Prospect Theory, Skewness Preference, and Behavioral Insurance Demand

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Tilburg University

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This Talk

Skewness preference ("downside risk aversion, gambling preference"):

- is a prevalent trait of individual risk preferences
- frequently determines behavior in insurance and financial situations
- however, is frequently not made explicit as an assumption

Turning "on" and "off" skewness preference in prospect theory models is decisive for insurance demand.

AGENDA

Skewness

Skewness Preference

Skewness Preference and Prospect Theory

Prospect Theory and Behavioral Insurance

Conclusion

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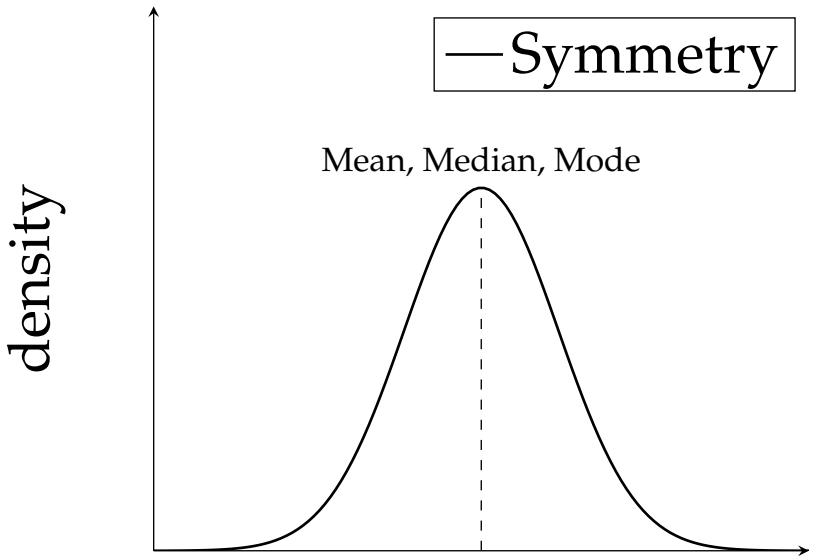
Skewness of continuous distributions (e.g. returns)



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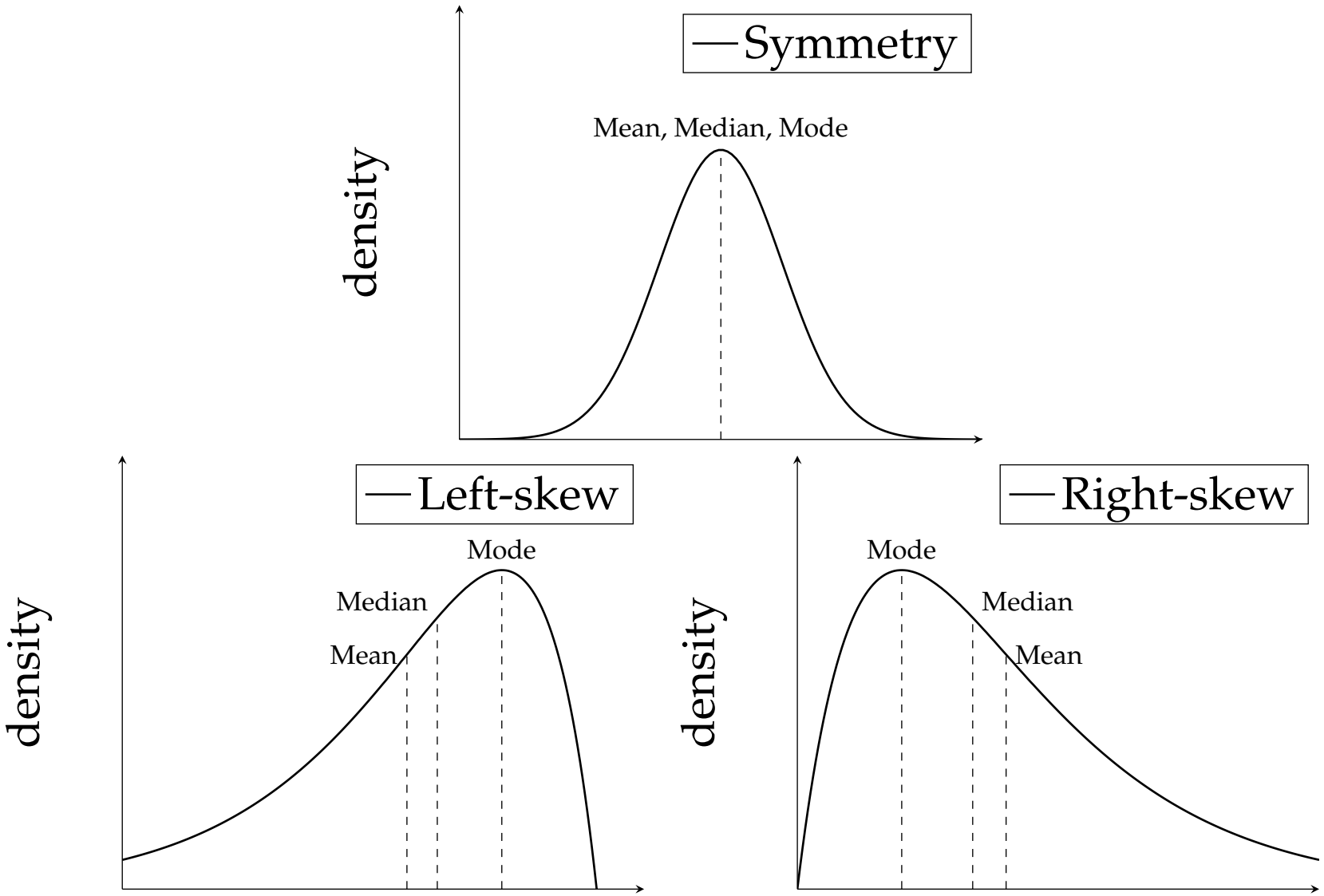
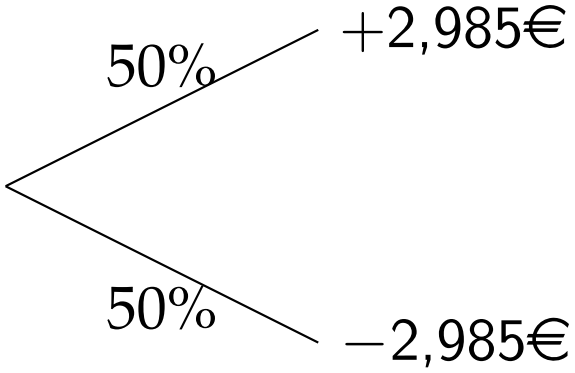


