Insights from Behavioral Economics on Index Insurance

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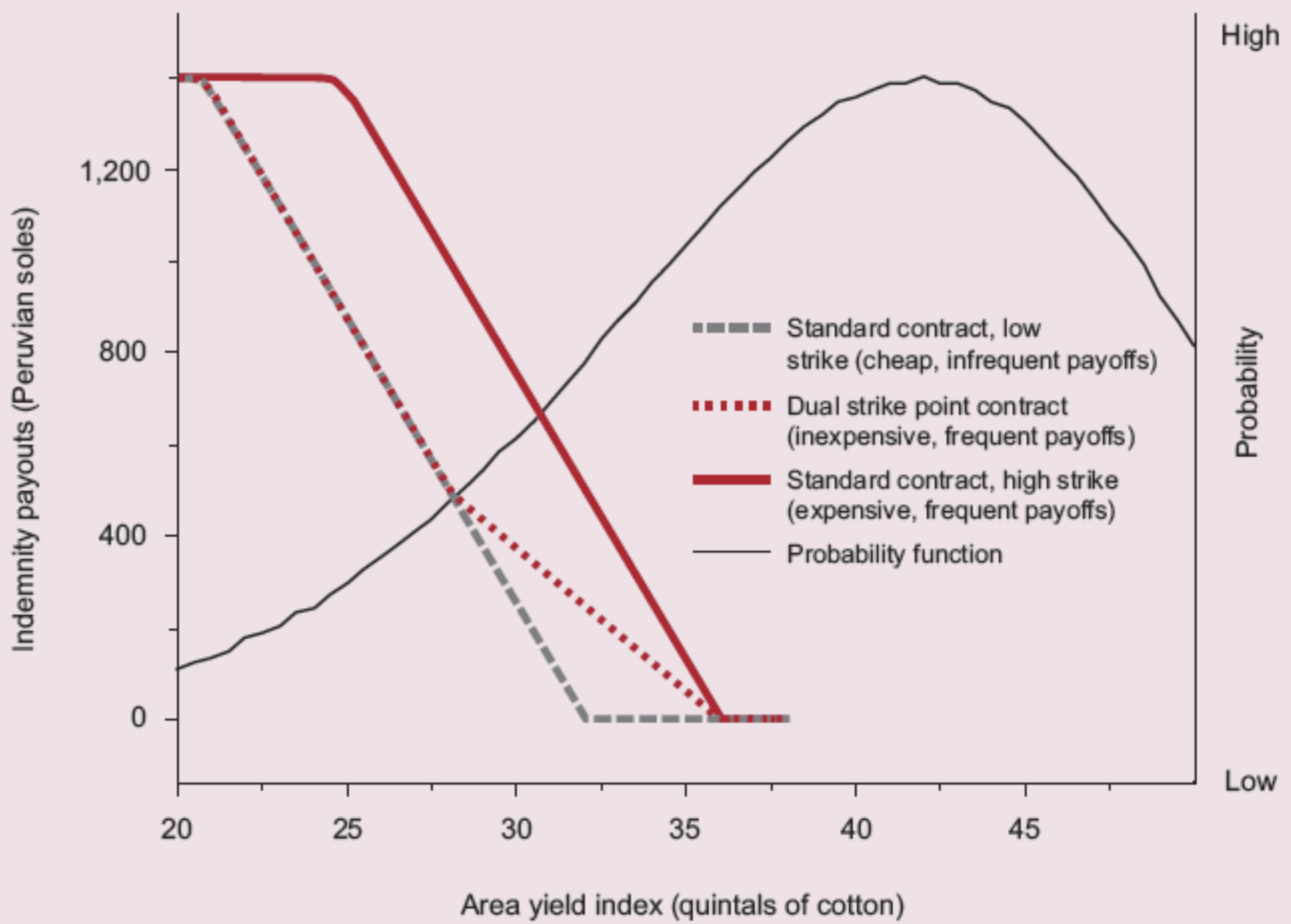
Introduction: The Puzzle of Index Insurance

- Standard Index Insurance Contract
  - Linear Payout as fall below strike point
    - Expect demand from risk averse agents under expected utility theory even for this partial insurance
    - Miranda's classic mean-variance treatment
  - Gine's non-linear payouts
    - → more better demand
- Despite this strong theoretical expectation, we know that demand often seems tepid—but why?

