

# Topics in Behavioral Decisions in Finance

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# Topics in Behavioral Decisions in Finance

1. Organisation
2. Brief Overview of Behavioral Economy
3. Cumulative Prospect Theory
4. Application and Limits of CPT
5. Alternative Theories

⇒ Why?

- ▶ Barberis 2017, AEA
- ▶ Thaler 2016, AER
- ▶ Barberis 2013, JEP
- ▶ Wakker 2010, Cambridge University Press, "Prospect Theory for Risk and Ambiguity"

## 2. Brief Overview

1950s-1990s: "Traditional Finance"

- ▶ psychological shortcomings
- ▶ new way of thinking about Finance questions
  1. insurance
  2. portfolio choice
  3. corporate finance
- ...
- ▶ not alternative to mainstream economics (Micro)

## 2. Brief Overview

Some questions:

- ▶ Why do people buy insurance, gamble, and hold stocks?
- ▶ Why do people hold on to losing stocks?
- ▶ Why are IPOs underpriced?

Standard paradigm:

- ▶  $t = 0, 1, 2, \dots$  time
- ▶  $S_t$  possible states
- ▶  $p(s_t)$  probability of  $s_t \in S_t$  occurring in  $t$
- ▶  $X_t$  payoff/ consumption in  $t$

## 2. Brief Overview

- ▶ Agent-utility function  $U(X | S)$ 
  - time-independent discount factor  $\delta$(implicitly: von-Neumann/Morgenstern axioms)
- ▶  $\Rightarrow$  max expected lifetime utility
$$\max_{x_t} \sum_t \delta^t \left( \sum_{s_t \in S_t} U(x_t | s_t) \rho(s_t) \right) \quad \text{s.t. } x_t \in X_t$$
- ▶ Behavioral Decisions:
  - 1.) Non-standard preferences : " $U$ ", " $\delta$ "
  - 2.) Non-standard beliefs: " $\rho$ "
  - 3.) Non-standard decision making : " $\max$ "

## 2. Brief Overview

1: Reference-dependence, prospect theory, ambiguity

Implies: loss aversion, time preferences (non-standard), self-control issues, time inconsistency, social preferences

2: Overconfidence, extrapolation, experience effects

Implies: overestimation, confirmation bias, projection bias, law of small numbers.

3: Bounded rationality, cognitive limitations.

Implies: rules of thumb???, simplification, fruniing????(there are ??)

Not simply oeparated 1 weakest, 3 strongest depf?? from EU

## 2. Brief Overview

Alternatives:

- ▶ Bounded rationality
- ▶ Evolutionary game theory
- ▶ Decision theory (unawareness, unforeseen contingencies)

Behavioral economics is controversial!

- ▶ poor experimental standards
- ▶ depo?? from revealed preference approaches

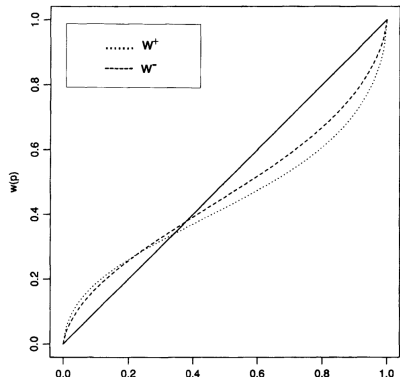
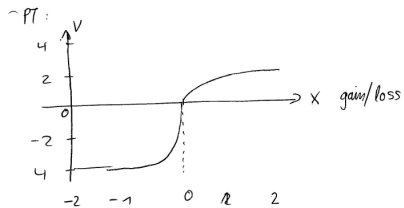
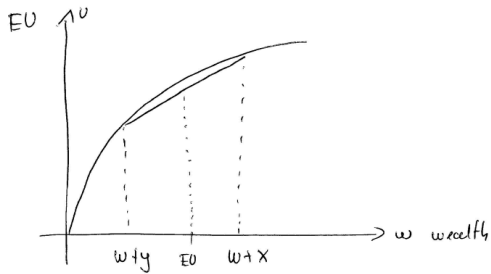


### 3. Prospect Theory and Cumulative PT

- ▶ most finance models assume EU to evaluate risks
- ▶ experimentally, at least, not a good fit
- ▶ many alternatives
- ▶ (C)PT by Kahneman and Tversky 1979, Tversky and Kahneman 1992
- ▶ alternatives: disappointment aversion, rank-dependent utility, salience theory, regret theory, SP8H Hec???

