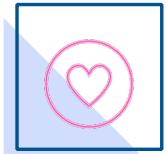
- Value Function
- PWF

Midterm will be take-home exam.

★★★★★

PROSPECT THEORY

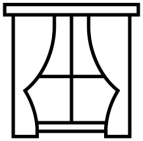
EPISODE 2



EE 434 Behavioral Finance, SEM1/2021

Sunsiree Kosindesha

Framing



A decision frame

- A decision-maker's view of a problem and the possible outcomes
- A frame is affected by:
  - the presentation,
  - the person's perception of the question, and
  - personal characteristics.

referent point

Violation of EUT

- If a person's decision changes simply because of a change in frame, expected utility theory is violated because it assumes that people should have consistent choices, regardless of presentation or how a problem is framed.

A decision frame: example

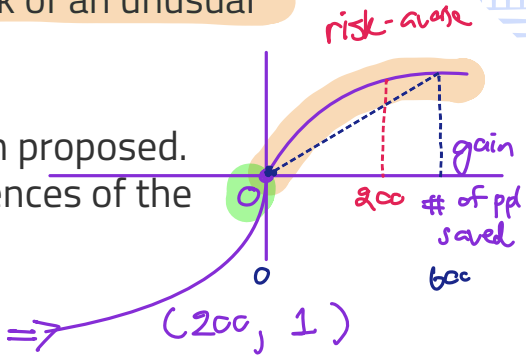
- Thought experiment B (in handout: “Foundation of Finance part 2: EUT?”
  - Respondents were asked to imagine different starting wealth positions
- Frame also matters even the outcomes are nonmonetary.

Adapted from Tversky&Kahneman(1981) unusual Asian Disease

Airborne Disease: Survival frame

Imagine that the United States is preparing for the outbreak of an unusual airborne disease, which is expected to kill 600 people.

Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimates of the consequences of the programs are as follows:



If Program A is adopted, 200 people will be saved.

If Program B is adopted, there is a ⅓ probability that 600 people will be saved, and a ⅔ probability that no people will be saved. ⇒ $(600, \frac{1}{3}; 0, \frac{2}{3})$

Which of the two programs would you favor?
What are the referent points in this case? 0 : no one saved (600 killed)

Adapted from Tversky&Kahneman(1981) unusual Asian Disease

Airborne Disease: Mortality frame

Imagine that the United States is preparing for the outbreak of an unusual airborne disease, which is expected to kill 600 people.

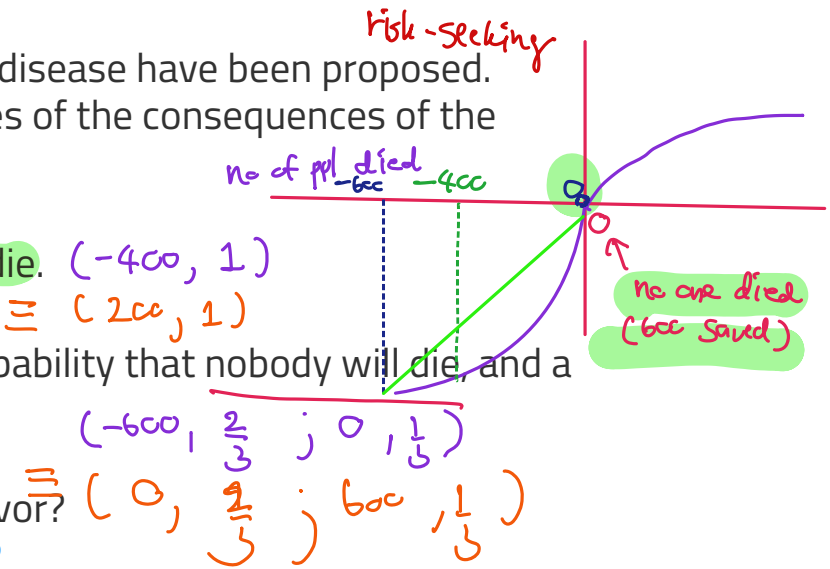
Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimates of the consequences of the programs are as follows:

If Program C is adopted, 400 people will die.

If Program D is adopted, there is a ⅓ probability that nobody will die, and a ⅔ probability that 600 people will die.

