Reference Dependent Preferences

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Reference Dependent Preferences

- So far, we have assumed that utility comes from *final outcomes*
  - Amount of money, jaffa cakes, etc.
- People make choices based on these utilities
- However, there is evidence that preferences may depend on *frame of reference*
- How do you feel about getting $1000?
  - Does it depend on whether you were expecting to get nothing, or expecting to get $2000?
  - Does it depend if the person next you is getting $2000
- Why does this matter?
  - Because choice behavior can be affected by reference points
  - Examples in labor economics, finance, tax, etc

Two Examples of Reference Dependent Preferences

1. The Endowment Effect
2. Reference Points in Risky Choice

Endowment Effect

Kahneman, Knetch and Thaler [1990]

- 44 subjects
- 22 subjects given mugs
- The other 22 subjects given nothing
- Subjects who owned mugs asked to announce the price at which they would be prepared to sell mug
- Subjects who did not own mug announced price at which they are prepared to buy mug
- Experimenter figured out 'market price' at which supply of mugs equals demand
- Trade occurred at that market price using Becker-DeGroot-Marschak procedure

- Prediction: As mugs are distributed randomly, we should expect half the mugs (11) to get traded
  - Consider the group of 'mug lovers' (i.e. those that have valuation above the median), of which there are 22
  - Half of these should have mugs, and half should not
  - The 11 mug haters that have mugs should trade with the 11 mug lovers that do not
- In 4 sessions, the number of trades was 4,1,2 and 2
- Median seller valued mug at $5.25
- Median buyer valued mug at $2.75
- Willingness to pay/willingness to accept gap
- Subject's preferences seem to be affected by whether or not their reference point was owning the mug

- Buying and selling a lottery

This lottery is yours to keep (if this is one of the questions that is selected at the end of the experiment). However, you will be offered the opportunity to exchange this lottery for certain amounts of money (for example $5)

...you will be offered the opportunity to buy a lottery ticket. That is, you will be offered the opportunity to use some of this additional $10 in order to buy a lottery ticket. If you choose to do so (and that question is selected as one that will be rewarded), then you will pay the specified cost for the lottery, and you would keep the remaining amount of money and the lottery.

- Willingness to pay/Willingness to accept gap for a 50% $10, 50% $0 lottery
  - Willingness to Pay: $3.76
  - Willingness to Accept: $4.59
- Your data
  - Willingness to Pay: $3.00
  - Willingness to Accept: $4.21
- Endowment effect widely observed
  - But see Plott and Zeller [2005]

Two Examples of Reference Dependent Preferences

1. The Endowment Effect
2. Reference Points in Risky Choice

Reference Points in Risky Choice

- People tend to be very risk averse for lotteries that contain both gains and losses

  Imagine that you have the opportunity to play a gamble that offers a 50% chance to win $2000 and a 50% chance to lose $500. Would you play the gamble?

- Redelmeier and Tversky (1992)
  - Only 45% of subjects played the gamble
- Loss of $500 viewed as more important than gain of $200
- Is this a sign of 'reference dependence'?
  - Not necessarily
  - Could be risk aversion/probability weighting
  - Though would have to be very large
  - Gain of $2000 does not offset loss of $500

Reference Points in Risky Choice

- A better experiment: Manipulate the reference point
- Two groups:
- Group 1: Given 3500 'Agoras': Choose between
  - An additional 500 Agoras with certainty
  - 50% chance of additional 1500 Agoras and 50% chance of losing 500 Agoras
- Group 2: Given nothing up front: Choose between
  - 4000 Agoras with certainty
  - 50% chance of 5000 Agoras and 50% chance of 3000 Agoras
- Notice that these give the same probabilities over final outcomes
- Same choice over final outcomes in each case
  - Group 1 chose risky option 38% of the time
  - Group 2 chose risky option 54% of the time

Reference Points in Risky Choice

- Your data
- Two groups:
- Group 1: Given $10: Choose between
  - Keeping your $10
  - 50% chance of additional $12 and 50% chance of losing $10
- Group 2: Given nothing up front: Choose between
  - $10 with certainty
  - 50% chance of $22 and 50% chance of $0
- Same choice over final outcomes in each case
- What would you expect given previous results?
- Your data
  - Group 1: 53% chose risky option
  - Group 2: 38% chose risky option
- You do not exhibit this effects!

Winner is......