Skewness of binary distributions

A symmetric risk:



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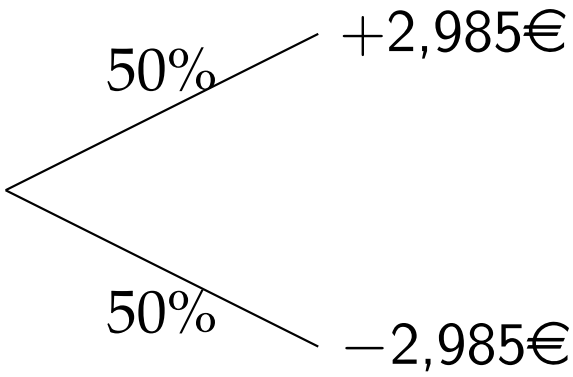
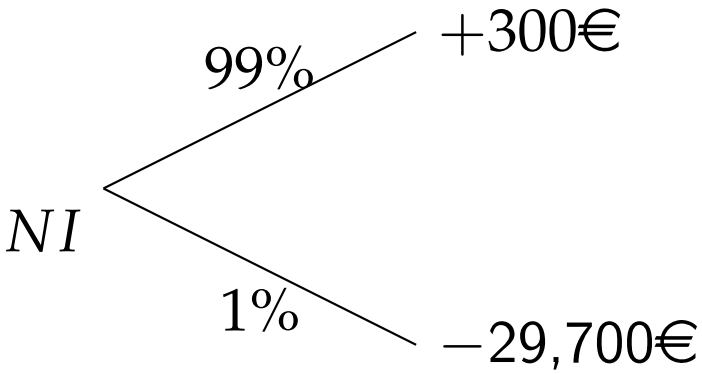
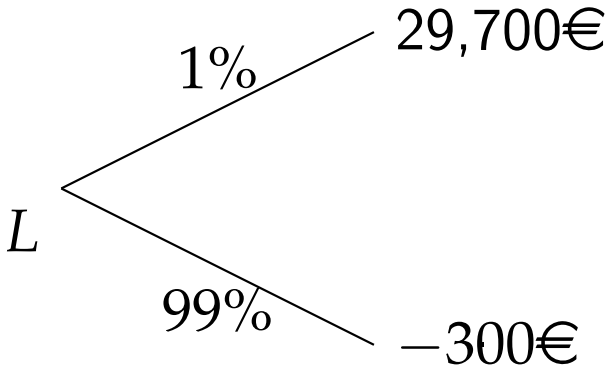




"not insuring disability risk" (left-skewed)



"lottery ticket" (right-skewed)

Theorem [Skewness in Binary Lotteries (Ebert 2015)]

The following statements, each of which illustrates that L_Y is more right-skewed than L_X, are equivalent:

(i) The right tail of L_Y is relatively longer than the right tail of L_X.

(ii) The right tail of L_Y is lighter than that of L_X.

(iii) The probability to receive the high outcome is smaller for L_Y.

(iv) At least one odd moment of order three or higher is larger for L_Y.

(v) L_Y has higher odd moments of all orders.

Skewness: Summary

Right-Skew ("positive skewness, large skewness, high skewness"): Large gain with small probability

Left-Skew ("negative skewness, low skewness"): Large loss with small probability

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- liking right-skew
- disliking left-skew

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- Emphasis on left-skew aversion: downside risk aversion, crash aversion, catastrophe risk aversion
- Emphasis on right-skew seeking: gambling preference, lottery preference
- Meaning both (i.e., right-skew seeking left-skew aversion): Prudence, decreasing absolute risk aversion, probability weighting

Skewness Preference: Empirical Evidence (Selection)

- Golec and Tamarkin (1998): horse-race betting is explained by skewness-seeking
- Ebert and Wiesen (2011, MS): laboratory evidence (for right-skew seeking)
- Laury, McInnes, Swarthout (2009, JRU), Ebert (2015, JEBO): laboratory evidence for left-skew aversion
- Boyer, Mitton and Vorkink (2010, RFS): stocks with skewed returns are overpriced

Skewness Preference: Applications in Finance

- Conine and Tamarkin (1981, JF): Skewness preference can explain underdiversification
- Barberis and Huang (2008, AER): Stocks as lotteries
- Kumar (2009): Poor individuals hold more lottery stocks
- Schneider and Spalt (2015, JF): CEOs allocate more money to divisions that earned skewed returns
- Gao and Lin (2014, RFS): the stock and lottery markets are substitutes

Skewness Preference under Expected Utility

- Positive third derivative (!) (Menezes, Geiss, Tressler 1980, AER)
- All commonly used utility functions imply skewness preference (Brockett and Golden 1992, MS, Ebert 2013, TD)

However, skewness preference in expected utility is "mild":

- "third-order" property
- "high mean and low variance are more important than skewness"
- Laboratory evidence suggests that skewness is *more* important than variance

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Prospect Theory

Postulated by Daniel Kahneman and Amos Tversky (1979, Econometrica), Tversky and Kahneman (1992, JRU)

2002 Nobel Prize for Daniel Kahneman:

"...for having integrated insights from psychological research into economic science, especially concerning human judgment and decision-making under uncertainty."