Which of the two programs would you favor?

What are the referent points in this case?



Integration vs. Segregation

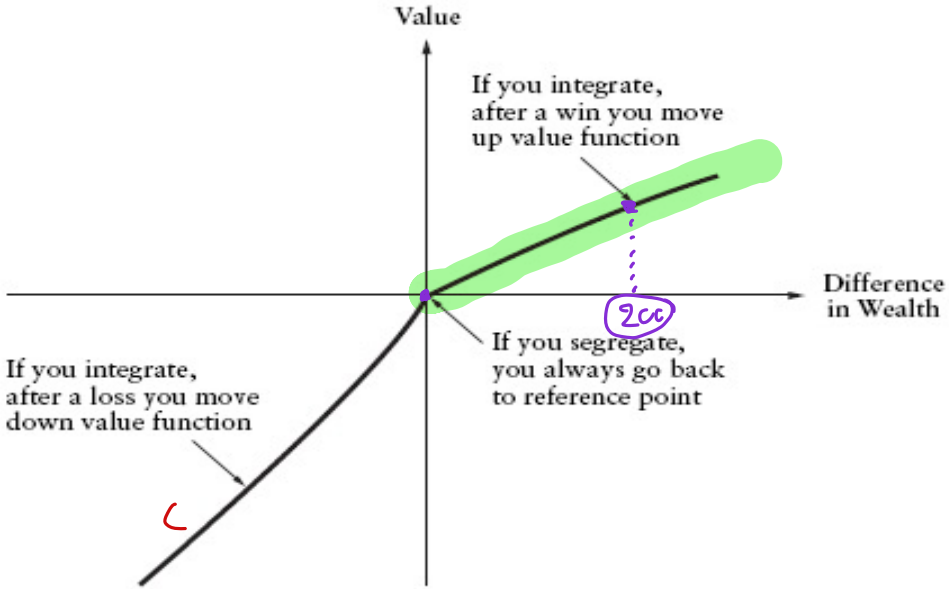
Integration vs. Segregation

- After one-shot gamble has played out, there has been gain or loss from accepting such gamble.
- This gain or loss is now considered as prior gain or loss, "prior" to the current decision.

Integration vs. Segregation

- On the gain-loss axis, does individual go back to zero (segregation) or move along curve (integration)?
- Integration occurs when positions are lumped together.
- Segregation occurs when situations are viewed one at a time.

Integration vs. segregation

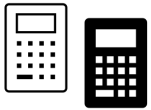


Integration vs. Segregation

- Kahneman and Tversky recognized that sometimes people adopt the frame of integration.
- For example, more bets are placed on long shots at the end of a horse racing day, suggesting that at least some bettors are integrating the outcomes of races and taking risks they would not ordinarily take in order to try to break even.

risky shot / small chance

Mental Accounting



Mental accounting

- Accounting is process of categorizing money, spending and financial events.
- Mental accounting is a description of way people intuitively do these things and is one method people use to make financial decision-making manageable.
- Richard Thaler, "mental accounting is the set of cognitive operations used by individuals and households to organize, evaluate, and keep track of financial activities."

See: Thaler, R. H., 1999, "Mental accounting matters," Journal of Behavioral Decision Making 12, 183–206.

Mental accounting

- Many people nominally place their money in silos:
  - expenditures (food, housing, entertainment, vacation),
  - wealth (checking account, retirement savings), and
  - income (salary, bonus).
- It is important to note that often these "accounts" are mental constructs rather than actual accounts.
  - For example, most of us have not explicitly set up a bank account (or piggy bank) for entertainment.

Mental accounting

- Traditionally, economists have assumed that funds are fungible (substitutable), but because of the silo approach created by mental accounting, this may not be so.

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

Theater ticket problems

- Imagine you have decided to see a play where admission is $20.
- As you enter theater you discover that you have lost a $20 bill.
- Would you still pay $20 for a ticket to the play?

Theater ticket problems

- Imagine that you have decided to see a play and paid the admission price of $20 per ticket.
- As you enter the theater you discover that you have lost the ticket. The seat was not marked, and the ticket cannot be recovered.
- Would you pay $20 for another ticket?

