Prospect Theory

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Outline

- Expected Utility Theory
- Phenomena Violating EXU Theory
- Solving the inconsistencies
- Theory of Prospect Theory
- Some Evidence That support Prospect Theory

The EXU Theory

- **Expectation: U(X,P) = u(X)·P**, where X is the vector of the outcomes and P is the corresponding probabilities
- **Acceptable asset position: U(X + w, p) > u(w) = U(w);** the domain of the utility function is final states rather than gains or losses
- **Risk aversion: u is concave, u"< 0**

Phenomena Violating The EXU Theory

- **Violation of the substitution/independence axiom**
- **The isolation effect**: discarding components that are shared by all prospects.
- **Framing effects**
- **Nonlinear preferences**: nonlinearity of preferences in probability
- **Source dependence**
- **Risk seeking**: a gain with small probability but a loss with large probability
- **Loss aversion:** losses loom larger than gains

Violation of substitution axiom: the certainty effect

PROBLEM 3:

A:	(4,000,.80),	or	B:	(3,000).
$N = 95$	[20]			[80]*

PROBLEM 4:

C:	(4,000,.20),	or	D:	(3,000,.25).
$N = 95$	[65]*			[35]

Violation of substitution axiom: another type

PROBLEM 7:

A: (6,000, .45), B: (3,000, .90).

$N = 66$ [14] [86]*

PROBLEM 8:

C: (6,000, .001), D: (3,000, .002).

$N = 66$ [73]* [27]

The isolation effect

PROBLEM 10: Consider the following two-stage game. In the first stage, there is a probability of .75 to end the game without winning anything, and a probability of .25 to move into the second stage. If you reach the second stage you have a choice between

(4,000, .80) and (3,000).

Your choice must be made before the game starts, i.e., before the outcome of the first stage is known.

A schematic view of the problem 10

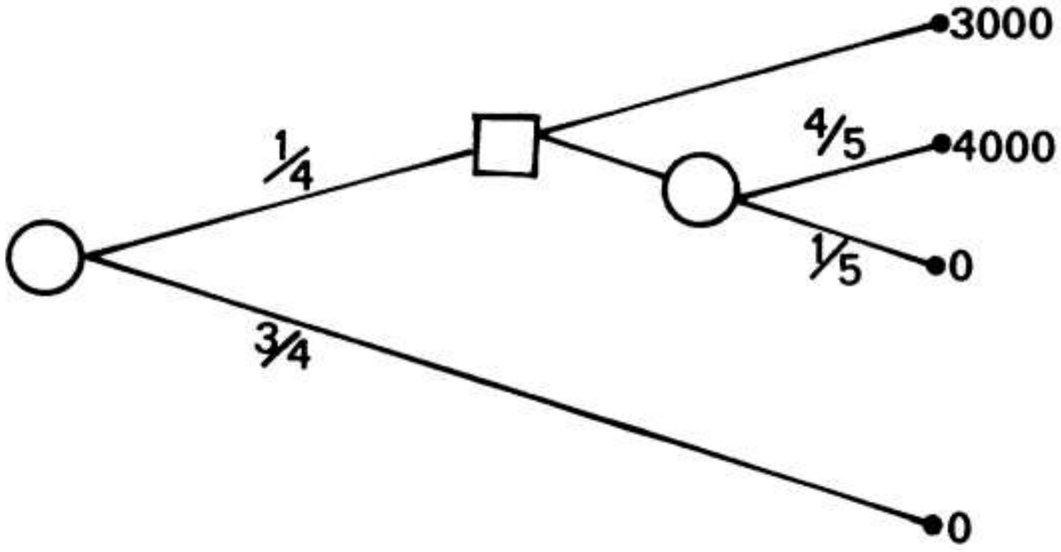


FIGURE 2.—The representation of Problem 10 as a decision tree (sequential formulation).

Framing effect

TABLE I

PREFERENCES BETWEEN POSITIVE AND NEGATIVE PROSPECTS

Positive prospects					Negative prospects				
Problem 3:	(4,000, .80)	<	(3,000).		Problem 3′:	(−4,000, .80)	>	(−3,000).
$N = 95$	[20]		[80]*		$N = 95$	[92]*		[8]
Problem 4:	(4,000, .20)	>	(3,000, .25).		Problem 4′:	(−4,000, .20)	<	(−3,000, .25).
$N = 95$	[65]*		[35]		$N = 95$	[42]		[58]
Problem 7:	(3,000, .90)	>	(6,000, .45).		Problem 7′:	(−3,000, .90)	<	(−6,000, .45).
$N = 66$	[86]*		[14]		$N = 66$	[8]		[92]*
Problem 8:	(3,000, .002)	<	(6,000, .001).		Problem 8′:	(−3,000, .002)	>	(−6,000, .001).
$N = 66$	[27]		[73]*		$N = 66$	[70]*		[30]

Does varying the outcomes of a prospect have an impact on preference as well?