- The chosen person is
- Robin Shillock
    - Selling price: $4.75

Loss Aversion

- In 1979 Kahneman and Tversky introduced the idea of 'Loss Aversion'
- Basic idea: Losses loom larger than gains
  - The magnitude of the utility loss associated with losing x is greater than the utility gain associated with gaining x
- Initially applied to risky choice
- Later also applied to riskless choice [Tversky and Kahneman 1991]
- Single idea can explain
  - Increased risk aversion for lotteries involving gains and losses
  - Endowment effect
  - Status quo bias

A Simple Loss Aversion Model

- World consists of different dimensions
  - e.g cash and mugs
- Will be asked to choose between alternatives that provide different amount of each dimension

$$\begin{pmatrix} x_c \\ x_m \end{pmatrix}$$

- Has a reference point for each dimension

$$\begin{pmatrix} r_c \\ r_m \end{pmatrix}$$

- **Key Point: Utility depends on changes, not on levels**

A Simple Loss Aversion Model

- Utility of an alternative comes from comparison of output to reference point along each dimension

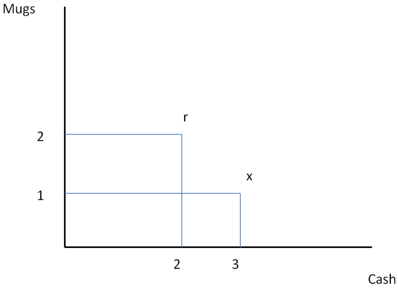
$$\begin{pmatrix} x_c \\ x_m \end{pmatrix}, \begin{pmatrix} r_c \\ r_m \end{pmatrix}$$

- Utility for gains relative to r given by a utility function u

$$\begin{aligned} u_c(x_c - r_c) \text{ if } x_c &> r_c \\ u_m(x_m - r_m) \text{ if } x_m &> r_m \end{aligned}$$

- Utility of losses relative to r given by u of the equivalent gain multiplied by $-\lambda$ with $\lambda > 1$

$$\begin{aligned} -\lambda u_c(r_c - x_c) \text{ if } x_c &< r_c \\ -\lambda u_m(r_m - x_m) \text{ if } x_m &< r_m \end{aligned}$$



- x is a gain of $1 and loss of 1 mug relative to r
- Utility of x

$$u_c(1) - \lambda u_m(1)$$

Loss Aversion and the Endowment Effect

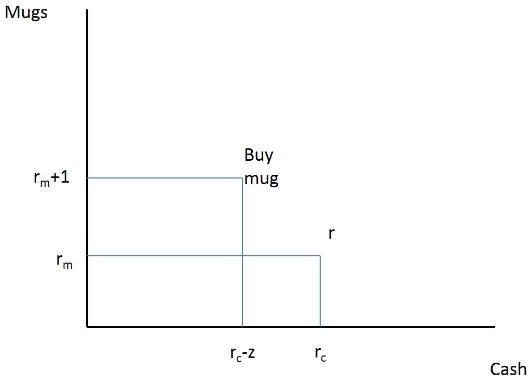
- How can loss aversion explain the Endowment Effect (i.e. WTP/WTA gap)?
- Willingness to pay:
  - Let (r_c, r_m) be the reference point with no mug
  - How much would they be willing to pay for the mug?
  - i.e. what is the z such that

$$0 = U\begin{pmatrix} r_c \\ r_m \end{pmatrix} = U\begin{pmatrix} r_c - z \\ r_m + 1 \end{pmatrix}$$

- Assume linear utility for money
- Utility of buying a mug given by

$$U\begin{pmatrix} r_c - z \\ r_m + 1 \end{pmatrix} = u_m(1) - \lambda z$$

- Break even buying price given by $z = \frac{u_m(1)}{\lambda}$



- Buying is a loss of $z and gain of 1 mug relative to r
- Utility of buying

$$u_m(1) - \lambda z$$

- Willingness to accept:
  - Let (r_c, r_m) be the reference point with mug
  - How much would they be willing to sell your mug for?
  - i.e. what is the y such that

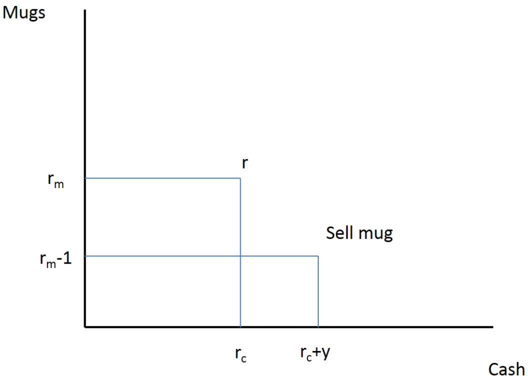
$$0 = U\begin{pmatrix} r_c \\ r_m \end{pmatrix} = U\begin{pmatrix} r_c + y \\ r_m - 1 \end{pmatrix}$$