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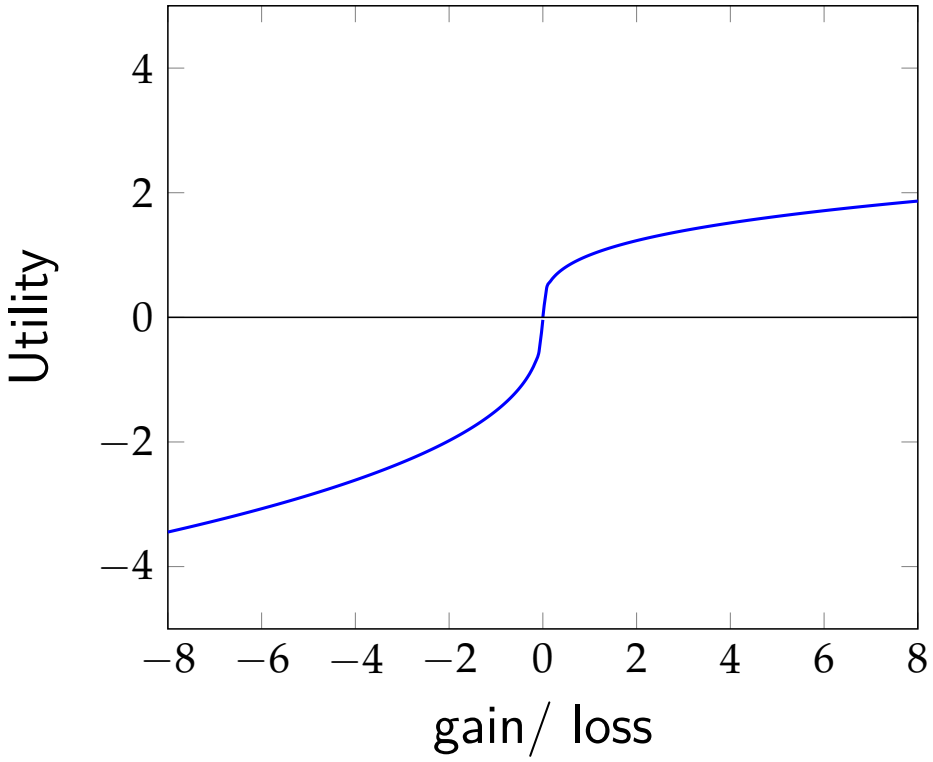
2. S-shaped utility: The utility function is concave over gains and convex over losses
3. Loss aversion:The utility function is steeper for losses than for gains
4. Probability weighting: Overweighting of small probabilities and insensitivity towards changes in moderate probabilities

S-shaped Utility and Diminishing sensitivity



S-shaped Utility and Loss Aversion: Insurance Example

Policy PunishDrive: "Pay a premium of 50€˙ For each time you drive, pay another 1 € (if you drive well) and up to 2€ if you drive badly.

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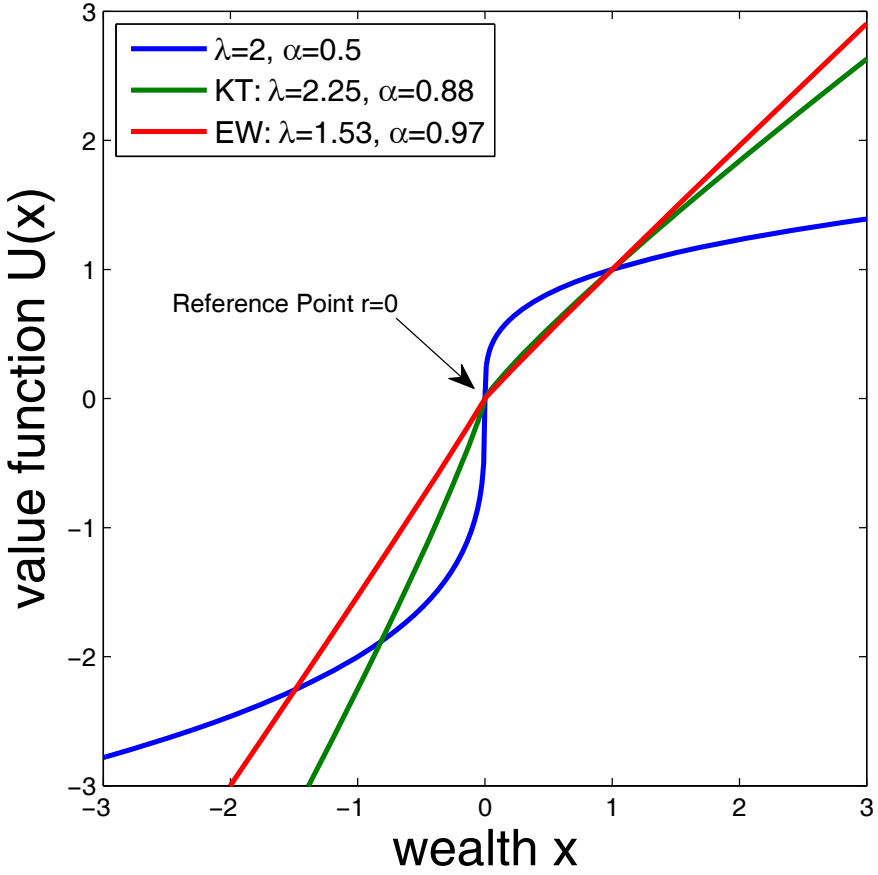
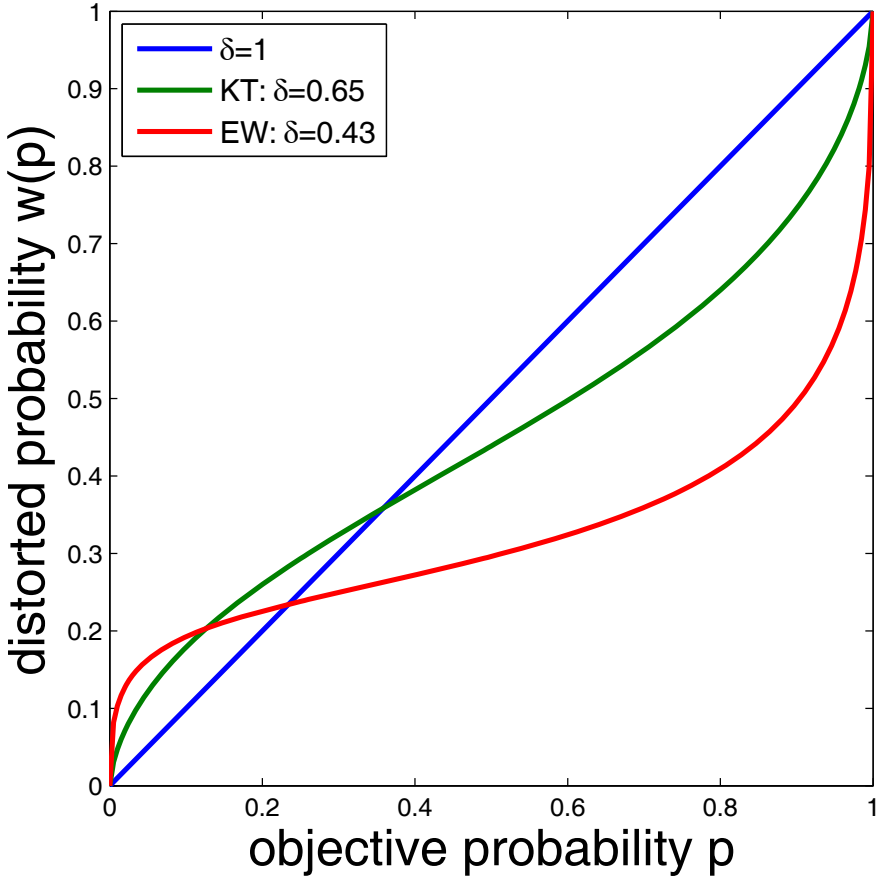
Diminishing sensitivity and narrow framing over time

"For injuries ought to be done all at one time, so that, being tasted less, they offend less; benefits ought to be given little by little, so that the flavor of them may last longer."