PROBLEM 11: In addition to whatever you own, you have been given 1,000. You are now asked to choose between

A: (1,000, .50), and B: (500).

$N = 70$ [16] [84]*

PROBLEM 12: In addition to whatever you own, you have been given 2,000. You are now asked to choose between

C: (−1,000, .50), and D: (−500).

$N = 68$ [69*] [31]

How to solve these inconsistencies

- Assigning value to gains and losses rather than to final assets
- Replacing probabilities by decision weights

Prospect Theory

A choice is made in a two phase process:

- **Editing phase:** a preliminary analysis of the offered prospects yielding a simpler representation of these prospects.
- **Evaluation phase:** the prospect of highest value is chosen.

Editing phase

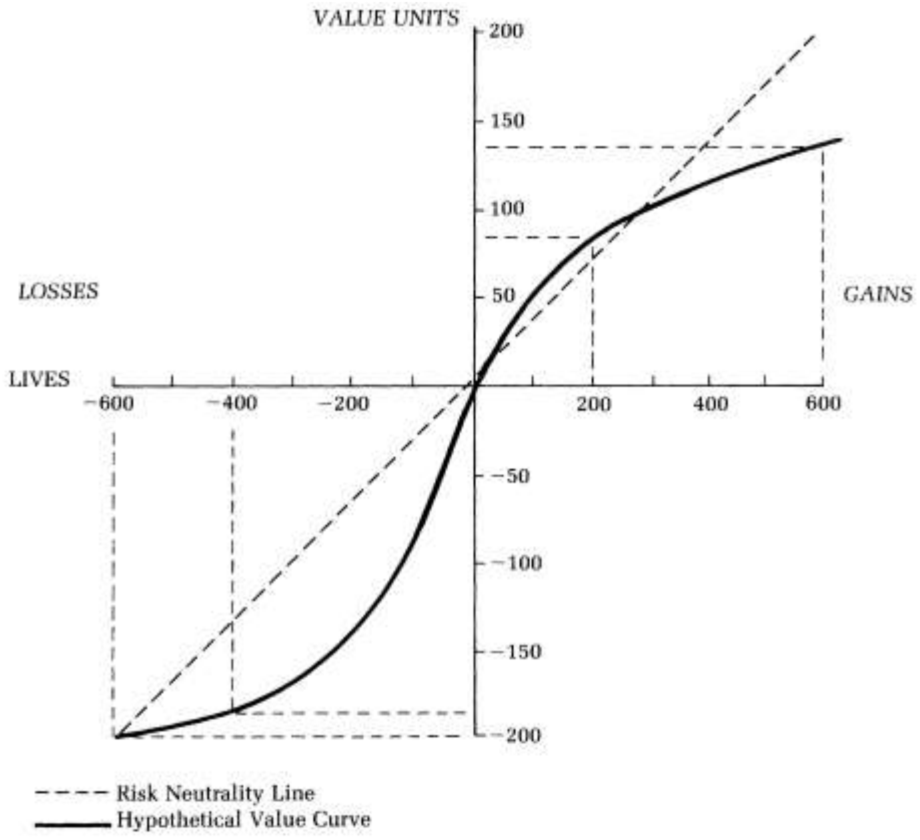
- **Coding:** viewing the prospect as gain or loss
- **Combination:** simplifying the prospect by combining the probabilities associated with identical outcomes
- **Segregation:** segregating risky and riskless components of the prospect
- **Cancellation:** the discarding of common constituents, i.e., outcome-probability pairs.
- **Simplification:** rounding probabilities and outcomes. (101, .49) →(100,.50)
- **Dominance:** the scanning of offered prospects to detect dominated alternatives

Evaluation Phase

- Prospect theory distinguishes between evaluation of strictly positive/negative and regular prospects.
- A regular prospect is defined as $p + q < 1$ or $x \geq 0 \geq y$ or $x \leq 0 \leq y$; and the corresponding evaluation is $V(x, p; y, q) = \prod(p)v(x) + \prod(q)v(y)$.
- A strictly positive/negative prospect is defined as $p + q = 1$ and either $x > y > 0$ or $x < y < 0$; and the corresponding evaluation is $v(y) + \prod(p)[\, v(x) - v(y) \,]$.
- if $\prod (p) + \prod (l - p) = 1$ ➔ both evaluation are the same.
- What are the properties of v(.) and ∏(.)?