Figure 1—Dual strike-point contract



Source: Author's calculations.

Introduction: The Puzzle of Index Insurance

- Maintaining expected utility perspective, look for explanations & solutions:
  - Basis risk and poor design (but even partial insurance is valuable)
  - Contracts priced over actuarially fair—suddenly basis risk becomes more important.
    - GIIF as solution?
    - Interlinkage as solution?
  - Liquidity constraints (but solutions)
  - Trust (Alain's observations; Gine et al. on India)
  - Understanding (probabilities; complexity)
- Is it possible that we are wrong in our fundamental approach about the behavioral principles that guide demand?
- Expected utility theory in general has been heavily questioned by behavioral experiments
- Let's look at a few elements of that critique and consider what it might mean for design of index insurance contracts and how we might test the veracity of these alternative designs

Behavioral Paradox 1

- A volunteer from the audience—thank you, Lena!
- *Problem 1*
- I give Lena $10
- Lena, you must choose which of the following lotteries you want to play:
  - *Lottery A:* Heads you get $10, Tails you get 0
  - *Lottery B:* Heads you get $5 and Tails you get $5
- Lena, your choice, please …
- *Problem 2*
- I given Lena $20
- Lena, you must choose which of the following lotteries you want to play:
  - *Lottery A'*: Heads you loose $10, Tails you loose 0
  - *Lottery B'*: Heads you loose $5 and Tails you loose $5
- Lena, your choice, please ....

Behavioral Paradox 2

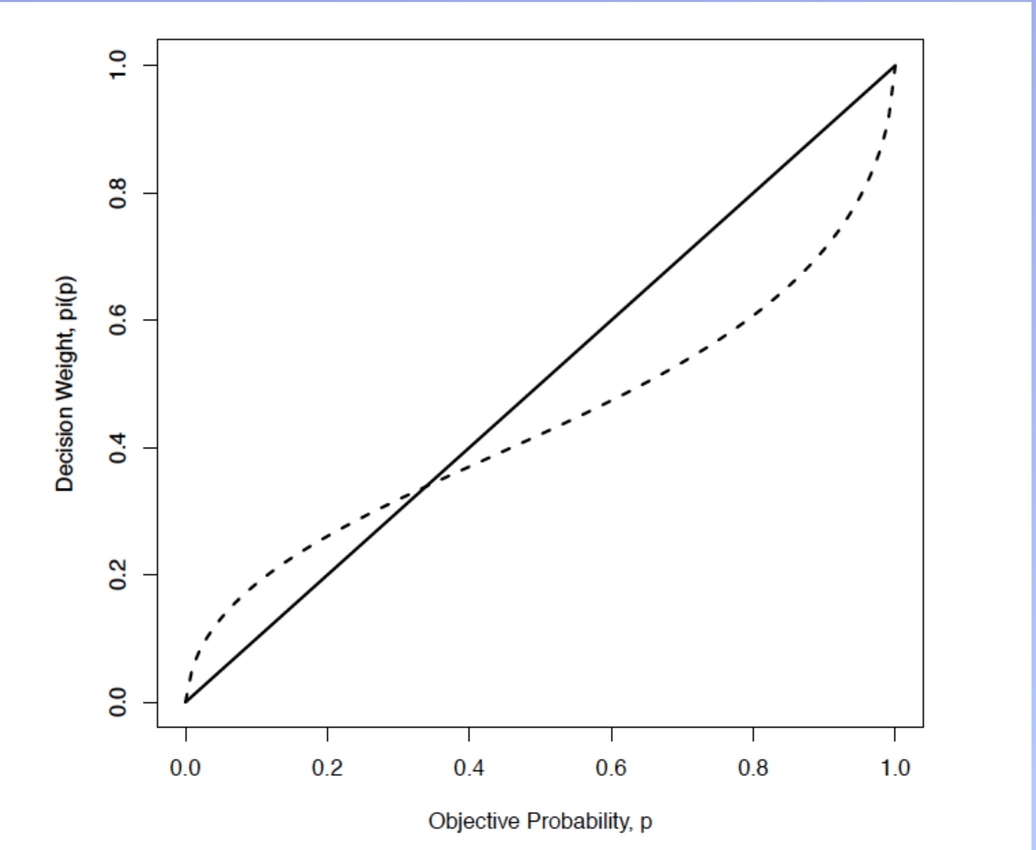
- A volunteer from the audience—thank you, Nora!
- *Problem 1*
- Nora, you must choose which of the following lotteries you want to play:
  - *Lottery A:* Certainty of receiving 100 million.
  - *Lottery B:* 10% chance of 500 million; 89% chance of 100 million; 1% chance of nothing.
- Nora, your choice, please …
- *Problem 2*
- Nora, you must choose which of the following lotteries you want to play:
  - *Lottery A':* 11% chance of 100 million; 89% chance of nothing.
  - *Lottery B':* 10% chance of 500 million; 90% chance of nothing.
- Nora, your choice, please ....

