Week 4:
Prospect Theory, Framing and Mental Accounting

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FI5614 Behavioural Finance

Department of Finance
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Outline

Admin

Class Test: Key Information

Logistics

Date	Week 5, Thursday
Time	1pm–2pm (60 min)
Location	Purdie, Lecture Theatre A
Format	Closed-book
Bring	Pens + tagged calculator
Scope	Weeks 1–4 only

No negative marking — if unsure, guess!

Students with adjustments: check your University email.

Structure

100 marks total

Section	Marks	
A: Multiple choice	40	(20 questions)
B: Short answer	30	(10 questions)
C: Calculations	30	(3 questions)

How to prepare

1. Sample class test on Moodle
2. Key Concepts slides
3. Redo tutorial questions
4. Review lecture slides & readings

Reading Diary: Key Information

The Task

Weight	40% of total mark
Format	Two essays, 800 words each
Topic	Your choice (behavioural finance)
References	APA preferred
Deadline	Week 11, Mon, 12 noon
Submit	Single PDF via MMS

You may submit one draft for formative feedback (ideally by Week 9). Weeks 6–8 tutorials will help you prepare.

What Makes a Good Entry?

1. Academic writing — clear, formal, precise (not a blog post)
2. Motivation — why should the reader care?
3. Literature — draw on high-quality research (ABS 3/4-star journals)
4. Critical reasoning — synthesise, offer perspective, explore limitations

Common pitfalls

- Pure summary without an argument
- Weak motivation
- Low-quality or non-academic sources
- Two essays on the same topic

Pulse Module Survey — Mid-Semester Feedback

Please fill out the
Pulse Module Survey now

Your feedback helps me improve this module — both for the remaining weeks and for future cohorts.

The survey is **anonymous** and takes only a few minutes.

Scan to open the survey

Review Quiz

Interactive quiz on Vevox

Quick review of Week 3 material

Please open Vevox and enter the session code

Prospect Theory

From Expected Utility Theory to Prospect Theory

Required readings:

- Ackert & Deaves, Chapter 3 (main)
- Kahneman, D. (2011). *Thinking Fast and Slow*, Part IV (particularly chaps. 25–27 and 29)

Topics covered:

1. Prospect Theory
2. Framing
3. Mental Accounting
4. Applications in Finance

Prospect Theory

Prospect theory was developed by Kahneman and Tversky based on observing actual behaviour.

Experimental evidence says that people often behave contrary to expected utility theory.

- Expected utility theory is normative: what people *should* do
- While prospect theory is positive: what people *do*

Prospect Theory

Properties of choice not consistent with expected utility theory:

- Diminishing sensitivity
- Reference dependence
- Risk-aversion for gains, risk-seeking for losses
- Loss aversion (losses loom larger than gains)

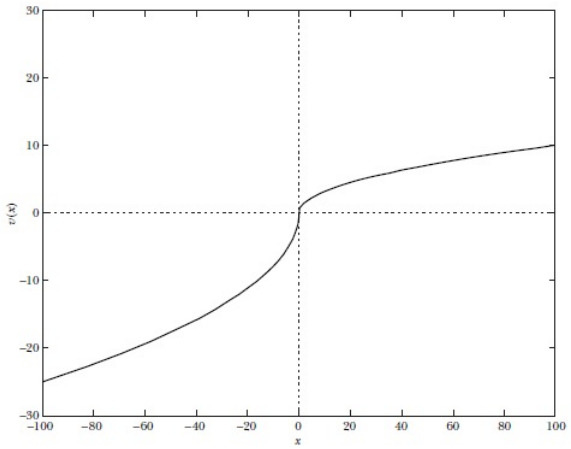
Prospect Theory (Kahneman and Tversky, 1979) is a descriptive theory of choice:

- Individuals prefer lotteries with highest expected value

$$E[v(A)] = \sum p_i \cdot v(X_i)$$

- v is concave over gains, convex over losses, has a kink at 0
- Current wealth W does not affect the preference

Value Function



Notes: The graph plots the value function proposed by Tversky and Kahneman (1992) as part of cumulative prospect theory, namely $v(x) = x^{\alpha}$ for $x \geq 0$ and $v(x) = -\lambda(-x)^{\alpha}$ for $x < 0$, where x is a dollar gain or loss. The authors estimate $\alpha = 0.88$ and $\lambda = 2.25$ from experimental data. The plot uses $\alpha = 0.5$ and $\lambda = 2.5$ so as to make loss aversion and diminishing sensitivity easier to see.

