# Biasing the Future: the Effects of Inter-Temporal Judgment Biases on Decisions to Mitigate against Low-Probability, High-Consequence Hazards

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## Abstract

Rational decisions to invest in mitigation against low-probability, high-consequence events require a set of cognitive skills that elude most human decision makers: an ability to consider the long-term consequences of decisions made in the present, and an ability to learn from events that occurred in the distant past. In this paper I review what is currently known about biases in inter-temporal decision making, and explore their consequences for decisions to take protective action in response to natural and man-made hazards.

The focus of the decision will be to reconcile what seem, at times, to be contradictory findings about the willingness of individuals and communities to make long-term investments in protection against events that have a low –probability of occurrence. On one hand, there is considerable experimental and field evidence that individuals' judgments about the future follow hyperbolic discounting schedules that discourage investments in costly instruments whose benefit can be seen only in the long run, such as regularly investing in earthquake insurance or installing storm shutters. The manifestation of such biases are easily witnessed by the failure of communities to invest in the maintenance and improvement of protective infrastructures (e.g., levees) and the reluctance of individuals to invest in protection against events whose last occurrence was in the distant past (e.g., a reluctance to buy earthquake insurance). On the other hand, this bias is far from universal; in other domains individuals appear willing to make sustained investments in protective actions that offer few observable benefits, such as those rooted in superstitious beliefs about the nature of hazards.

In the paper I explore the degree to which these lines of evidence can be reconciled by generalizing traditional inter-temporal judgment models to recognize two components of decision making that likely influence decisions to take protective actions: 1) proper and improper mental models of the functioning of hazards that introduce endogeity to subjective estimates of the probability of hazards; and 2) social norms or imitative behaviors. Using a blend of experimental data and limited field evidence I show how incorporating these elements can both better explain existing patterns of investment in protective action as well as suggest alternative approaches to improving the quality of these decisions.