Behavioral Paradox 1, Results

- Typical play in these games reveals "preference reversals," from the perspective of conventional expected utility theory:
  - In Lena's game, most people Choose B in problem 1 and A' in problem 2
  - In Nora's game, most people choose A in problem 1 and B' in problem 2
- The preference reversal observed in Lena's game signals that people respond differently to the 'same situation' depending on whether framed as a gain and or a loss:
  - Suggests that people do not perfectly integrate their assets as we typically assume in modeling behavior in the face of risk (& insurance demand)
  - A budgeting effect, or separate mental accounts
  - Loss aversion is not the same as risk aversion (in gains)

Behavioral Paradox 2, Results

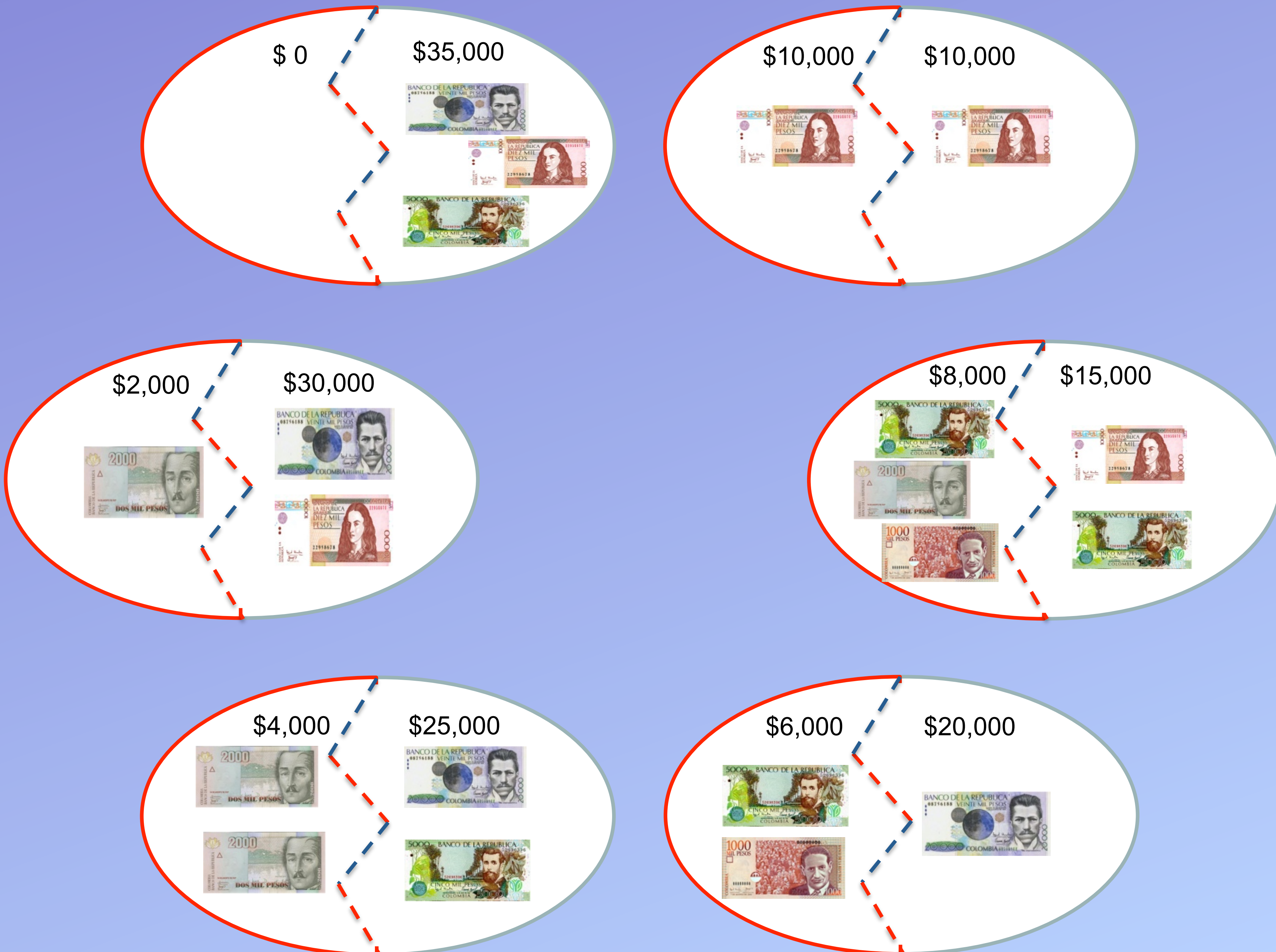
- The reversal in Nora's game illustrates Allais' Paradox—people are not indifferent to the removal of a common consequence (89% chance of getting $100 million)
  - Violates 'independence' axiom of expected utility theory
  - May suggest S-shaped probability weighting scheme
  - Or, a distinctive preference for certainty [more later]