Source: Barberis (2013)

Common Value Function Functional Form

Value function (not utility) used often is:

$$\begin{aligned} v(x) &= x^{\alpha} \text{ for } x \geq 0 \text{ and } 0 < \alpha < 1 \\ v(x) &= -\lambda(-x)^{\beta} \text{ for } x < 0, \lambda > 1, \text{ and } 0 < \beta < 1 \end{aligned}$$

Kink at origin is from λ.

Ask people about 50/50 coin toss where loss is \$50 and gain is unknown. What gain would make people indifferent between gamble or no gamble?

Many say about \$125, which implies a value of 2.5 for λ.

Value above one reflects loss aversion.

Example: Small Chance of High Payoff

Which of the two alternatives do you prefer?

- A. 0.001 chance (0.1%) to win $5,000
- B. Sure gain of $5

Most people choose A

$\Rightarrow$ People are not always risk-averse for gains.

$\Rightarrow$ People put a lot of weight on small probabilities.

$\Rightarrow$ Example: buying an insurance policy vs. buying a lottery ticket.

Reminder: Allais Paradox

Which of the two alternatives do you prefer?

- A. 53% to win $50,000
- B. 51% to win $60,000

Most people choose B

Which of the two alternatives do you prefer?

- A. Sure gain of $50,000
- B. 98% to win $60,000

Most people choose A

$\Rightarrow$ Not consistent with either expected utility or prospect theory

Reminder: Allais Paradox

51% to win \$60,000 is preferable to 53% to win \$50,000:

$$51\% \cdot v(60{,}000) \quad > \quad 53\% \cdot v(50{,}000)$$

If we add 47% to each probability:

$$\begin{aligned} 51\% \cdot v(60{,}000) \quad &> \quad 53\% \cdot v(50{,}000) \\ + & \\ 47\% \cdot v(60{,}000) \quad &> \quad 47\% \cdot v(50{,}000) \end{aligned}$$

we have:

$$98\% \cdot v(60{,}000) > 100\% \cdot v(50{,}000)$$

$\rightarrow$ which is inconsistent with the observed choice (violation of Independence Axiom)

Probability Weighting: Cumulative Prospect Theory

People seem to put a lot of weight on small probability events.

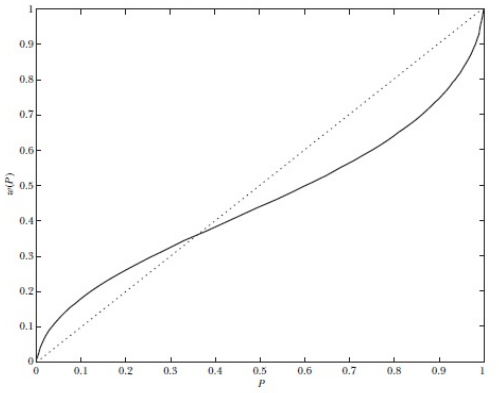
⇒ Cumulative Prospect Theory (Kahneman and Tversky, 1992):

- Individuals prefer lotteries with highest expected value

$$E[v(A)] = \sum w(p_i) \cdot v(X_i)$$

- v (value function) is concave over gains, convex over losses, has a kink at 0
- w is an S-shaped weighting function of probabilities

Weighting Function



Notes: The graph plots the probability weighting function proposed by Tversky and Kahneman (1992) as part of cumulative prospect theory, namely $w(P) = P^{\delta}/(P^{\delta} + (1 - P)^{\delta})^{1/\delta}$, where P is an objective probability, for two values of δ. The solid line corresponds to $\delta = 0.65$, the value estimated by the authors from experimental data. The dotted line corresponds to $\delta = 1$, in other words, to linear probability weighting.

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

Source: Barberis (2013)

Weighting Function Notes

Instead of using simple probabilities as in expected utility, prospect theory uses decision weights, which differ from probabilities.