Theater ticket problems

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

Theater ticket problems

- Nothing is really different between the questions.
- A certain amount of money ($20) has been irretrievably lost, and the only decision you have to make is whether or not the theater experience is worth $20 to you.
- Whether or not the $20 was lost in the form of cash or in the form of a theater ticket is truly irrelevant.

Rationally → Think marginally

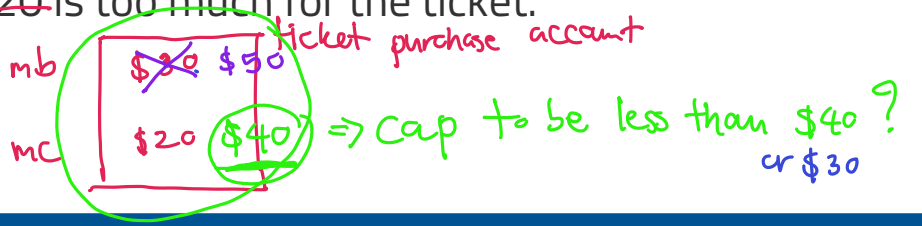
Theater ticket problems

- When the ticket was originally purchased, a “ticket purchase account” was set up.
- If all had gone as planned, the play would have been attended using the original ticket, the pleasure of witnessing the play would have offset the cost of the ticket, and the “ticket purchase account” would have been closed.

Theater ticket problems

- In the 1st scenario, the lost $20 bill is not directly linked to the ticket, so people are willing to purchase a new ticket. While not happy about losing $20, absent budget constraints, there is no reason to connect this loss to the ticket purchase decision. Segregation is used.

- In 2nd question, integration is more likely because both lost ticket and new ticket would be from same "ticket purchase account." Integration might suggest that ~~$20~~ $40 is too much for the ticket.



Prospect theory & Mental Accounting

- When does a person close a mental account?

- Prospect theory tells us that people feel losses more severely than gains, which implies that when there is discretion as to when to close an account,
  - they may choose to avoid doing so if losses will be realized.
  - If gains, on the other hand, will be realized, they may be quite ready to close an account.

Paper gain / loss
"Unrealised gain / loss" VS Realized gain / loss

Prospect theory & Mental Accounting

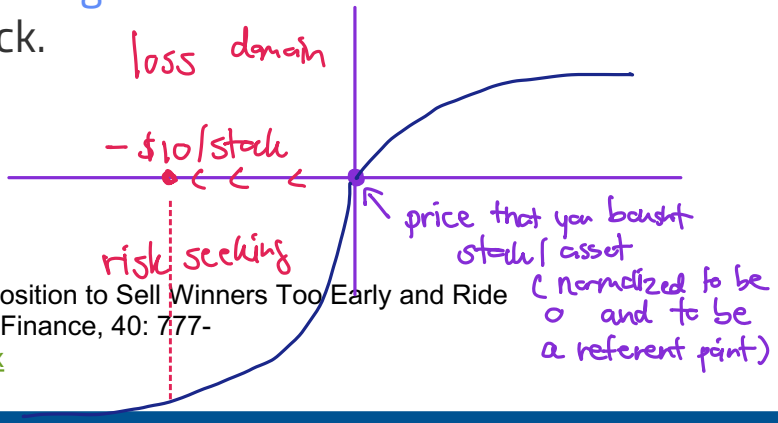
- In the context of a stock portfolio, consider a stock investor who has witnessed one of his picks drop in price.
- As long as he holds it, he can view it as a "paper loss," in a remaining open account.
- Selling the stock is equivalent to closing the account—and closing the account is a painful experience because of loss aversion.

Selling the stock / the asset ≡ closing stock's mental account
≡ making the paper loss a realized loss

Prospect theory & Mental Accounting

- The tendency to sell winners too soon and hold losers too long is called the disposition effect.

- Holding on the loser stocks is to integrate the current decision and the past performance of the stock.



See: SHEFRIN, H. and STATMAN, M. (1985), The Disposition to Sell Winners Too Early and Ride Losers Too Long: Theory and Evidence. The Journal of Finance, 40: 777-790. https://doi.org/10.1111/j.1540-6261.1985.tb05002.x

Prospect theory & Mental Accounting

- The type of investor, who looks at a stock, notices that it has dropped, realizes that this event is history, resets his new reference point to the current stock price, is using segregation.