Behavioral Paradox 3, Ambiguity Aversion

- Before turning to the meaning of these behavioral findings for index insurance, let's look at one more standard behavioral finding.
- Standard Risk aversion lottery
- Ambiguity Aversion lottery
- Standard finding


$ 0
$35,000
$10,000
$10,000
$2,000
$30,000
$8,000
$15,000
$4,000
$25,000
$6,000
$20,000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$6,000
$20,000

Implications for Index Insurance

- Consider the following expected utility representation of well-being with and without an actuarially fair index insurance:

$$V^I = \iint u(y(\theta,\varepsilon) - K + W - \pi + \rho(\theta))\phi(\theta,\varepsilon)\,d\theta\,d\varepsilon$$

$$V^N = \iint u(y(\theta,\varepsilon) - K + W)\phi(\theta,\varepsilon)\,d\theta\,d\varepsilon$$

$$where E(\rho(\theta)) = \pi$$

- Note the following:
  - Asset integration (not matter if do or do not include for –K+W for relative rankings
  - That is gains and losses treated the same
  - Objective probabilities (no probability decision weights)
  - Some things are certain (pi), other things are not (rho), yet all evaluated with the same expected utility framework
- Finally, note that from the farmer's perspective, index insurance is ambiguous
  - Conditional on having a loss ($y(\theta,\varepsilon) < \tilde{y}$), unclear if the farmer will get a payout ($\bar{y}(\theta) < \tilde{y}?$)

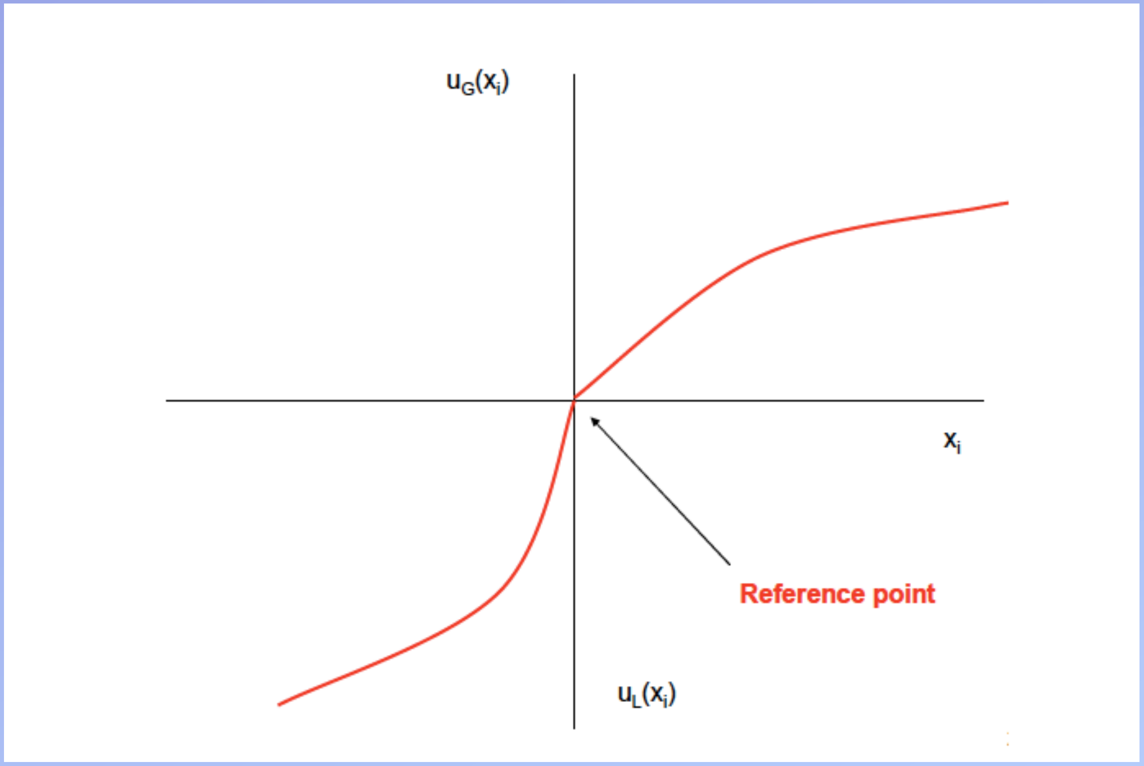
Behavioral Economics-informed Alternative Approaches