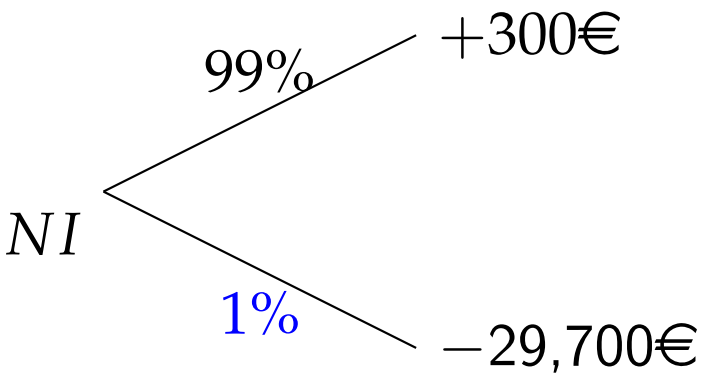
Nicolo Machiavelli, The Prince, Chapter 8.

Utility functions (left) and probability weighting functions (right)





Overweighting of small probabilities induces skewness preference



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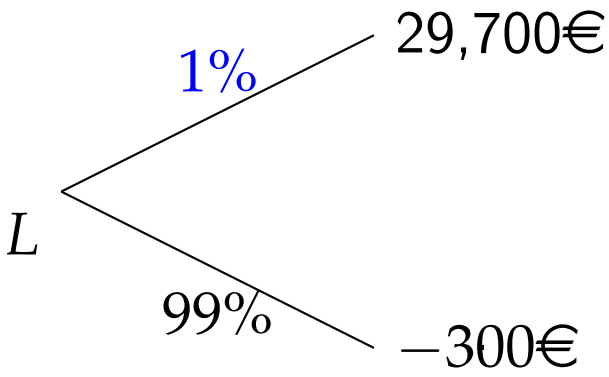

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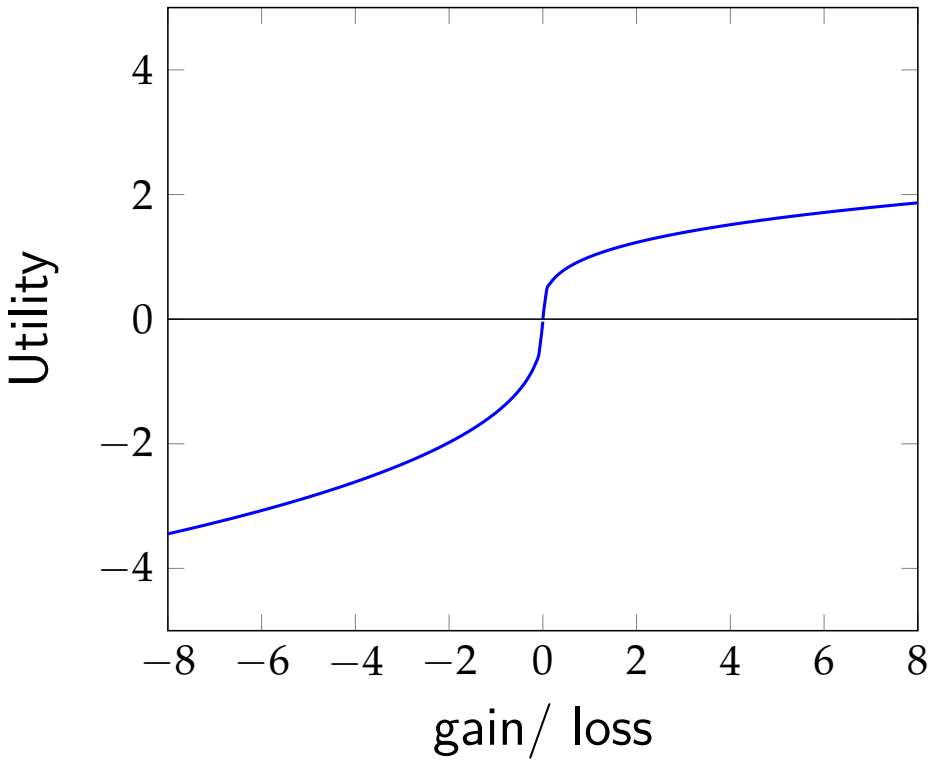

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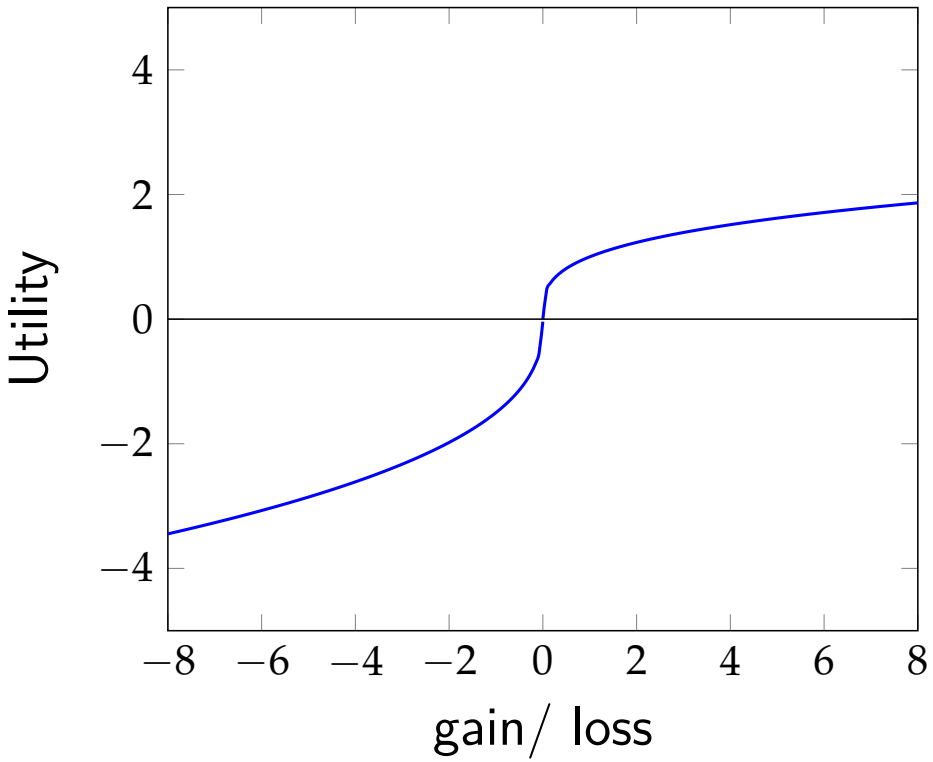