- Weighting function for losses can vary from weighting function for gains
- Low probabilities are given relatively higher weights than more probable events
- Certainty is weighted highly vs. near-certainty
- Using functions like this solves some earlier puzzles

Fourfold Pattern

	Gains	Losses
High probability	95% chance to win $10,000	95% chance to lose $10,000
Certainty Effect	Fear of disappointment	Hope to avoid loss
	Risk averse	Risk seeking
	Accept unfavorable settlement	Reject favorable settlement
Low probability	5% chance to win $10,000	5% chance to lose $10,000
Possibility Effect	Hope of large gain	Fear of large loss
	Risk seeking	Risk averse
	Reject favorable settlement	Accept unfavorable settlement

Four Elements of CPT

Reference dependence

People derive utility from gains and losses, rather than absolute level of wealth

Loss aversion

People are more sensitive to losses than gains of same magnitude: i.e. $|v(100)| < |v(-100)|$, value function is steeper in the region of losses

Diminishing sensitivity

People are risk-averse over gains and risk-seeking over losses: i.e. value function is concave (convex) in the region of gains (losses)

Probability weighting

People do not weight outcomes by their objective probabilities, but by transformed probabilities or decision weights that overweight low probabilities and underweight high probabilities

Endowment Effect

Assume your favourite band (sports team) is playing in St Andrews:

- Suppose you don't have a ticket yet. How much are you *willing to pay* for the ticket?

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- Suppose you already got your ticket. Someone wants to buy it from you. For how much are you *willing to accept* to sell it?
- Which number would be larger?

Endowment Effect

Carmon and Ariely (2000): A study at Duke University — NCAA Final Four men's basketball tournament.

Participants were first asked to estimate their lowest selling prices and highest buying prices for the tickets:

Variable	10% Trimmed Mean ($)	Median ($)
Selling price	2,411	1,500
Buying price	166	150

Endowment Effect

Three groups:

- **Sellers** were given a mug, then asked the price at which they would sell it
- **Buyers** looked at the mug, and asked the price at which they would buy it
- **Choosers** could either receive a mug or a sum of money as desirable as receiving the good

The resulting prices were:

Group	Price
Sellers	$7.12
Buyers	$3.12
Choosers	$2.87

→ Is the choice between Choosers and Sellers really different?

Endowment Effect

Even in a certainty setting, we see applications of prospect theory.

Endowment Effect

Willingness to accept compensation for a good is greater than the willingness to pay for it.

The effect can be explained by loss aversion:

- When an item is part of one's endowment, giving it up is foreseen as a loss, whereas passing up the opportunity to obtain the same item is perceived as a forgone gain
- Letting go of an item is more painful than not obtaining this same item
- No endowment effect is expected in experienced traders, owners who view their goods as carriers of value for future exchanges, or in extreme poverty

Limitations of Prospect Theory: Reversals

You are offered a choice between two bets:

- A. 70% to win $160, 30% to lose $15
- B. 95% to win $40, 5% to lose $10

When people choose directly between two bets, they prefer B.

When they evaluate the bets separately and are asked how much they are willing to pay for a bet, they pay more for A.

Limitations of Prospect Theory: Emotional Framing

- Would you accept a gamble that offers 10% chance to win $95 and 90% chance to lose $5?
- Would you pay $5 to participate in a lottery that offers 10% chance to win $100 and 90% chance to win nothing?

Very often people reject the first proposal but agree to the second one.

A bad outcome is more acceptable when framed as the cost.

Limitations of Prospect Theory: Disappointment

Consider the following gambles:

1. One chance in a million to win $1 million
2. 10% chance to win $12 and 90% to win nothing
3. 90% chance to win $1 million and 10% to win nothing

Has “winning nothing” the same outcome in all three gambles?

Failing to win in the third scenario is very disappointing. The high probability of winning $1 million sets up a tentative new reference point.

Neither disappointment nor regret are included in prospect theory.

Expected Utility Theory and Prospect Theory

- Prospect Theory is consistent with a wide range of phenomena, but it also does not explain everything
- Any model is an approximation of reality. There is always a trade-off between how complicated and how realistic it is
- Prospect Theory is considerably harder to use than EU theory: e.g. it is not straightforward how to define a reference point
- For many phenomena the additional insights from Prospect Theory are not relevant

→ Economists still mostly use Expected Utility Theory

Framing

Framing

Essential condition for a theory of choice is the principle of invariance: different representations of the same problem should yield the same preference.

