Risky Choice Normative Theory

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(Subjective) Expected Utility Theory

- Normative theory of decision making under uncertainty
- EU = prob × utility, summed across outcomes
- EUT says you should pick the option with the highest EU.
- "Subjective" means the decision maker estimates the probabilities rather than knowing their precise values.

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Components of a Risky Choice

- Options/alternatives
- Outcomes
  - Probability
  - Utility
- Utility = value; extent to which an outcome achieves one's goals.

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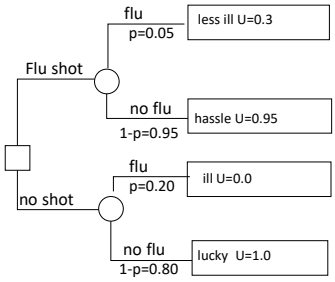
Decision Tree

EU=.05(.3)+.95(.95)=.92



EU=.2(0)+.8(1)=.80

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Pascal's Wager

	State of the World	
Option	God exists	God does not exist
Live Christian life	Saved (very good)	Small inconvenience
Live secular life	Damned (very bad)	Normal life

Blaise Pascal, 1623 - 1662

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St. Petersburg Paradox

- A fair coin is tossed multiple times.
- The initial stake starts at $2
- Doubled every time heads appears.
- The first time tails appears, the game ends and the player wins whatever is in the pot.

Table 1: St. Petersburg Game

Trial where first tails appears	Probability	Payout
1	$\frac{1}{2}$	$2
2	$\frac{1}{4}$	$4
3	$\frac{1}{8}$	$8
4	$\frac{1}{16}$	$16
...	...	...

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St. Petersburg Paradox

- Bernoulli argued that the paradox is due to *diminishing marginal utility* for money.
- Each dollar is worth less than the last.
- This utility function for money results in risk aversion.
- Expected Utility Theory allows any shape of utility function

Daniel Bernoulli
1700 - 1782

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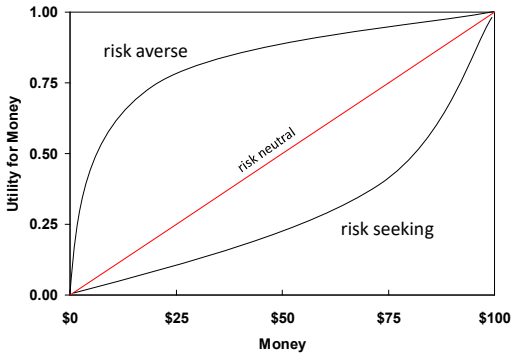

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Why is EUT normative?

- Why multiply probability by utility?

2 Rationales

- Long run argument
- Axiomatic argument

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Axioms of Expected Utility Theory

- *Connectedness (aka Completeness):*
  A>B or A<B or A≈B
- *Transitivity:*
  If A>B and B>C then A>C
- *Independence (sure thing principle)*
  - If an outcome is common to all options, it should not affect choice

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Independence Example

	50%	50%
Option A	London	Bermuda
Option B	Paris	Bermuda

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Independence Example

	50%	50%
Option A	London	Harrisburg
Option B	Paris	Harrisburg

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The Allais Paradox

	"Hi" option	"Lo" option
Choice 1	9% chance of winning $5000 90% chance of winning $1000 1% chance of winning nothing	100% chance of winning $1000
Choice 2	9% chance of winning $5000 91% chance of winning nothing	10% chance of winning $1000 90% chance of winning nothing

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Why isn't this normative?

	Tickets:	1	2-10	11-100
Choice 1	**"Lo" option**	$1000	$1000	$1000
	"Hi" option	$0	$5000	$1000
Choice 2	**"Lo" option**	$1000	$1000	$0
	"Hi" option	$0	$5000	$0

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Bounded Rationality

HERBERT A. SIMON

1916 – 2001
1978 Nobel Prize in Economics
CMU faculty 1949 - 2001

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bounded rationality

Decision making that "incorporates constraints on the information processing capacities of the actor" (Simon, 1972).

"Rational choice that takes into account the cognitive limitations of the decision maker" (Simon, 1990)

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Relax assumptions of SEUT

- Generation of alternatives (not exhaustive)
- Evaluation of Consequences
  - Limited info
- Criteria of choice
  - Satisfice rather than maximize

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