



Risk Preferences

PROSPECT THEORY IV:

Loss aversion, Probability weighting

EE416 SEM2/2019



Bias

(coined by Samuelson and Zeckhauser (1988))

- The tendency of people to _____ at the status quo even when it is in their interest to _____ what they are doing.
- Examples:
 - Failure to sell stocks when the market tanks because people do not want to admit to losses
 - Failure to adopt new technology and accept changes in production methods because the existing skills and knowledge become worthless
 - Failure to change saving plan for retirement
 - Staying in a bad relationship too long The failure to react to price changes
- An _____ became significantly more popular when it was designated as the status quo.

Status Quo Bias

(coined by Samuelson and Zeckhauser (1988))

- Samuelson and Zeckhauser (1988) discuss four potential causes for the status-quo bias:
 - (1) _____, which make the deviation from the status quo costly in itself;
 - (2) Uncertainty in the decisions situation, which requires costly effort to investigate alternatives and their benefits (search and decision-making cost). This might deal with limited _____. To make a change is harder than staying the same;
 - (3) Cognitive misperceptions like _____, endowment effect, anchoring or bounded rationality;
 - (4) Psychological commitment due to perceived sunk costs or other resource investments(_____) or due to regret avoidance.
- Loss aversion is a powerful conservative force that favors minimal changes from the status quo.

The Sunk Cost Fallacy

- Normative economic theory indicates that costs incurred in the past are _____ for future marginal payoffs, i.e. sunk costs must be ignored.
- The sunk-cost fallacy (bias) is the irrational behavior of “throwing good money after bad,” i.e. once found on a course of action to which they committed an investment (e.g. time, money, effort), people continue to _____ that course of action and _____ resources despite it being unprofitable (Arkes & Blumer, 1985).
- The larger the sunk cost, the stronger the bias, and cognitive ability does not alleviate the bias (Haita-Falah, 2017)

The Sunk Cost Fallacy

- Examples:
 - Students stay with a research topic way too long before switching to another one
 - Continued investment into engineering a new product that has become a black hole for money with no production in sight
 - Continued marketing expenditures on a product that consumers hate

The Sunk Cost Fallacy

- Explanation: _____, _____ behavior in the loss domain is responsible for the escalation on an initial investment.
- Other explanation: _____ (mental discomfort from inconsistency of ideas)
 - The best way one can justify past decisions is by continuing to pour resources into a failing course of action.



PROBABILITY WEIGHTING

PROSPECT THEORY, EE416
SEM2/2019



Recall: Prospect theory

- A prospect can be written as $(x, p; y, q)$ with $p + q \leq 1$.
- Note: $p + q < 1$ implies prospect yields 0 with probability $1 - p - q$.
- A person evaluates a prospect $(x, p; y, q)$ according to the functional

$$V(x, p; y, q) = \pi(p)v(x) + \pi(q)v(y)$$

Probability vs The weighting of probability

- The _____ that people assign to outcomes are not identical to the _____ of these outcomes.
- The weighting is an operation of system 1.
- We have different _____ to change in probability depending on the level of probability being considered.
- Psychological effect: possibility effect and certainty effect

The _____: 0% → 5%

- The move from a 0% chance to a 5% possibility of winning a prize or losing something transform the situation.
- It creates a possibility that did not exist earlier.
- The influence we give to the move from 0% probability to 5% illustrates the possibility effect.
- The weights reflect _____ of winning or _____ of losing.

The possibility effect: 0% → 5%

- The possibility effect causes highly unlikely outcomes to be weighted disproportionately _____ they “deserve” (if we evaluate the change in probability objectively).
- _____ increases the attractiveness of both _____ and _____ policies.

The _____: 95% → 100%

- Outcomes that are almost certain are given less weight than their probabilities justifies.

