DECISION-MAKING UNDER RISK

Prospect Theory Experiment

Why choices under risk depend on gains, losses, and the way probabilities are perceived.



REFERENCE POINT
Gain or loss

VALUE
Losses loom larger

PROBABILITY
Decision weights

Prospect theory is best studied through a family of choice tasks. The experiment below isolates its central patterns without treating one pair of lotteries as a complete test of the theory.

01 THE QUESTION
02 THE CHOICE
03 THE MECHANISM
04 THE EVIDENCE

A practical guide to the experimental design, the economic intuition, and the interpretation of results.

01 / THE TASK

The experiment: the same risk, a different frame

Participants choose between a sure outcome and a risky prospect. The researcher changes whether outcomes are framed as gains or losses, while keeping the probability structure transparent.

What is being tested?

The key question is not simply whether people like risk. It is whether risk-taking changes when an outcome is evaluated as a gain rather than as a loss relative to a reference point. The classic reflection pattern is risk aversion for gains and risk seeking for losses.

CHOICE A | GAINS

ILLUSTRATIVE LOTTERY

Option 1: Receive $3,000 for sure.

Option 2: 80% chance of $4,000; 20% chance of $0.

EV(sure) = $3,000
EV(risky) = 0.80($4,000) + 0.20($0) = $3,200
The sure choice is risk-averse despite its lower EV.

CHOICE B | LOSSES

REFLECTED LOSS FRAME

Option 1: Lose $3,000 for sure.

Option 2: 80% chance of losing $4,000; 20% chance of losing $0.

EV(sure) = −$3,000
EV(risky) = 0.80(−$4,000) + 0.20($0) = −$3,200
The gamble has a worse expected loss but offers a chance to avoid it.

THE REFLECTION EFFECT

A common pattern is to prefer certainty in the gain frame but gamble in the loss frame. It is a tendency observed across groups, not a rule that every participant must follow.

Teaching note: these are illustrative choice problems in the spirit of prospect theory. The full theory requires richer tasks to distinguish reference dependence, loss aversion, and probability weighting.

Four ingredients behind the choice

Prospect theory describes how people evaluate changes from a reference point and transform objective probabilities into decision weights.

1. REFERENCE DEPENDENCE

Outcomes are coded as gains or losses relative to a reference point, such as the status quo, an expectation, or an initial endowment.

2. LOSS AVERSION

A loss of a given size typically has a stronger impact than an equal-sized gain. The loss side of the value function is steeper.

3. DIMINISHING SENSITIVITY

The value function is commonly concave for gains and convex for losses. The difference between $100 and $200 can feel larger than the difference between $1,100 and $1,200.

4. PROBABILITY WEIGHTING

People do not always treat probabilities linearly. Small probabilities may receive disproportionate decision weight, while moderate and high probabilities may be underweighted.

A SIMPLE VALUE FUNCTION

For an outcome x measured relative to the reference point:

$$v(x) = x^{\alpha}, \; x \geq 0$$
$$v(x) = -\lambda(-x)^{\beta}, \; x < 0$$
$$0 < \alpha, \beta \leq 1; \; \lambda > 1$$

Cumulative prospect value: $V(L) = \Sigma_i \, \pi_i v(x_i)$, where π_i are decision weights.

THE CENTRAL DISTINCTION

$EU(L) = \Sigma_i \, p_i u(x_i)$
$V(L) = \Sigma_i \, \pi_i v(x_i)$
Expected utility uses objective probabilities p_i; prospect theory uses decision weights π_i and evaluates gains or losses relative to a reference point.

A practical experimental protocol

A well-designed task makes the reference point explicit, keeps probabilities understandable, and varies framing independently of participant characteristics.

PROCEDURE

- Set the reference point. State whether the participant begins with zero, an endowment, or a specified status quo.
- Randomize the frame. Assign gain and loss versions across participants or counterbalance their order within participants.
- Present clear lotteries. Display outcomes and probabilities in the same format; avoid wording that changes perceived likelihood.
- Check comprehension. Ask participants to identify possible outcomes and their probabilities before choosing.
- Incentivize choices. When feasible, randomly select one decision for real payment and implement its lottery.

WHAT TO RECORD

- Choice in each domain: sure option or risky option.
- Frame assignment, order, probability level, and displayed wording.
- Comprehension answers and response time, where appropriate.
- Risk preferences measured separately, if needed, rather than inferred from one item.

BASIC ANALYSIS

Let $Y_i = 1$ if participant i chooses the risky option:

$$\Pr(Y_i = 1 \mid L_i, X_i) = \Lambda(\alpha + \beta L_i + \gamma' X_i)$$

Λ is the logistic CDF; $L_i = 1$ marks the loss frame and X_i contains controls. A positive β indicates a higher probability of choosing the risky option in the loss frame.

DESIGN CHECK

Do not claim to identify all prospect-theory parameters from one pair of questions. Use multiple payoff levels and probability levels if the goal is to estimate a value function or probability weighting.

What the results can - and cannot - tell you

The experiment is informative when its patterns are tied to a specific mechanism. A single risk choice is not a complete measure of a person’s preferences.

READ THE PATTERN, NOT JUST THE AVERAGE

- More certainty-seeking for gains and more gambling for losses is consistent with the reflection effect.
- Different responses across probability levels can be consistent with probability weighting.
- Changing the reference point while holding final outcomes fixed helps test reference dependence.

COMMON PITFALLS

- Ambiguous reference points or confusing gain/loss wording.
- Hypothetical stakes treated as if they were real incentives.
- Conflating loss aversion with risk aversion.
- Over-interpreting a single binary choice.

A STRONGER DESIGN

- Vary gains and losses across several magnitudes.
- Vary probabilities, including small probabilities.
- Measure or manipulate the reference point explicitly.
- Pre-register primary comparisons and exclusion rules.

FOUNDATIONAL READINGS

Kahneman, D. & Tversky, A. (1979). “Prospect Theory: An Analysis of Decision under Risk.” Econometrica, 47(2), 263-291.

Tversky, A. & Kahneman, D. (1992). “Advances in Prospect Theory: Cumulative Representation of Uncertainty.” Journal of Risk and Uncertainty, 5, 297-323.

The 1979 paper introduces prospect theory; the 1992 paper develops the cumulative formulation. The paired lotteries in this guide are teaching examples, not a verbatim reproduction of a single original questionnaire.