- Such an approach helps prevent a disposition effect from happening.

Loss Aversion & Financial Insights

THE JOURNAL OF FINANCE • VOL. LIII, NO. 5 • OCTOBER 1998

Are Investors Reluctant to Realize Their Losses?

TERRANCE ODEAN*

ABSTRACT

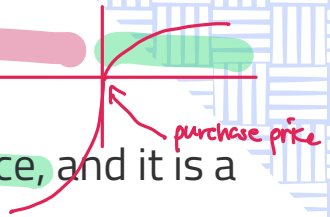
I test the disposition effect, the tendency of investors to hold losing investments too long and sell winning investments too soon, by analyzing trading records for 10,000 accounts at a large discount brokerage house. These investors demonstrate a strong preference for realizing winners rather than losers. Their behavior does not appear to be motivated by a desire to rebalance portfolios, or to avoid the higher trading costs of low priced stocks. Nor is it justified by subsequent portfolio performance. For taxable investments, it is suboptimal and leads to lower after-tax returns. Tax-motivated selling is most evident in December.

Odean (Journal of Finance 1998)

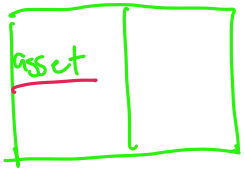
Are Investors Reluctant to Realize Their Losses?

- Use a database that included trading records for 10,000 accounts at a large discount brokerage house with almost 100,000 transactions during 1987–1993
- Reference point: nominal purchase price of each stock (or average purchase price in the case of multiple transactions)

Are Investors Reluctant to Realize Their Losses?



- A stock is a winner if its current price is above its purchase price, and it is a loser if its current price is below its purchase price.
- Odean calculated the proportion of gains realized (PGR) and the proportion of losses realized (PLR).



$$PGR = \frac{\text{Realized gains}}{\text{Realized gains} + \text{Paper gains}}$$

what investors sold

what investors could have sold

unrealized gain

Paper gains include any sales that could have been made at a gain

$$PLR = \frac{\text{Realized losses}}{\text{Realized losses} + \text{Paper losses}}$$

Paper gains include any sales that could have been made at a loss

losses

unrealized loss

H_0: PGR = PLR H_a: PGR > PLR

Are Investors Reluctant to Realize Their Losses?

- To provide insight into the tendency of these individual investors to sell winners while holding losers, Odean tested the hypothesis that the proportion of gains realized exceeded the proportion of losses realized.

TABLE 10.1 AGGREGATE PROPORTION OF GAINS (PGR) AND LOSSES (PLR) REALIZED

	Entire Year	December	January–November
PLR	0.098	0.128	0.094
PGR	0.148	0.108	0.152
Difference in proportions	−0.050	0.020	−0.058
t-statistic	−35	4.3	−38

Source: Odean, T., 1998, "Are investors reluctant to realize their losses?" in *Journal of Finance* 53(5), 1775–1798.

Odean (Journal of Finance 1998)

Are Investors Reluctant to Realize Their Losses?

