



★★★★★

FOUNDATIONS OF FINANCE: EXPECTED UTILITY THEORY?



EE 434 Behavioral Finance, SEM1/2021

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01



ALLAIS PARADOX



Allais Paradox



<https://www.menti.com/pph4yqfryg>



Question 1: Which do you prefer between A and A*?

Prospect A <i>30%</i>		Prospect A* <i>70%</i>	
\$1,000,000	100%	\$ 0	1%
		\$ 1,000,000	89%
		\$ 5,000,000	10%

Question 2: Which do you prefer between B and B*?

Prospect B		Prospect B* <i>100%</i>	
\$0	89%	\$ 0	90%
\$1,000,000	11%	\$5,000,000	10%

Allais Paradox

A large number of people choose A over A* and B* over B.

* pattern 1 $A \succ A^*$
 $B^* \succ B$
↳ Violate EVT

pattern 2 $A^* \succ A$
 $B^* \succ B$
↳ Not Violate EVT

$A \succ A^*$

$$\underline{E[U(A)] > E[U(A^*)]}$$

$B^* \succ B$

$$\underline{E[U(B^*)] > E[U(B)]}$$

$$\underline{1 \times U(\$1M) > 0.89U(\$1M) + 0.1U(\$5M)}$$

$$\underline{0.1U(\$5M) > 0.11U(\$1M)}$$

$$\underline{0.11U(\$1M) > 0.1U(\$5M)}$$

← contradiction!

Note : assume $U(\$0) = 0$

apple + banana vs. orange + banana

Allais Paradox



<https://www.menti.com/fk8zf4ftb4>



Question 1: Which do you prefer between A and A*?

Prospect A		Prospect A*	
\$1,000,000	89%	\$ 1,000,000	89%
\$1,000,000	11%	\$ 0	1%
		\$ 5,000,000	10%

Context (handwritten note with arrow pointing to the top right)

*** (handwritten mark in a circle next to the second row of Prospect A)

Question 2: Which do you prefer between B and B*?

Prospect B		Prospect B*	
\$0	89%	\$ 0	89%
\$1,000,000	11%	\$ 0	1%
		\$5,000,000	10%

Context (handwritten note with arrow pointing to the top right)

*** (handwritten mark in a circle next to the second row of Prospect B)

go with A & B or A* & B* based on your risk preference.

Allias paradox

After removing commonalities, the choices between prospects A and A^* or B and B^* are exactly the same.

Thus, people should choose A and B or A^* and B^* .

An axiom known as "Context independence" is contradicted by the Allais paradox.

Alias paradox

Suppose a person is indifferent between two prospects, A and B. If we consider another prospect, C, independence implies that this person should also be indifferent between one gamble that combines A with C and another that combines B with C with fixed probability.

02

Observe investors' behavior
individuals' behavior

→ Can the observed behavior
be explained by comparing
Expected value of the gamble?

→ Can EUT explain?

→ Can other theories explain?
Prospect theory?

RABIN'S CALIBRATION

Key:

EUT might not be the best positive
theory to explain the behavior!
↳ providing description.

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Eventhough, EUT might be the best
normative theory. → what people should do.

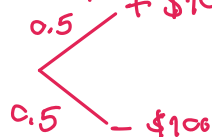


Rabin's calibration (Rabin, Econometrica 2000)

People tend to dislike risky prospects even when they involve an expected gain.

e.g. A 50-50 gamble of losing \$100 vs. gaining \$105.

Would you accept this bet?



→ Expected value of the gamble = $0.5(-\$100) + 0.5(\$105) = -50 + 52.5 = \$2.5 > 0$

Standard explanation:

EU theory with a concave utility function. → EUT? because of risk aversion!

Rabin: * If an expected-utility maximizer always turns down modest stakes gamble X, she will always turn down large-stake gamble Y.

* If a person turns down gambles where she loses \$100 or gain \$110, each with 50% probability, she will turn down 50-50 bets of losing \$1,000, or gaining Any sum of money.