Unfortunately this sometimes does not work out in practice:

Framing

People have different perspectives and come up with different decisions depending on how a problem is framed.

Framing Example

Prospect pair 1: you are given $1,000 — then choose between:

- A1: (0.5, another $1,000)
- B1: ($500)

Prospect pair 2: you are given $2,000 — then choose between:

- A2: (0.5, −$1,000)
- B2: (−$500)

- Results for 1: most prefer B1.
- Results for 2: most prefer A2.

Problems are identical! People have chosen differently because of different frames.

An Odder Example

You must make two lottery choices. One draw will be in morning; other in afternoon.

Prospect pair 1:

- A1: ($2,400)
- B1: (0.25, $10,000)

Prospect pair 2:

- A2: (−$7,500)
- B2: (0.75, −$10,000)

People prefer A1 and B2. But A1 and B2 combo leads: (0.25, $2,400, −$7,600). And B1 and A2 combo leads: (0.25, $2,500, −$7,500).

People on average choose a gamble that is dominated by the one they turn down.

Mental Accounting

Mental Accounting

Related to prospect theory and frames.

Accounting

The process of categorizing money, spending and financial events.

Mental Accounting

A description of the way people intuitively do these things, and how it impacts financial decision-making:

- Account assignment
- Closure
- Evaluation

Often the tendency to use mental accounting leads to odd and suboptimal decisions.

Prospect Theory, Mental Accounting and Prior Outcomes

Problem with prospect theory is that it was set up to deal with one-shot gambles — but what if there have been prior gains or losses?

Do we:

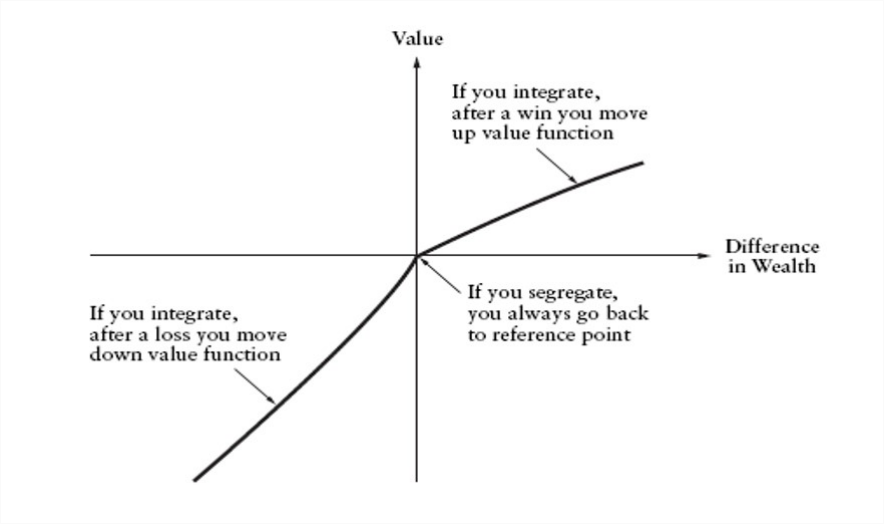
Segregation

Go back to zero, or

Integration

Move along the curve?

Integration vs. Segregation



Theatre Ticket Problem

1. Imagine you have decided to see a play where admission is $10. As you enter the theatre you discover that you have lost a $10 bill. Would you still pay $10 for a ticket to the play?

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1. Imagine you have decided to see a play where admission is $10. As you enter the theatre you discover that you have lost a $10 bill. Would you still pay $10 for a ticket to the play?
2. Imagine that you have decided to see a play and paid the admission price of $10 per ticket. As you enter the theatre you discover that you have lost the ticket. The seat was not marked and the ticket cannot be recovered. Would you pay $10 for another ticket?

Sunk Cost Bias

Nothing is really different about the problems.

Is the ticket worth $10?

- Of respondents given the first question, 88% said they would buy a ticket.
- Of respondents given the second question, 54% said they would *not* buy a ticket.

In the 2nd question, integration is more likely because both the lost ticket and new ticket would be from the same "account." Integration might suggest that $20 is too much for the ticket.