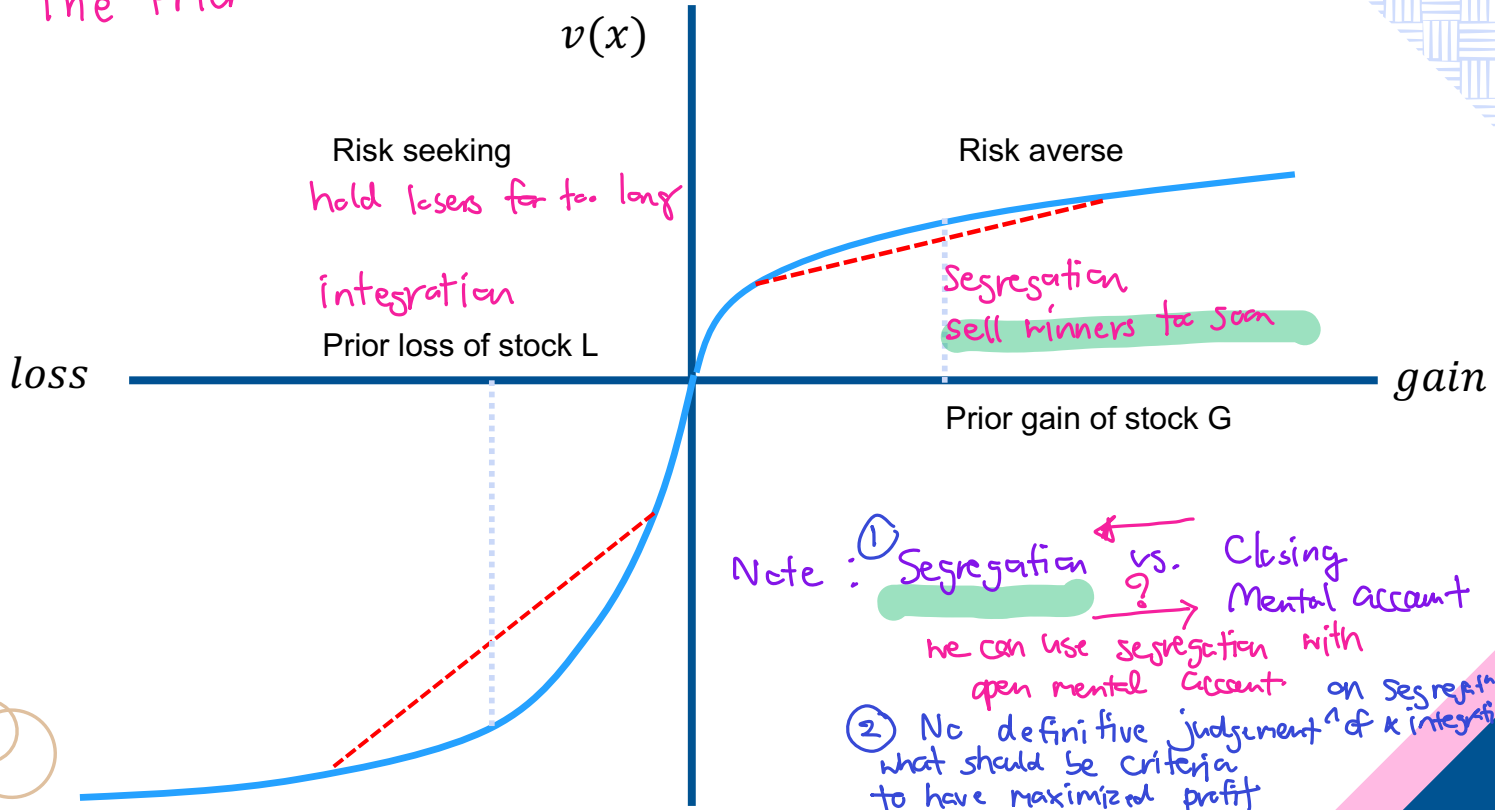
- Figures in the table uses all investor accounts.
- There is a clear tendency to sell winners over losers (PGR > PLR) over the entire year.
- It is important to note that for tax reasons investors should prefer to sell losers, not winners.
- An investor with a positive tax rate should put off realizing gains on winners because of the tax liability generated, but should recognize losses sooner in order to reduce current tax liability.

Odean (Journal of Finance 1998)

Are Investors Reluctant to Realize Their Losses?

- For the entire year, the disposition effect operates despite the fact that some investors understand this tax issue and act accordingly.
- In the month of December, when investors are most likely to transact for tax reasons, there is actually a greater tendency to sell losers rather than winners.
- It is in the other 11 months where the disposition effect dominates.
- Investors were selling ~~medium-term (not~~ long-term~~)~~ winners and holding on to ~~medium-term (not~~ long-term~~)~~ losers. Odean found that winners sold outperform losers held by 3.41% on a risk-adjusted basis.

The Prior



Note: ① Segregation vs. Closing Mental account ?
we can use segregation with open mental account on segregation

② No definitive judgement of integration what should be criteria to have maximized profit

Odean (Journal of Finance 1998)

Are Investors Reluctant to Realize Their Losses?