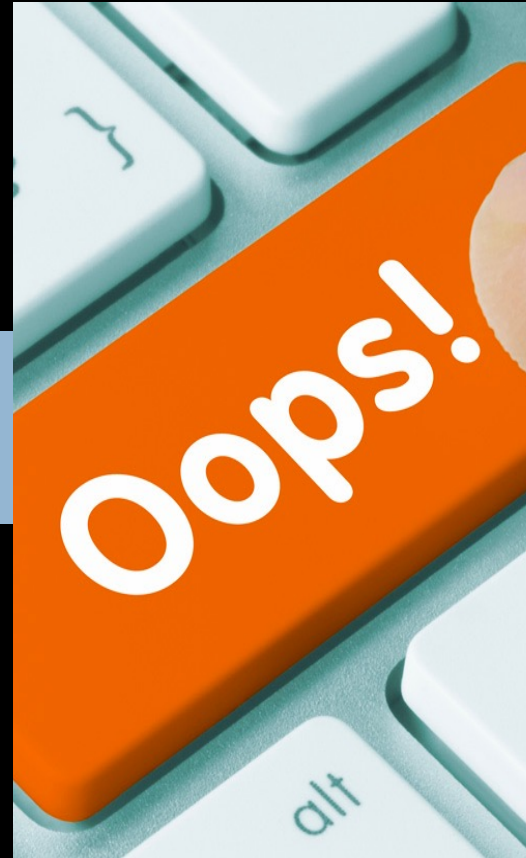
Rabin's Point:

This explanation doesn't work, because according to EU theory, anything but virtual risk neutrality over modest stakes implies manifestly unrealistic risk aversion over large stakes.

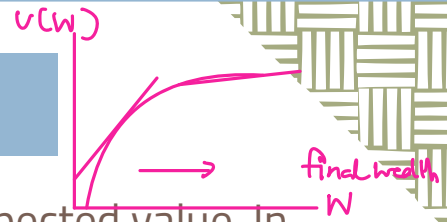


03

Bernoulli's Error



Bernoulli's Error



One way to evaluate a prospect is to calculate expected value. In 1738, Daniel Bernoulli noted that there was a difference between the actual value of money and the psychological value of money. Bernoulli noticed that people dislike risk, and want to avoid the worst outcomes at great cost, that is, they are **risk-averse**.

This can be explained by **diminishing marginal utility of wealth**. Hence, a **concave utility function** is implicitly assumed in EUT.

Expected Utility Theory has been widely accepted and used for many years, but it has its own issues.

“ Bernoulli’s Error ”

Consider this example:

Today **Wanda** and **Loki** each have a wealth of \$5 million.

Yesterday, **Wanda** had \$1 million and **Loki** had \$9 million.

Are they equally happy?

Today?



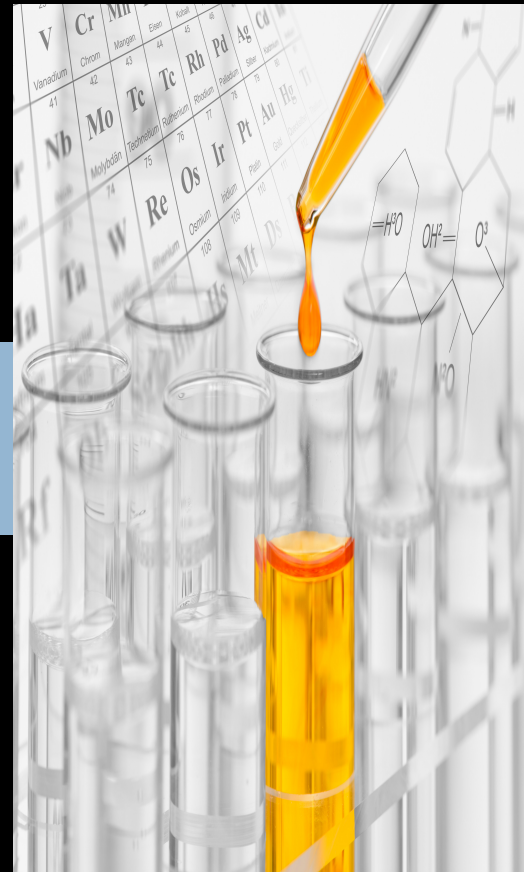
Bernoulli's Error

The expected utility model only takes into account final states of wealth, not changes in wealth.