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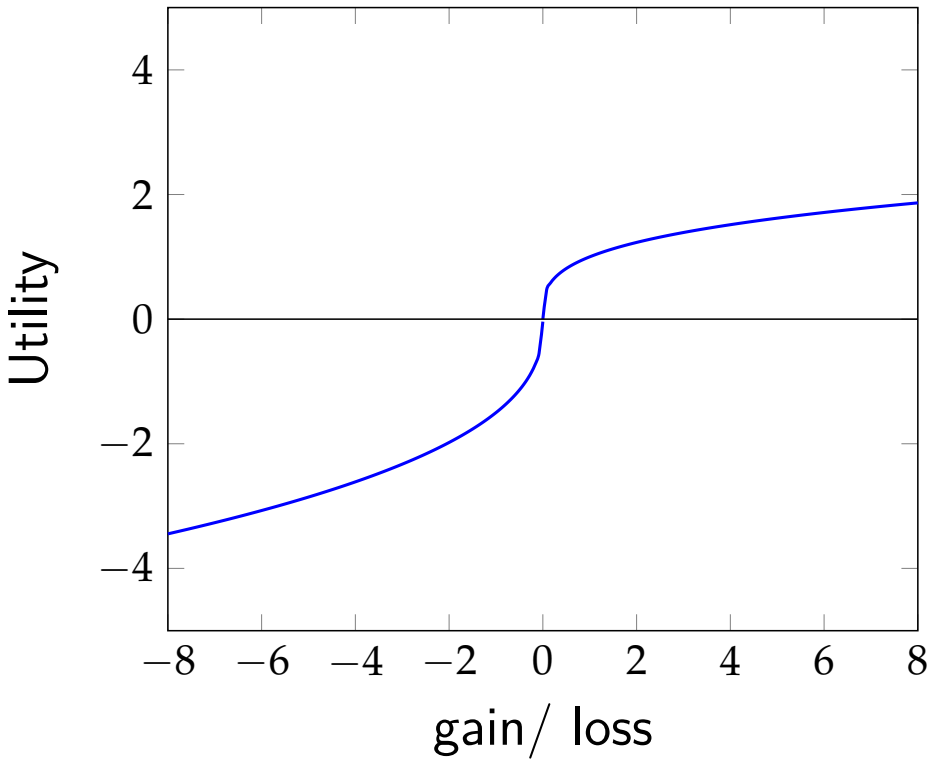

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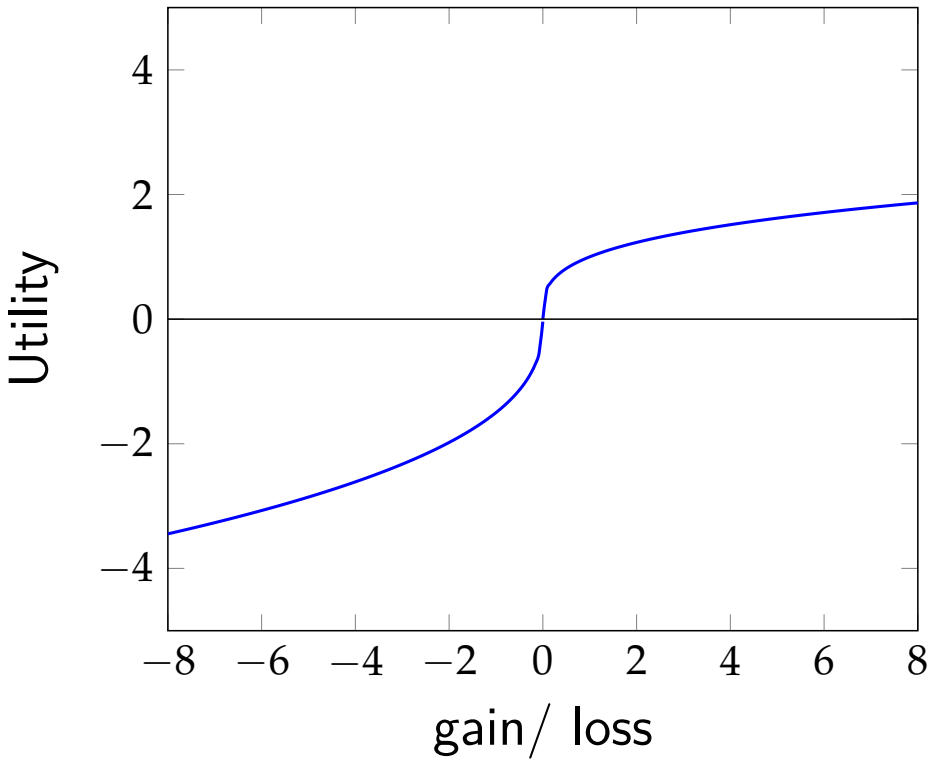