- Cumulative prospect Theory (Kahneman & Tversky)
  - Losses versus gains
  - Risk-seeking over losses versus risk averse over gains
  - Low deductible preference
  - Peculiar probability weights
- Certain and uncertain utility (Andreoni & Sprenger)
  - Losses versus gains (generalize)
  - Ambiguity
  - Preference for certainty

Behavioral Economics-informed Alternative Approaches

- Cumulative prospect Theory:

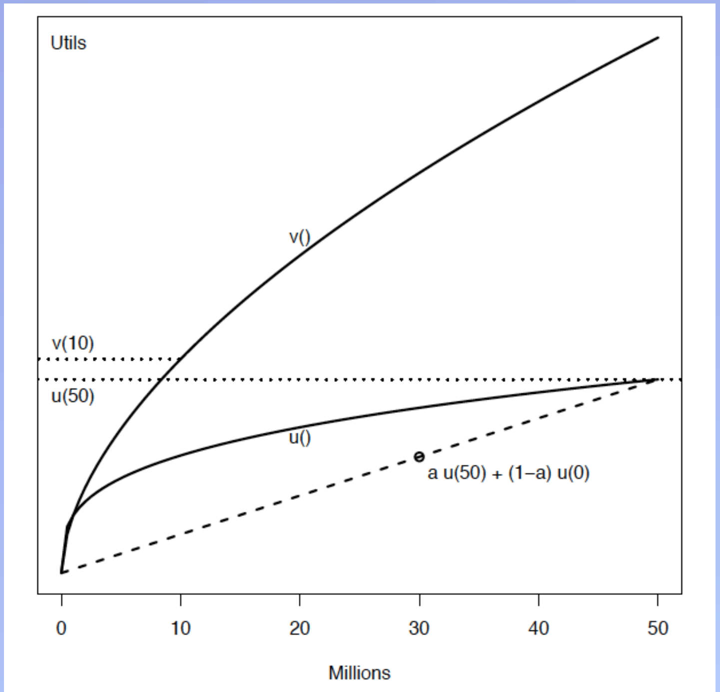
$$U(\tilde{x}) = \sum_{x_{min}}^{0} w^{-}(p) \quad v^{-}(x^{-}) \quad + \sum_{0}^{x_{max}} w^{+}(p) \quad v^{+}(x^{+})$$



Behavioral Economics-informed Alternative Approaches

- Certain and uncertain utility (Andreoni & Sprenger)

$$W(X,L) = \begin{cases} v(x_j) & if \quad L \in \mathcal{L}_D \\ \sum_{i=1}^{S} p_{Ni} \times u(x_i) & if \quad L \in \mathcal{L}_N \end{cases}$$



Contract Design under Non-expected Utility

- Alternatives
  - Gains versus losses
  - Probabilistic-seeming premium
  - Deductibles
- Exploratory Mechanisms
  - Standard risk, loss and ambiguity lotteries
    - Test for alternative theories
  - Framed alternative contracts to reveal preferences
    - Losses versus gains
    - Different premium structures
    - Deductibles