Example from the work of Kahneman and Tversky

Prob(%) of winning a gamble	0	1	2	5	10	20	50	80	90	95	98	99	100
Decision weight	0	5.5	8.1	13.2	18.6	26.1	42.1	60.1	71.2	79.3	87.1	91.2	100

- The decision weights are _____ to the corresponding probabilities at the extremes: the impossible and the sure thing.
- The decision weights depart sharply from probabilities near these points.
- At 2%, the rare event is overweighted by a factor of 4.
- At 98%, a 2% risk of not winning the prize reduces the weight by 13% , from 100 to 87.
- _____ to _____ probabilities.
- To note, sometimes the very small probabilities get ignored.

Probability Weighting in Kahneman & Tversky (1979)

- They suggest that the probability-weighting function $\pi(p)$ will have several features such as:
 - Overweighting of small probabilities_____,
 - Underweighting of large probabilities_____,
 - Subcertainty_____,
 - A discontinuity at the endpoints.

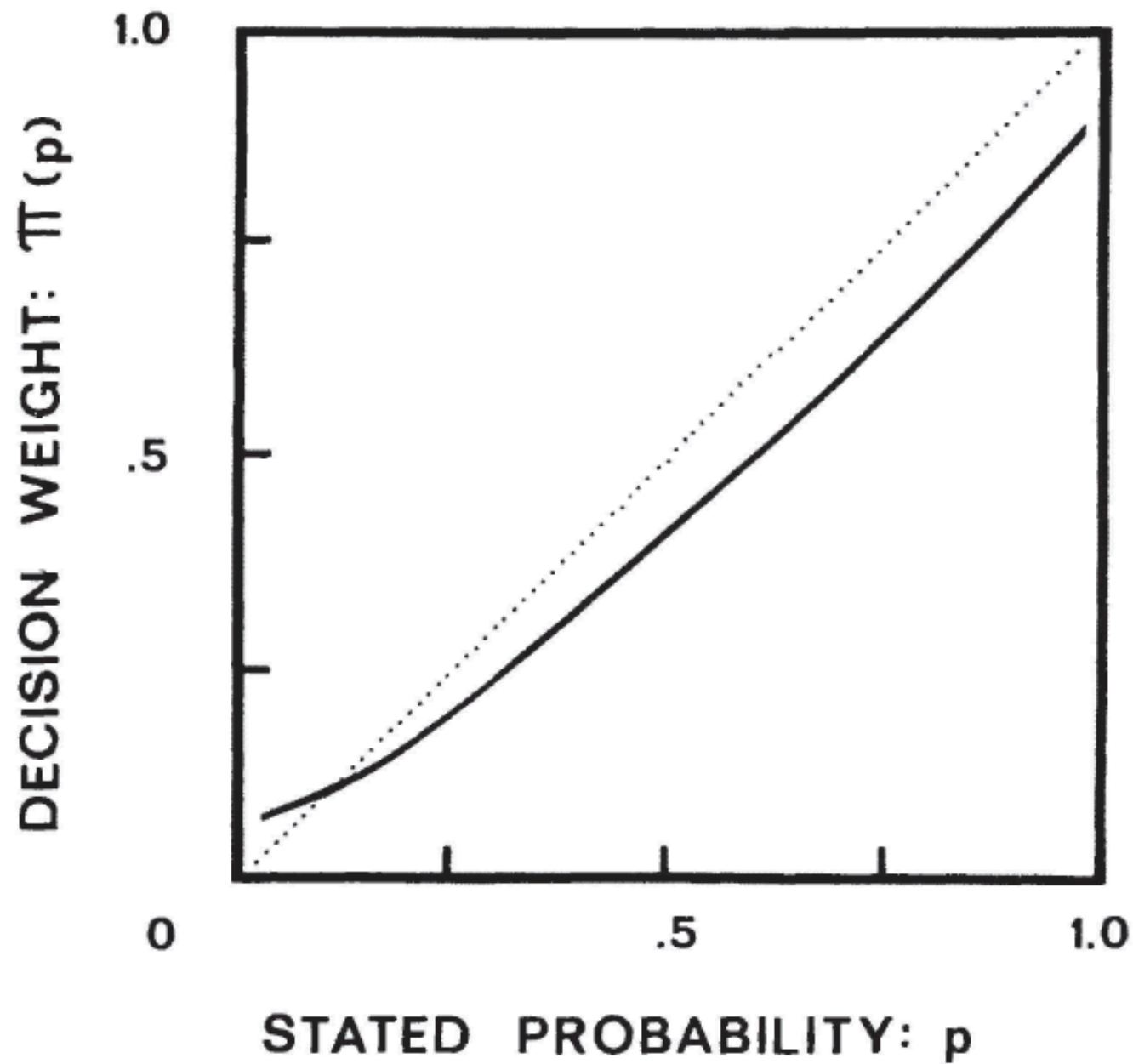


FIGURE 4.—A hypothetical weighting function.

A Simple Functional Form

- $\pi(p) =$
- If $\alpha > 0$ and _____, then this functional form generates overweighting of small probabilities, underweighting of large probabilities, subcertainty, and a discontinuity at the endpoints.

Inverse S-Shaped Probability Weighting Functions

- In the ensuing years, people started to eliminate the discontinuity at the endpoints by assuming an inverse S-shaped probability weighting function.
- Indeed, people posited specific, parametrized functional forms. Two prominent examples:

Inverse S-Shaped Probability Weighting Functions

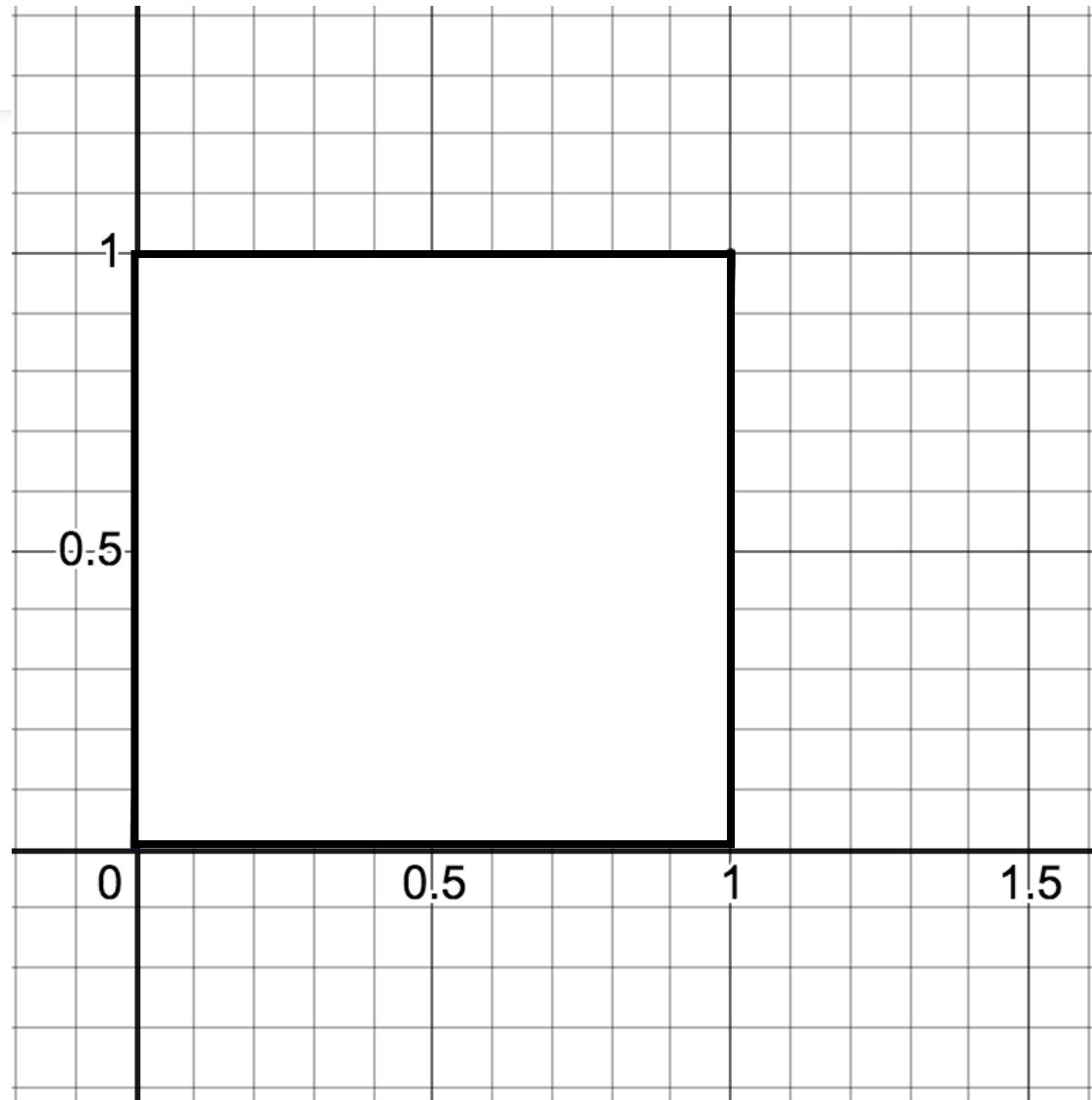
- Tversky & Kahneman (JRU 1992) suggest

$$\pi(p) = \frac{p^\gamma}{(p^\gamma + (1-p)^\gamma)^{1/\gamma}} \quad \text{for some } \gamma \in (0.279, 1)$$

- Prelec (ECTA 1998) suggests

$$\pi(p) = \exp(-(-\ln p)^\alpha) \quad \text{for some } \alpha \in (0, 1)$$

Inverse S-Shaped Probability Weighting Functions



$$\pi(p) = \exp(-(-\ln p)^{0.5})$$

$$\pi(p) = \frac{p^{0.5}}{(p^{0.5} + (1 - p)^{0.5})^{1/0.5}}$$

Differential Weighting for Gains vs. Losses

- Tversky & Kahneman (JRU 1992) propose differential probability weighting for gains and losses.
- Weights on losses and weights on gains derived from two separate probability-weighting functions π^- and π^+ .

Economic Applications

- Barberis & Huang (AER 2008): Rank-dependent probability weighting yields a preference for assets with positively skewed returns.
- Barberis (MS 2011): Rank-dependent probability weighting can generate a preference for casino gambling despite negative expected returns because certain gambling strategies can generate an asset with positively skewed returns.

Economic Applications

- Bruhin, Fehr-Duda, & Epper (ECTA 2010) Experimental data on certainty equivalents for simple lotteries. Estimate a mixture model of cumulative prospect theory, and conclude that roughly 20% of subjects are essentially expected value maximizers while roughly 80% exhibit significant non-linear probability weighting (and very little curvature in value function).