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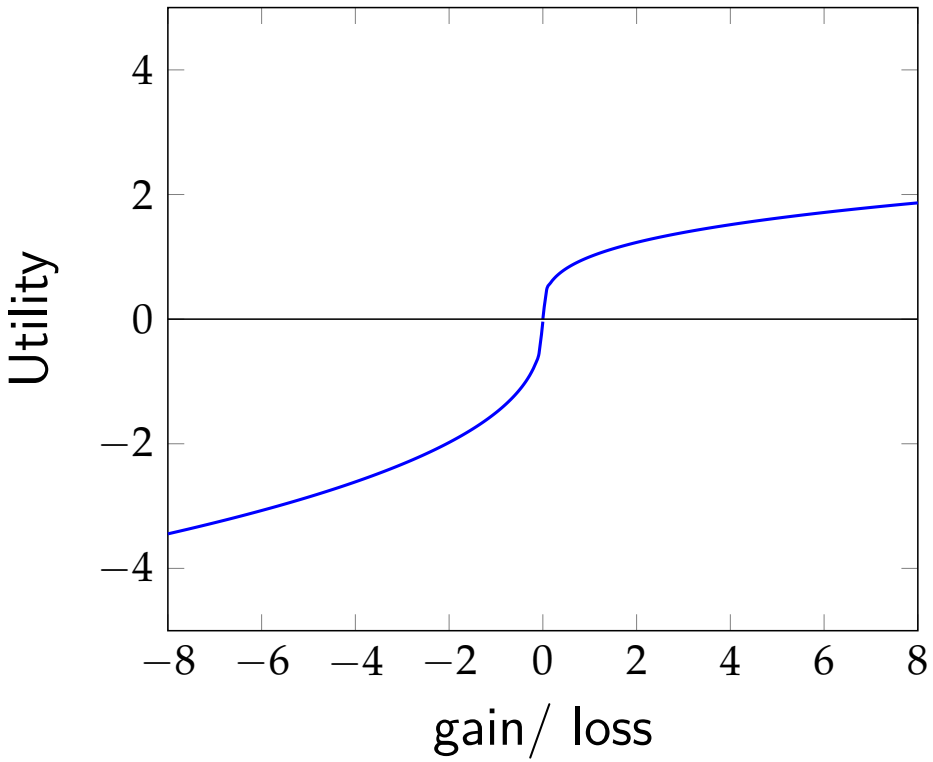

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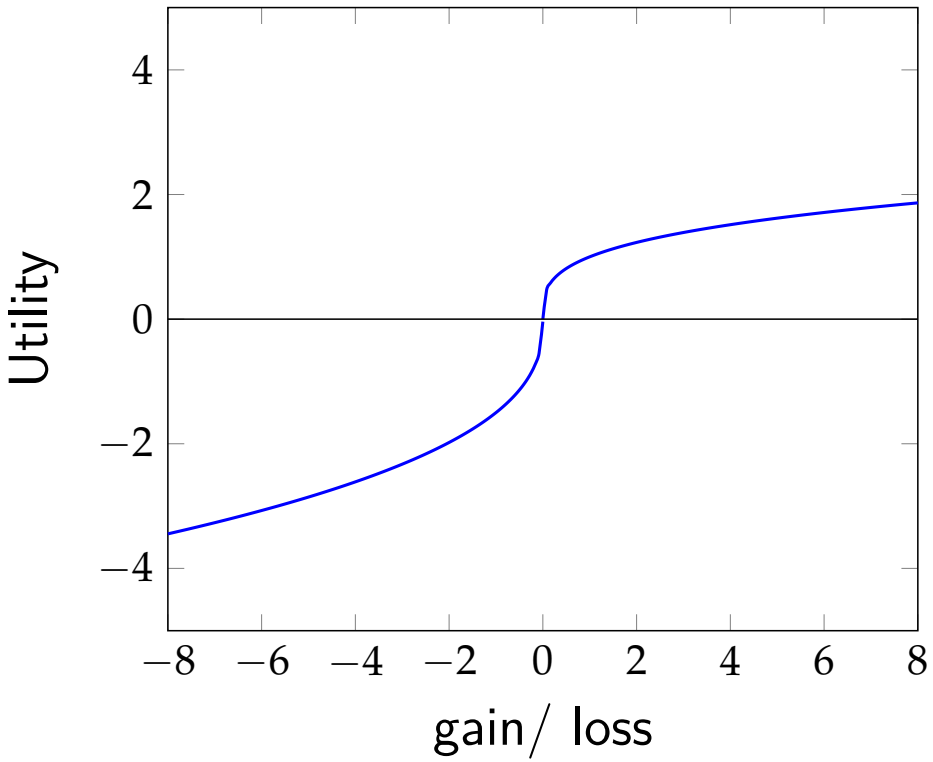

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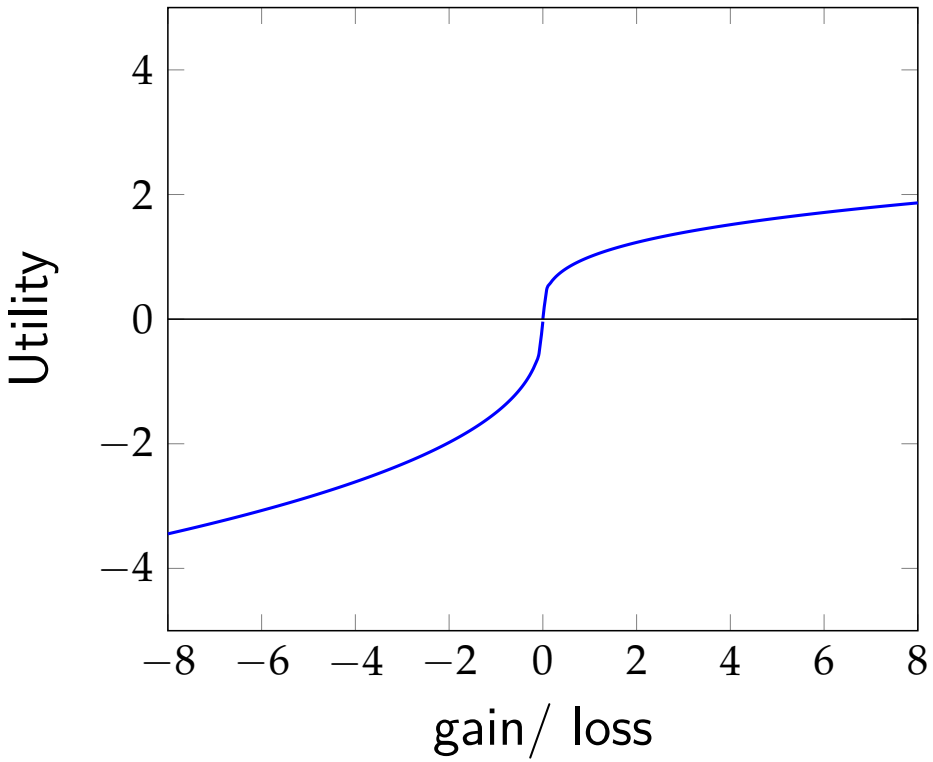