### 3. Prospect Theory and Cumulative PT

- ▶ A reference-dependent utility function is a family  $\{U(\cdot \mid \gamma) : x \longrightarrow \mathbb{R} \mid \gamma \in X\}$  of utility functions over  $X$  indexed by  $\gamma \in X$ .
- ▶ the utility  $U(X \mid \gamma)$  describes the utility of the consumption and the reference point is  $\gamma$ .
- ▶ Prospect Theory (1979)  
gramble  $(X, p, y, q)$   
 $EU = pV(w + x) + qV(w + y)$   
 $PT = w(p)V(x) + w(q)V(y)$



# Four key features

## 1. Reference-dependence

- ▶ gains and losses, and final wealth
- ▶  $\Rightarrow$  experimental evidence, consistent with perception of alternative

## 2. Loss aversion

- ▶  $V(x)$  has a kink?? in  $\bigcirc$ .
- ▶  $\Rightarrow$  losses loom larger than gains.
- ▶ evidence:  $(110, \frac{1}{2}, -100, \frac{1}{2})$  is unattractive.

## Four key features

### 3. Diminishing sensitivity

- ▶  $V(\cdot)$  concave over gains, convex over losses
- ▶ evidence:  $(500, 1) \succ (1000, \frac{1}{2})$   
 $(-500, 1) \preceq (-1000, \frac{1}{2})$

### 4. Probability weighting:

- ▶ transform probability with decision weights  $w(\cdot)$   
high weight on low probabilities
- ▶ evidence:  $(5, 1) \prec (5000, 0.001)$  lottery  
 $(-5, 1) \succ (-5000, 0.001)$  insurance

Note:  $w$  are decision weights and beliefs

## Cumulative Prospect Theory (Tversky and Kahneman, 1992)

- ▶ address some limitations
- ▶ applies probability weighing to the cumulative distribution function (gain at least 50, lose 100 or more)

$(x_{-m}, p_{-m}, \dots, x_{-1}, p_{-1}, x_0, p_0, x_1, p_1, \dots, x_n, p_n)$

$x_i < x_j$  for  $i < j$ ,  $x_0 = 0$

is assigned  $\sum_{i=-m}^n \pi_i V(x_i)$

with

$$\pi_i = \begin{cases} w(p_i + \dots + p_n) - w(p_i + \dots + p_n), & 0 \leq i \leq n \\ w(p_{-m} + \dots + p_i) - w(p_{-m} + \dots + p_{i-1}), & -m \leq i \leq 0 \end{cases} \quad (1)$$

- ▶ individuals overweight tails of a probability distribution
- ▶ preserves a taste for lottery like gambles

# Cumulative Prospect Theory (Tversky and Kahneman, 1992)

- ▶ Tversky and Kahneman suggest:

$$V(x) = \begin{cases} x^\alpha, & x \geq 0 \\ -\lambda(-x)^\alpha, & x < 0 \end{cases} \quad (2)$$

$$w(p) = \frac{p^\delta}{(p^\delta + (1-p)^\delta)^{\frac{1}{\delta}}}$$

$$\alpha = 0.88, \quad \lambda = 2.25, \quad \delta = 0.69 \quad ???$$

- ▶ (there are alternatives)

## Challenges and Discussion

- ▶ how to define gains and losses?
- ▶ total wealth, financial wealth, stock holdings, individual stocks?
- ▶ what is a gain:
  - ▶ exceeds zero?
  - ▶ risk-free rate?
  - ▶ expectation?
- ▶ probability weighting in many applications more important than loss aversion
- ▶ diminishing sensitivity  $\Rightarrow$  Rabin 2000  
(not as important feature theoretically)
- ▶ overweighting VS underweighting:??? events  
(Taleb ,2007),evidence for both
- ▶ could be
  - decision from description  $\Rightarrow$  overweighting
  - decision from experience  $\Rightarrow$  underweighting
- ▶ not ?? decv how to interpret:      overestimation (belief)  $\Rightarrow$  mistake  
    overweighting (preference)  $\Rightarrow$  not mistake???  
(some evidence fro preference)