- Besides the possible reason that closing an account at a loss is difficult because of mental accounting and loss aversion (or regret aversion, TBD), integration also play a role for disposition effect.
- Stock L has suffered losses, while stock G has experienced gains.
- After a large gain (G), you have moved to the risk averse segment of the value function.
- On the other hand, after a large loss (L) you have moved to the risk-seeking segment of the value function.
- The implication is that since you are less risk averse for losers, you are more likely to hold on to them.

MANAGEMENT SCIENCE
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Recall earlier: $\pi(p)v(x) + \pi(1-p)v(y)$

GAMBLING WITH THE HOUSE MONEY AND TRYING TO BREAK EVEN: THE EFFECTS OF PRIOR OUTCOMES ON RISKY CHOICE*

RICHARD H. THALER AND ERIC J. JOHNSON
Johnson Graduate School of Management, Cornell University, Ithaca, New York 14853
The Wharton School, University of Pennsylvania, Philadelphia, Pennsylvania 19104-6371

How is risk-taking affected by prior gains and losses? While normative theory implores decision makers to only consider incremental outcomes, real decision makers are influenced by prior outcomes. We first consider how prior outcomes are combined with the potential payoffs offered by current choices. We propose an editing rule to describe how decision makers frame such problems. We also present data from real money experiments supporting a "house money effect" (increased risk seeking in the presence of a prior gain) and "break-even effects" (in the presence of prior losses, outcomes which offer a chance to break even are especially attractive).
(DECISION MAKING; PROSPECT THEORY; SUNK COSTS; MENTAL ACCOUNTING)

1. Introduction

Imagine that you are attending a convention in Las Vegas, and you walk into a casino. While passing the slot machines, you put a quarter into one machine and, surprisingly, you win $100. Now what? Will your gambling behavior for the rest of the evening be altered? Might you make a few more serious wagers, even if you usually abstain? Suppose

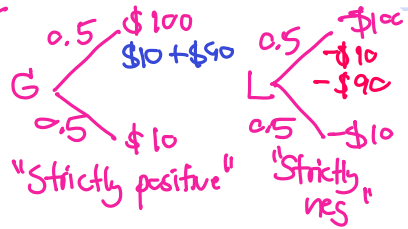
Within the prospect theory, there is some flexibility in how prospects are edited

Strictly positive and strictly negative gambles

Consider a prospect $(x, p; y, 1-p)$, where $x > y > 0$ or $x < y < 0$, then $|x| > |y|$

$$V = v(y) + \pi(p)[v(x) - v(y)]$$

e.g.



In editing phase,

Prospects can be decomposed into two components:

(i) the riskless component, i.e., the minimum gain or loss which is certain to be obtained or paid;

(ii) the risky component, i.e., the additional gain or loss which is actually at stake

Source: Tversky & Kahneman (1979, p. 276)

Consider two presentations of prior gain

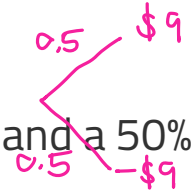
The two-stage vs. The one-stage version of prior gain

➢ *The two-stage version:*

You have just won $30. Now choose between:

(a) no further gain or loss.

(b) a gamble in which you have a 50% chance to win $9 and a 50% chance to lose $9.



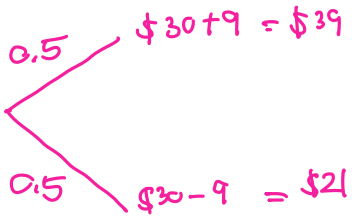
Notice that the wording of this problem does suggest segregating the prior outcome as it is presented separately, but it also suggests that the prior gain is in the same (mental) account as the subsequent choices.

➢ *The one-stage version:*

Choose between:

(a) A sure gain of $30.

(b) A 50% chance to win $39 and a 50% chance to win $21.



Editing rules

Editing rules help determine specific alternative representations of prospects that can emerge from the editing phase. Editing rules considered by Thaler&Johnson (1990)

- Prospect theory with memory
- Prospect theory, no memory
- Concreteness
- Hedonic Editing

Prospect theory with memory

Prior outcomes are incorporated into the perceived balance of the relevant mental account

⇒ Integration

The gamble in the two-stage and one-stage version presented above is edited as

$$v(\underline{21}) + \pi(0.5)[v(\underline{39}) - v(\underline{21})]$$

The way to read this in words is:
"If I accept this gamble I win $21 for sure, plus I have a 50% chance of increasing my gain from $21 to $39"

Prospect theory, no memory

(still in the same mental account)

($30)

Prior outcomes are encoded, valued, and then forgotten. Prior outcomes do not alter the coding of subsequent gambles. Under this editing hypothesis, the presentation of the gambles makes a difference.