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- Pure gain risk: mild skewness preference (why?)
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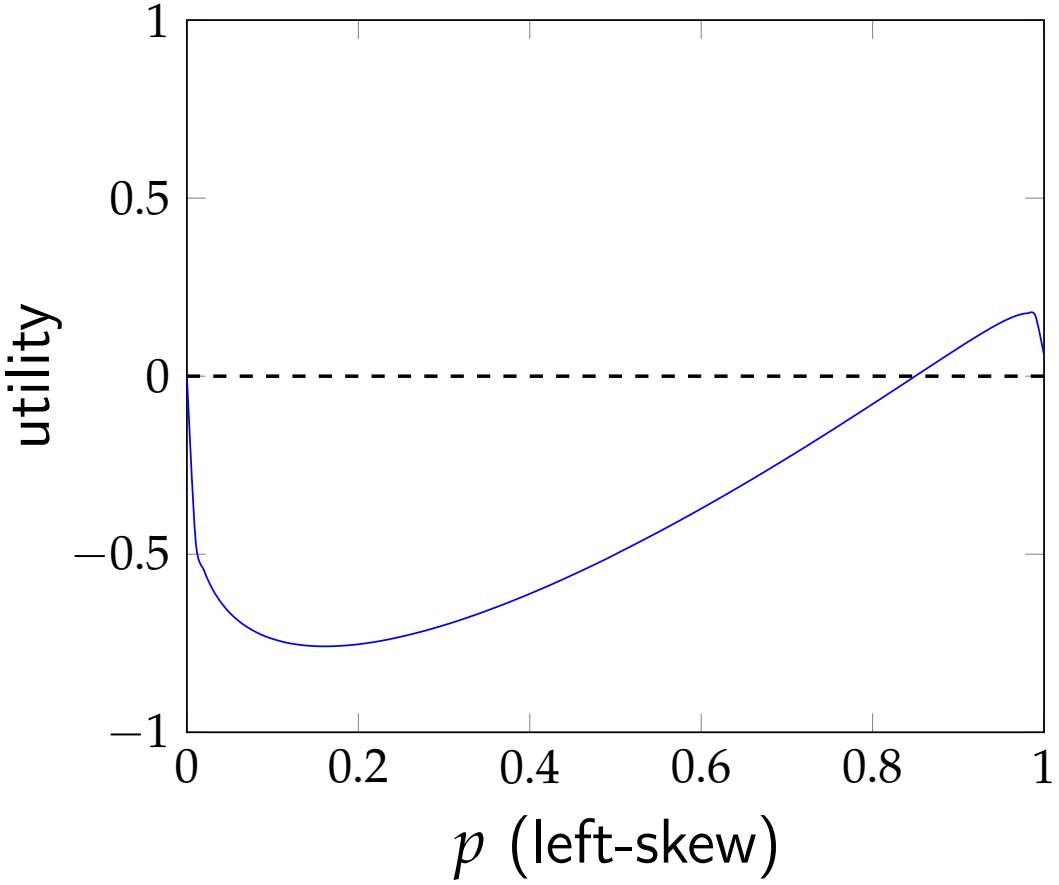
- Gain-loss risk (most interesting case): skewness aversion

From Ebert & Stadje (work in progress)

S-shaped utility from taking a risk with expectation 0, variance 1, and varying skewness (the larger p, the more left-skewed the risk)



S-Shape vs. Probability Weighting

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But many insurance models are *without* probability weighting and *with* S-shape...

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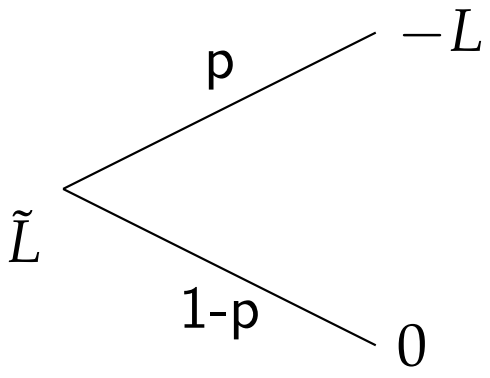
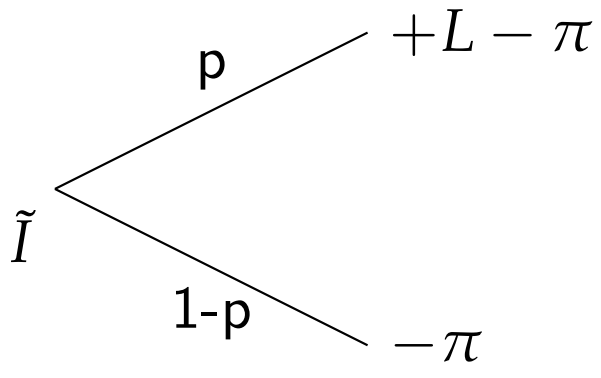
The idea of insurance is to reduce risk