Wanda and Loki both have final wealth of \$5 mil (same final state). But they had different initial wealth (different changes).

04

Thought experiments



Thought experiment A

<https://www.menti.com/dhncr1xqhp>



Suppose initial wealth is 0

Problem 1: Choose between...

Sure thing: win \$900

Gamble: 90% win \$1000, 10% win \$0

risk aversion
Expected Value = 900



Expected value = -\$900

Problem 2: Choose between...

Sure thing: lose \$900

Gamble: 90% lose \$1000, 10% lose \$0

risk loving



Thought experiment A

In Problem 1, most people...
Choose sure thing
Explained by risk aversion

In Problem 2, most people...
Choose the gamble
Explained if people are risk seeking



Thought experiment B

<https://www.menti.com/hjr6pv8apz>



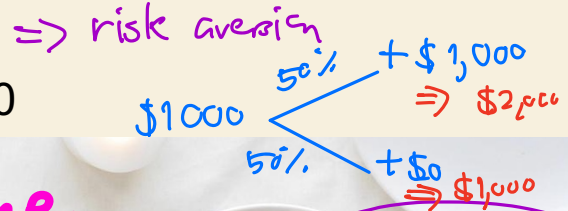
For EUT:
The frame
will not matter!

Gain frame

Problem 3: In addition to whatever you own, you have been given \$1000.
Choose between...

Sure thing: win \$500

Gamble: 50% win \$1000, 50% win \$0



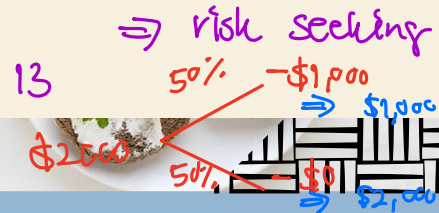
Loss frame

Problem 4: In addition to whatever you own, you have been given \$2000.
Choose between...

Sure thing: lose \$500

Gamble: 50% lose \$1000, 50% lose \$0

This class
 \Rightarrow majorly 17



Thought experiment B

In this thought experiment, the final payoffs in problem 3 and 4 are exactly the same.

Sure thing:

having \$1,500 for sure

Gamble:

50% \$2,000 and 50% \$1,000

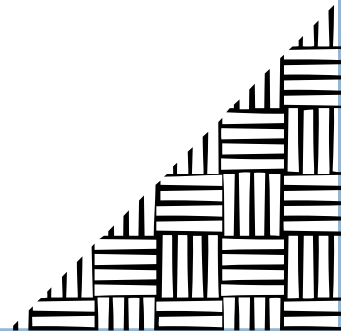
Findings suggest that people are risk-averse over potential gains, and risk-loving over potential losses.

seeking

HOW CAN YOU BE BOTH RISK AVERSE/NEUTRAL IN GAINS AND RISK SEEKING IN LOSSES?

Thought experiments C

People feel the pain of a loss more strongly than the desire of an equally-sized gain.



The slide features a light blue background with several decorative elements. On the left, there is a large orange triangle pointing downwards, partially overlapping a green triangle pointing upwards. Below these, there are patterns of horizontal and vertical lines in blue and green, resembling a staircase or a grid. In the top right corner, there are two overlapping orange circles and some blue lines. The word 'DANKE!' is written in large, white, bold, sans-serif capital letters on a blue rectangular background that spans across the top of the slide.

DANKE!

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