⇒ Segregation

The two-stage version

one shot — another shot

$$v(30) + \pi(0.5)v(9) + \pi(0.5)v(-9)$$

"I have already won $30. I can now take this gamble which will yield me a 50% chance to gain $9 and a 50% chance to lose $9."

⇒ Integration

The one-stage version

$$v(21) + \pi(0.5)[v(39) - v(21)]$$

Concreteness

Subjects do no active editing per se, but rather accept the problem as presented to them.

⇒ segregation

The two-stage version

$$v(30) + \pi(0.5)v(9) + \pi(0.5)v(-9)$$

⇒ integration

The one-stage version

$$\pi(0.5)v(39) + \pi(0.5)v(21)$$

Hedonic Editing

People edit the gambles in a way that would make the prospects appear most pleasant or least unpleasant.

The signs and magnitudes of x and y determine whether hedonic editing calls for segregation or integration.

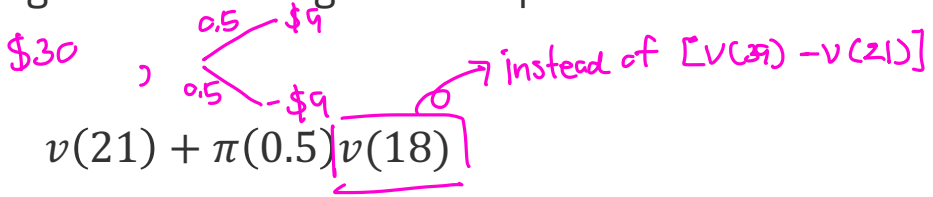
The rules for hedonic editing follow from four principles:

- Segregate gains.
- Integrate losses.
- Segregate small gains from larger losses (The "silver lining" principle).
- Integrate (cancel) smaller losses with larger gains. ⇒ "house money effect"

The hedonic editing hypothesis assumes that these four principles are applied whenever possible.

Hedonic Editing

The gamble in the two-stage and one-stage version presented above is edited as:



This can be read as: "If I win the gamble I will win $21 for sure, and I have a 50% chance to also win another $18."

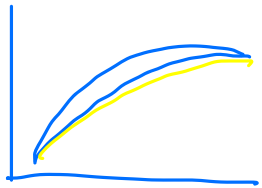
Hedonic editing permits combining and separating. That is, when there are two events x and y, assume that people either integrate the two and code the joint event as $v(x + y)$, or they segregate the events and code them as $v(x) + v(y)$.

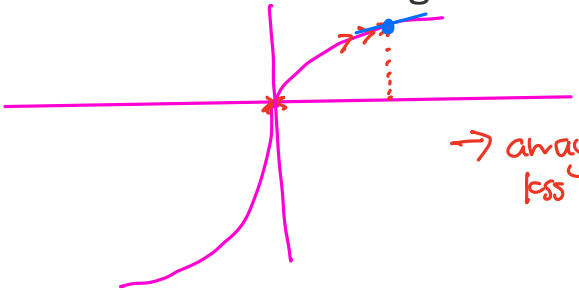
Path-dependent behavior: house money effect

Integrate (cancel) small losses that could happen with the larger gain

- After a prior gain, people become more open to assuming risk. This observed behavior is referred to as the house money effect, alluding to casino gamblers who are more willing to risk money that was recently won.

- If one integrates after a large gain, one has moved safely away from the value function loss aversion kink, serving to lessen risk aversion.





→ away from incorporating loss aversion into decision: view future small loss as the reduction in prior gain

Path-dependent behavior: : house money effect

- The essence of the idea is that until the winnings are completely depleted, losses are coded as reductions in a gain, as if losing some of "their money" doesn't hurt as much as losing one's own cash.

- In sum, the house money effect is used to label an event when a prior gain can increase subjects' willingness to accept gambles.

