# PROSPECT THEORY

## A QUICK OVERVIEW

EE 434 Behavioral Finance, SEM1/2021

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# An example of how we can apply Prospect theory to understand investors' behavior

## Prospect Theory and Stock Returns: An Empirical Test

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We test the hypothesis that, when thinking about allocating money to a stock, investors mentally represent the stock by the distribution of its past returns and then evaluate this distribution in the way described by prospect theory. In a simple model of asset prices in which some investors think in this way, a stock whose past return distribution has a high (low) prospect theory value earns a low (high) subsequent return, on average. We find empirical support for this prediction in the cross-section of stock returns in the U.S. market, and also in a majority of forty-six other national stock markets. (*JEL* D03)

Received November 19, 2014; accepted May 20, 2016, by Editor Stefan Nagel.

A crucial ingredient in any model of asset prices is an assumption about how investors evaluate risk. Most of the available models assume that investors evaluate risk according to the expected utility framework, and models based

Nicholas Barberis, Abhiroop Mukherjee, Baolian Wang, Prospect Theory and Stock Returns: An Empirical Test, *The Review of Financial Studies*, Volume 29, Issue 11, November 2016, Pages 3068–3107, https://doi.org/10.1093/rfs/hhw049

# Prospect theory

Kahneman & Tversky (1979) develop Prospect Theory to incorporate observed behaviors that cannot be explained by EUT.

Some key features they emphasize in their model:

- Evaluation of choices are made relative to a reference point.
- Diminishing sensitivity (risk-averse in gains, risk-loving in losses)
- Loss Aversion
- Probability weighting

$$EU = \sum_{i=1}^{n} p_i \, U(W_i)$$

$W_1, W_2, \ldots, W_n$

objective probability

# PROSPECT THEORY

Given a referent point, $x, y > 0$, $x > 0 \& y = 0$, $x > 0 \& y < 0$, $x, y < 0$

A person evaluates a prospect $(x, p; y, q)$ according to the functional

$$V(x,p;y,q) = \pi(p)v(x) + \pi(q)v(y) + \pi(1-p-q)v(0)$$

if $p+q < 1$

$v(0) = 0$ and we usually normalize the referent point to be at 0.

What's new?

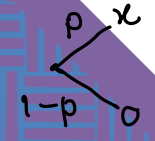
$\pi(.)$: the probability weighting function and $v(.)$: the value function

Reminder: EU theory says we use: evaluate wealth

Assumption: Suppose that our initial wealth is $w$, our referent point here

$$U(x,p;y,q) = p\,u(w+x) + q\,u(w+y) + (1-p-q)u(w+0)$$

For prospect $X = (x, p; 0, 1-p)$, i.e. $X = (x, p)$




Expected value $= p(w+x) + (1-p)(w+0) = w + px$

Expected utility $= p\,u(w+x) + (1-p)u(w+0) = p\,u(w+x) + (1-p)u(w)$

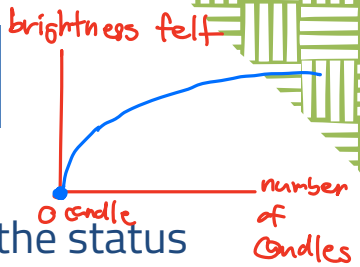
Prospect theory value $= \pi(p)v(x) + \pi(1-p)v(0) = \pi(p)v(x)$

# Prospect theory

Prospect theory attempts to explain
(1.) risk aversion in gains and
(2.) risk loving in losses
by positing that the utility function is fundamentally wrong from biological principles as follows:

- The nervous system is set up to primarily detect differences, not absolute levels.

# “Gain”




- A gain is perceived as a pleasurable change from the status quo (reference point) and the nervous system shows a decreasing response both to the intensity and duration of pleasurable stimuli.



# “Loss”

A loss is perceived as a painful change from the status quo (reference point) and the nervous system shows a decreasing response both to the intensity and duration of painful stimuli.

# The well-known “jacket/calculator” scenario of Tversky and Kahneman (1981)

https://www.menti.com/peibvp6ez7

Imagine that you are about to purchase a jacket for $125, and a calculator for $15 The calculator salesman informs you that the calculator you wish to buy is on sale for $10 at the other branch of the store, located 20 minutes drive away.

## How likely would you make the trip to the other store?

# The well-known “jacket/calculator” scenario of Tversky and Kahneman (1981)

https://www.menti.com/peibvp6ez7

Imagine that you are about to purchase a jacket for $15, and a calculator for $125. The calculator salesman informs you that the calculator you wish to buy is on sale for $120 at the other branch of the store, located 20 minutes drive away.

## How likely would you make the trip to the other store?

# “Loss”

Tversky and Kahneman (1981) find that people are much more likely to drive 20 minutes to save $5 off $15 than to save $5 off $125.

A discount of $5 has a greater impact when the price of the calculator is low than when it is high.

Source: Tversky, Amos. and Daniel Kahneman (1981), “The framing of decisions and the psychology of choice,” Science, 211 (4481), 453–58.

# “A referent point”

Although Prospect Theory is silent about how reference points are formed, we now know that reference points can arise from many different sources: expectations, goals, the status quo, and salient counterfactuals.

We do not yet fully understand how reference points are determined, but they should be subject to phenomena such as adaptation and social pressure (social norms), etc.

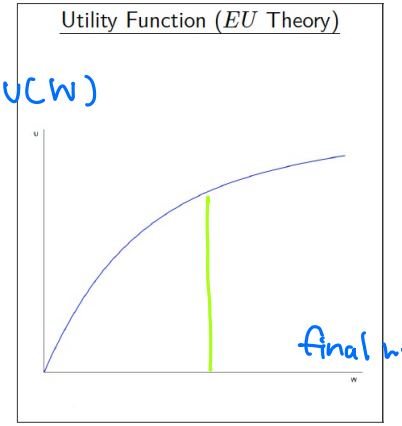
Source: Lewis, J. et al. “Diminishing Sensitivity to Outcomes : What Prospect Theory Gets Wrong about Diminishing Sensitivity to Price.” .

# Utility function vs. Value function

## Utility function

Evaluation of choices is made over final states of wealth.

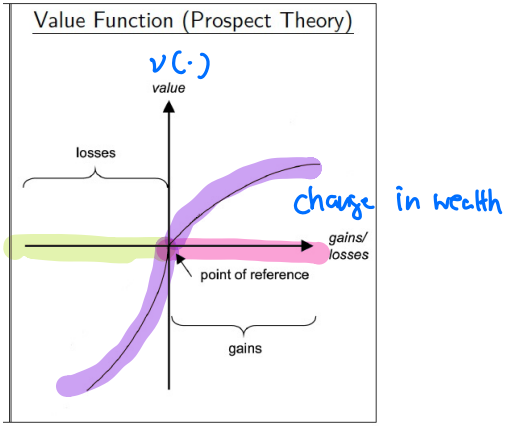
x-axis: final wealth
y-axis: utility




## Value function

Evaluation of choices is made relative to a reference point.

x-axis: gain, loss
y-axis: value



# DANKE!

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