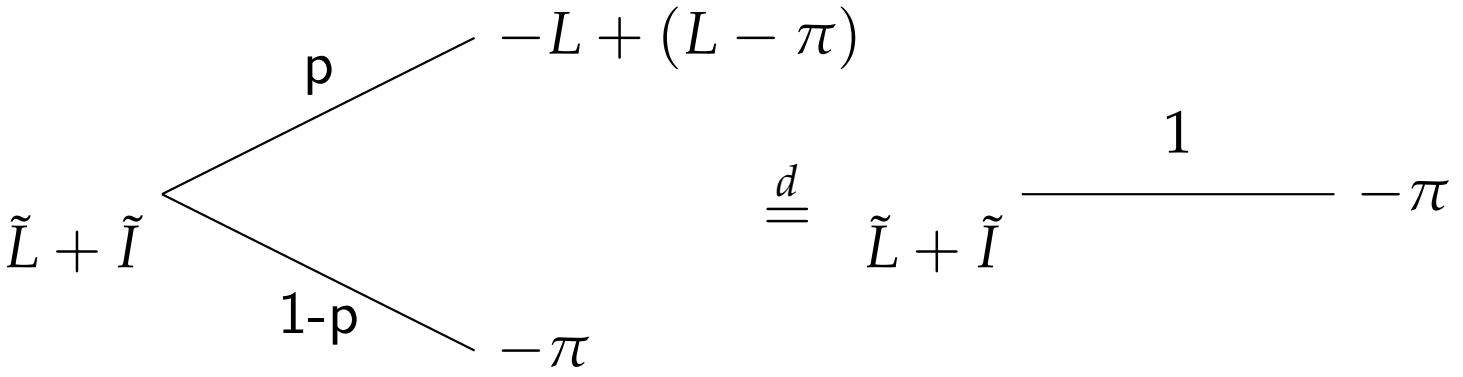


Risk to be insured



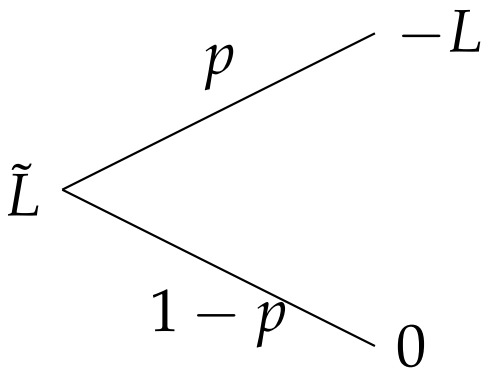
(Full) Insurance Policy

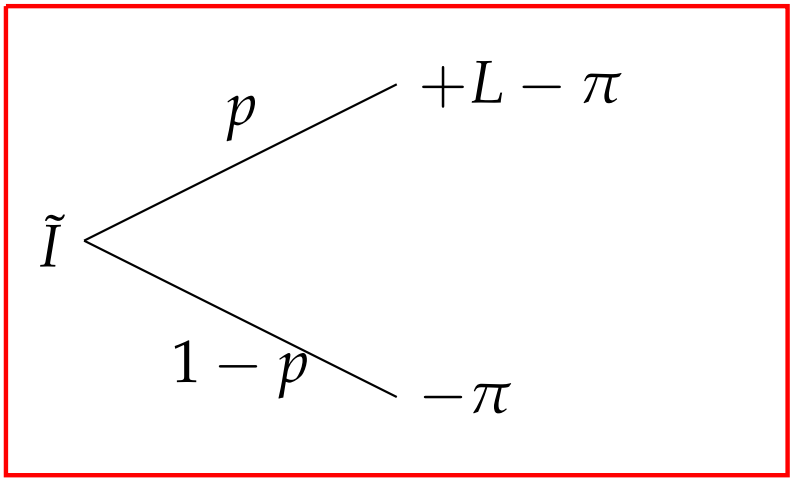
In total, all risk is eliminated:



Underinsurance is often attributed to narrow framing (I/II)

Viewed in isolation, the insurance policy is "risky".





The "risky" insurance contract

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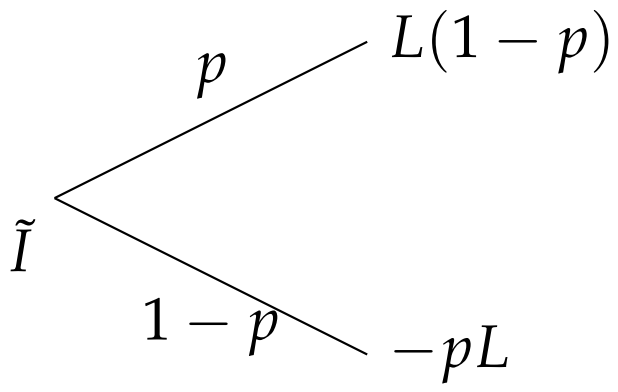
- Brown (2007) on annuities: "Without the annuity, the individual has $100,000 for certain. With the annuity, in contrast, there is some positive probability that the individual will receive only a few thousand dollars (if he were to die within a few months) [...]"
- Main idea: "Risky" insurance is undesirable so that narrow framing induces underinsurance.

Back to the stylized example

Assume an actuarially fair premium pL so that $\tilde{I}$ becomes:



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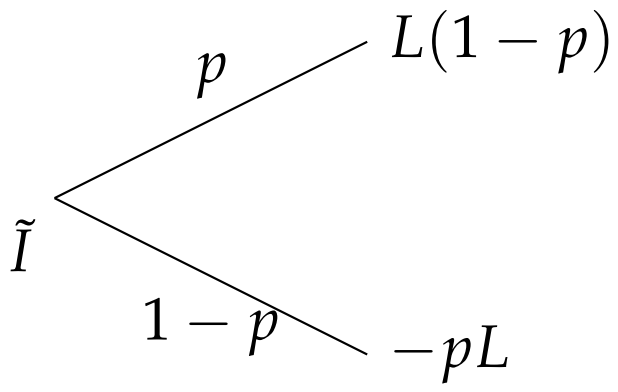

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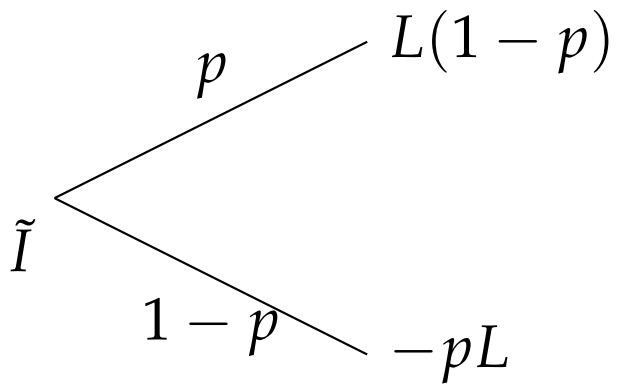

... which is risky, but also right-skewed.

Therefore (since p is small), buying insurance

- avoids left-skewed risk under broad framing
- yields a right-skewed risk under narrow framing

Does narrow framing really reduce insurance demand?

Independently of narrow or broad framing under prospect theory there will be:

- insurance demand if it is with probability weighting (induces skewness preference (trivial))

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Independently of narrow or broad framing under prospect theory there will be:

- insurance demand if it is with probability weighting (induces skewness preference (trivial))
- no insurance demand when "focusing on S-shaped utility" (induces skewness aversion (NOT trivial))

Skewness preference and insurance demand

The insight that S-shaped utility caters to underinsurance because it implies skewness aversion is also underlying the recent prospect theory insurance model of Schmidt (forthcoming, JRI), who further observes that:

Skewness preference and insurance demand

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> "taking into account probability weighting leads to opposite results [than the ones obtained for S-shaped utility only]"

(Recall: "probability weighting dominates")

When I read a prospect theory paper...

- I first check whether it is with or without probability weighting.

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Skewness preference: Other questions

- preferences apply to the perceived skewness
- For example, "small-probability neglect bias" makes left-skewed risks appear not left-skewed
- How is skewness perceived in dynamic settings?
- Ebert & Hilpert (2015): Technical trading ("chartism") generates skewed gambling experiences

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For prospect theory:

- skewness preference under probability weighting
- skewness aversion when there's only S-shape
- in case of conflict, probability weighting dominates