Opening and Closing Accounts

Once an “account” is closed, you go back to zero.

Evidence that people avoid closing accounts at a loss:

- Selling a stock at a loss is painful: disposition effect
- Companies rarely have low negative earnings but often have low positive earnings — they manage earnings either pushing things to low positive, or they “take a bath” and move to high negative

Applications in Finance

Financial Applications

1. Cross-sectional returns
2. Aggregate returns
3. Investor behaviour

1. Cross-Section of Returns: Probability Weighting

Why do some assets have higher average returns than others?

CAPM: assets with higher betas should have higher average returns, assuming investors evaluate risk according to expected utility.

But what if investors overweight small probabilities?

Barberis and Huang (2008)

Investors are willing to pay more for stocks with positively skewed (lottery-like) payoffs.

Skewness Prediction

More positively skewed stocks will have lower average returns.

IPO underperformance

IPOs have positively skewed returns, since they are mostly issued by young firms. Green and Hwang (2012): the higher the predicted skewness of an IPO stock, the lower its long-term average return.

Option-implied skewness

Conrad, Dittmar, and Ghysels (2013) inferred ex-ante skewness from option prices — negatively (positively) skewed returns yield subsequent higher (lower) returns.

Preference for Skewness

Kumar (2009): retail investors have a taste for stocks with lottery-like payoffs.

Sensation seekers trade to entertain themselves but may hold well-diversified portfolios. Investors with a preference for skewness hold lottery-like stocks but may refrain from trading.

- Preference for small portfolios driven by a preference for skewness (especially idiosyncratic skewness)
- Individuals prefer stocks with high idiosyncratic volatility, high idiosyncratic skewness, or low prices

→ Same demographic characteristics that predict lottery participation

Equity Premium

Even though stocks appear to be an attractive asset (high average returns and a low covariance with consumption growth), investors appear unwilling to hold them (Mehra and Prescott, 1985).

U.S.	Real return on a market index (%) Mean	Real return on a relatively riskless security (%) Mean	Equity premium (%) Mean
1802–2004 (Siegel)	8.38	3.02	5.36
1871–2005 (Shiller)	8.32	2.68	5.64
1889–2005 (Mehra–Prescott)	7.67	1.31	6.36
1926–2004 (Ibbotson)	9.27	0.64	8.63

	Stocks		T-bills	
Investment period	Real	Nominal	Real	Nominal
1802–2004	$655,348.00	$10,350,077.00	$293.00	$4,614.00
1926–2004	$238.30	$2,533.43	$1.54	$17.87

Prospect theory, loss aversion, narrow framing, and probability weighting can help explain the equity premium.

Narrow Framing

Individuals evaluate a risk separately from other concurrent risks.

- Benartzi and Thaler (1995): investors apply PT to annual changes in one component of their wealth (stock holdings), ignoring correlation with consumption growth
- Di Giorgi and Legg (2012): as the aggregate stock market is negatively skewed, investors who overweight rare events require even higher returns than loss aversion alone would predict

Investors behave differently when selling vs. buying.

They are reluctant to sell assets trading at a loss relative to their purchase price:

Disposition Effect (Shefrin and Statman, 1985)

Investors sell winners too early and hold losers too long.

Odean (1998): individual investors are more likely to sell stocks that have gone up relative to purchase price — and the stocks they sell go on to outperform the stocks they keep.

Investor Behaviour: Disposition Effect

Both individual investors and mutual fund managers show the disposition effect — a greater propensity to sell winners and keep losers.

But this is costly:

- Stocks they sell beat the market by +2.35%
- Stocks they keep underperform by −1.06%

→ These stocks exhibit momentum — selling winners and holding losers is the opposite of what investors should do.

Conclusions

Conclusions

Expected Utility Theory

The choice satisfying “reasonable” axioms should comply with expected utility theory.

Cumulative Prospect Theory

Payoff is reference dependent. Value function is concave over gains, convex over losses, with a kink at 0. Small probabilities are over-weighted.

Applications in Finance

Positively skewed returns yield lower returns · Equity premium · Disposition effect

Closing Quiz

Interactive quiz on Vevox

Test your understanding of:
Prospect Theory, Framing and Mental Accounting

Please open Vevox and enter the session code