Economic Applications

- Snowberg & Wolfers (JPE 2010) Data from horse races on odds and probability of winning for different types of bets.
- Compare model with risk aversion vs. model of probability weighting, and conclude the latter better fits the data.

Probability _____ vs. Probability_____

- We cannot distinguish probability weighting from probability misperception.

The Fourfold pattern of risk preferences: The core achievement of prospect theory

	GAINS	LOSSES
HIGH PROBABILITY	95% chance to win \$10,000 _____ + Underweighting Fear of disappointment RISK _____ _____ unfavorable settlement Ex: refusing low-risk high return business opportunity	95% chance to lose \$10,000 _____ + Underweighting Hope to avoid loss RISK _____ _____ favorable settlement Ex: taking desperate gambles for a small hope of avoiding large loss
LOW PROBABILITY	5% chance to win \$10,000 Risk averse + _____ Hope of large gain RISK _____ _____ favorable settlement Ex: buying _____	5% chance to lose \$10,000 Risk seeking + _____ Fear of large loss RISK _____ _____ unfavorable settlement Ex: buying _____

Choices are:
 risk averse if sure thing (corresponding to the expected value) is preferred,
 risk seeking if the gamble is preferred.

The Fourfold pattern of risk preferences

- For intermediate/large probabilities, risk_____ behavior over gains and risk_____ behavior over losses.
- For small probabilities, risk_____ behavior over gains and risk_____ behavior over losses.