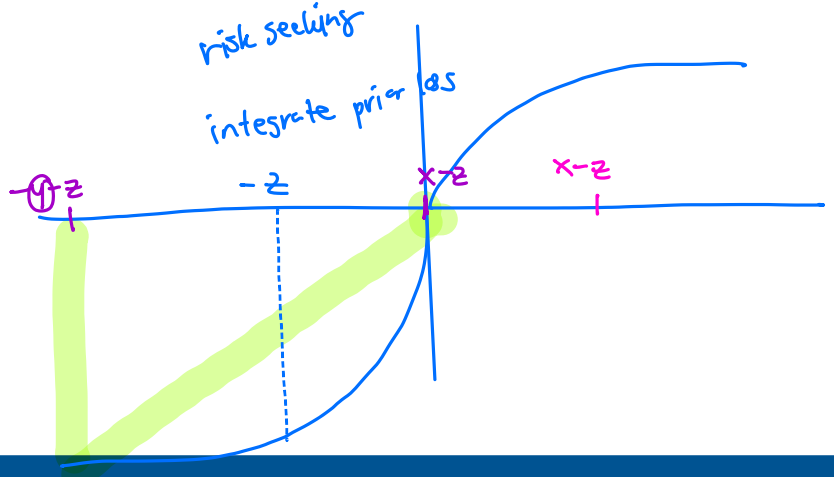
Path-dependent behavior: break-even effect

- After a prior loss, on the one hand, people seem to value breaking even, so a person with a prior loss may take a risky gamble in order to try to break even. This observed behavior is referred to as the break-even effect.

- When there is incomplete adaptation to recent losses, break-even effect is used to label an event when outcomes which offer the opportunity to "break even" after prior losses are especially attractive.

Path-dependent behavior: break-even effect

- When breaking even is possible, integration is facilitated; thus, risk seeking in the domain of losses should occur.
- A prior sure loss $-z$ is less preferred than $(x - z, p; -y - z, 1 - p)$, especially when $x - z \geq 0$



Path-dependent behavior: snake-bit effect

- On the other hand, an initial loss can cause an increase in risk aversion in what has been called the snake-bit effect, especially when the new opportunity does not offer the opportunity to break even.

λ (experiences)

- This is when possible subsequent losses are not integrated with the prior outcome.

λ (prior loss)

more risk aversive after loss
(higher level of loss aversion)

- A prior loss might even sensitize people to subsequent losses of a similar magnitude. This increase in loss aversion would tend to produce risk aversion for gambles that risk additional losses.

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PROSPECT THEORY AND ASSET PRICES*

NICHOLAS BARBERIS
MING HUANG
TANO SANTOS

We study asset prices in an economy where investors derive direct utility not only from consumption but also from fluctuations in the value of their financial wealth. They are loss averse over these fluctuations, and the degree of loss aversion depends on their prior investment performance. We find that our framework can help explain the high mean, excess volatility, and predictability of stock returns, as well as their low correlation with consumption growth. The design of our model is influenced by prospect theory and by experimental evidence on how prior outcomes affect risky choice.

Investor preference

- The investor derives direct utility not only from consumption but also from changes in the value of his financial wealth.

- When deciding how much to invest in the stock market, he takes both types of utility into account: the objective function he maximizes includes an extra term reflecting a direct concern about financial wealth fluctuations.

Utility from gain and loss

- How loss averse the investor is, depends on his prior investment performance.
- With prior gains, he becomes less loss averse: the prior gains will cushion any subsequent loss, making it more bearable.
- Conversely, after a prior loss, he becomes more loss averse: after being burned by the initial loss, he is more sensitive to additional setbacks.

Utility from gain and loss

$$v(X_{t+1}, S_t, z_t) = \begin{cases} X_{t+1} & , X_{t+1} \geq 0 \\ \lambda(z_t) X_{t+1} & , X_{t+1} < 0 \end{cases}$$

$$\lambda(z_t) = \lambda + k(z_t - 1)$$

$\lambda(z_t)$ is a function of the size of prior losses, measured by z_t, $k > 0$

X_{t+1} the gain or loss in period $t + 1$

S_t the time t value of the investor's holdings of the risky asset.

House money effect and excess volatility

Barberis, Huang, and Santos's model predicts that the existence of the house money effect in financial markets leads to greater volatility in stock prices.

DANKE!