reflecting among other things society’s impatience, or preference to receive benefits in the short run while deferring costs to the future. In a continuous-time setting with constant population and a single consumption good, this approach employs the mathematics of constrained optimization to maximize a discounted expected utility social welfare function. Traditionally, economists assumed that the discount rate is constant through time. In spite of sustained criticism the expected utility model still dominates econometric work in environmental valuation including discussions of whether or not economies are sustainable.

A growing number of theoretical and behavioral economists have called for the use of a hyperbolic discount rate. The ratio of rewards received in successive time periods becomes smaller and smaller the further in the future they occur. Although considerable evidence exists that people discount the value of delayed consumption more in the immediate as opposed to the distant future, it is not yet proved that individuals employ a continuously declining discounted utility function. Therefore, the hyperbolic function grasps some aspects of human behavior that the usual model does not, but it also relies on some assumptions shared with this model that can be rejected.

Opening up the black box of discounting by examining evidence from behavioral and neurological experiments reveals that the discounting phenomenon is much more complicated than the conventional financial investment model shows. For example, people seem to use different discount rates for different categories of goods. Money seems to be a special case. Studies have found that monetary rewards are discounted less steeply than other kinds of rewards. Other studies show that separate neural systems in the brain value immediate monetary rewards and delayed monetary rewards. That is, two separate neurological systems are involved in discounting money depending on the time length of the delay of the reward.

Animal behavior may shed some light on the ultimate reasons why humans discount the future. Evidence shows that animals discount the future in much simpler ways than humans do. Behavioral and neurological evidence indicates that humans are uniquely social animals and that the rational actor model supporting the traditional discounting model may apply to simpler organisms but not to humans. What are the underlying social and evolutionary reasons for the way humans discount?

Finally, what are the implications of the neurological and behavioral findings about discounting for environmental valuation and policy? When is it appropriate to discount? Can specific discount rates be identified for specific kinds of environmental decisions? Is it possible to formulate a framework for environmental valuation that does not involve choosing specific discount rates?