The value function v(.)

- The carriers of value are changes in wealth or welfare, rather than final states.
- v(.) is concave for gains and convex for losses
- $v(-y) - v(-x) > v(x) - v(y)$: loss looms larger!



Note: Modified from Kahneman and Tversky (1979)

Evidence for concavity of v(.)

PROBLEM 13:

(6,000, .25), or (4,000, .25; 2,000, .25).

$N = 68$ [18] [82]*

PROBLEM 13′:

(−6,000, .25), or (−4,000, .25; −2,000, .25).

$N = 64$ [70]* [30]

Applying equation 1 to the modal preference in these problems yields

$$\pi(.25)v(6{,}000) < \pi(.25)[v(4{,}000) + v(2{,}000)] \quad \text{and}$$

$$\pi(.25)v(-6{,}000) > \pi(.25)[v(-4{,}000) + v(-2{,}000)].$$

The weighting function ∏(.)

- ∏ is an increasing of p, with ∏ (0) = 0 and ∏ (1) = 1.
- For small values of p, ∏ is a sub-additive function of p, i.e., ∏ (r.p)> r∏ (p) for 0< r < 1.
- For small p, ∏ (p) > p; small probabilities are overweighted.
- There is evidence that for all 0 < p <1, ∏ (p) + ∏ (1 - p) < 1.

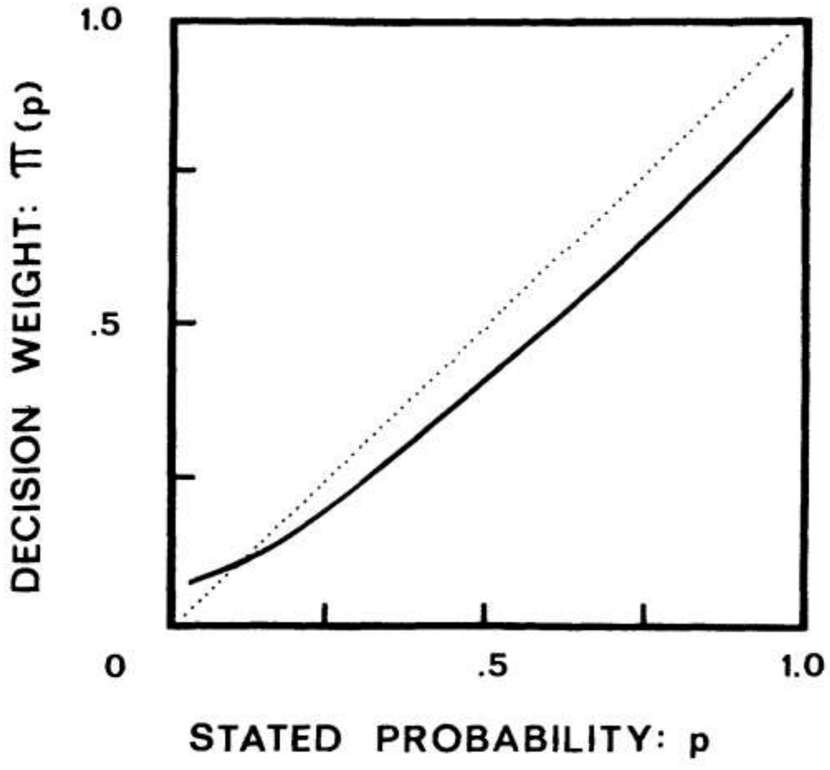


FIGURE 4.—A hypothetical weighting function.

Evidence for overweighting small probability

PROBLEM 14:

(5,000, .001), or (5).

$N = 72$ [72]* [28]

$\pi(.001)v(5{,}000) > v(5) \Rightarrow \pi(.001) > v(5)/v(5{,}000) > .001$

PROBLEM 14′:

(−5,000, .001), or (−5).

$N = 72$ [17] [83]*