- Assume linear utility for money
- Utility of selling a mug given by

$$U\begin{pmatrix} r_c + y \\ r_m - 1 \end{pmatrix} = -\lambda u_m(1) + y$$

- Break even selling price given by $y = \lambda u_m(1)$

A Simple Loss Aversion Model



- Selling is a gain of \$y and loss of 1 mug relative to r
- Utility of selling

$$-\lambda u_m(1) + y$$

- Willingness to pay

$$z = \frac{u_m(1)}{\lambda}$$

- Willingness to accept

$$y = \lambda u_m(1)$$

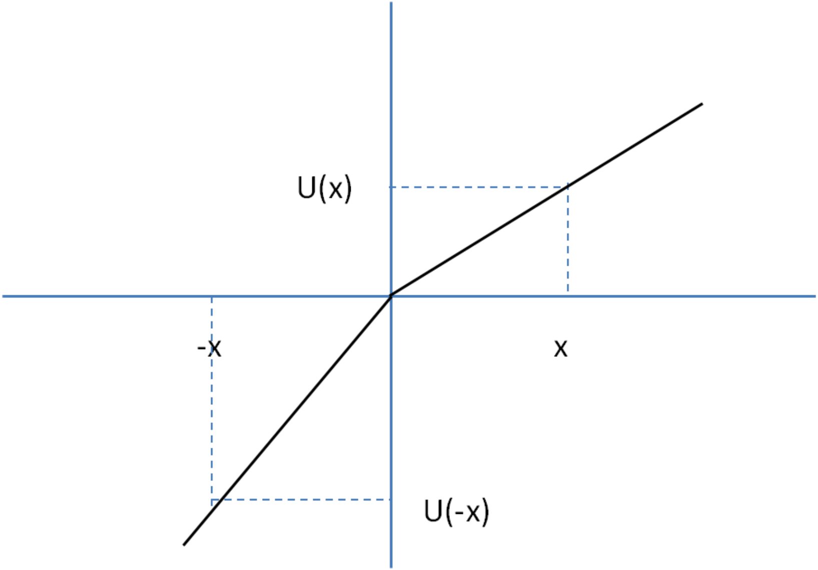
- WTP/WTA ratio

$$\frac{z}{y} = \frac{1}{\lambda^2}$$

- Less that 1 for $\lambda > 1$

Loss Aversion in Risky Choice

- Loss aversion can also lead to increased risk aversion for lotteries that involve gains and losses
- Now there is only 1 dimension (money)
- Lotteries evaluated as gains/losses relative to some reference point
- See also Kosegi and Rabin [2007]
- Again, assume linear utility for money
  - Utility of winning x is x
  - Utility of losing x is -λx


U(x)
-x
x
U(-x)

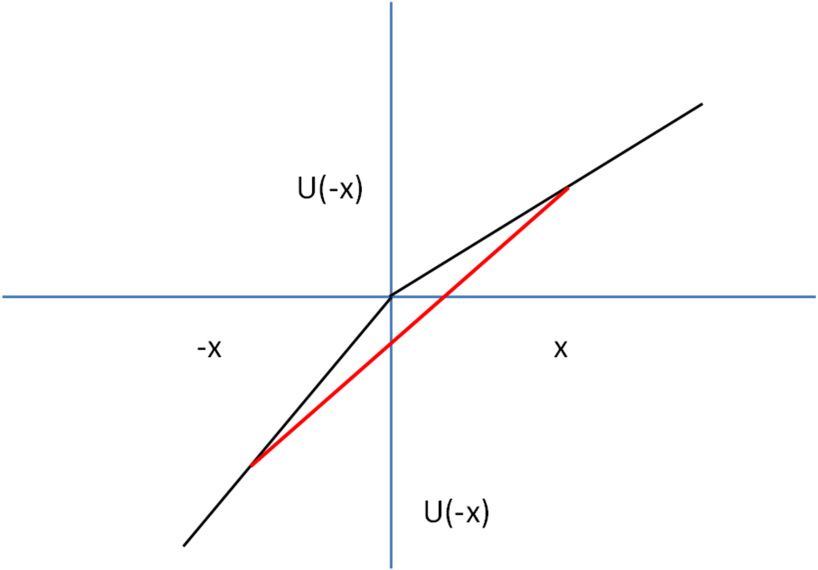
Loss Aversion in Risky Choice

- What is the certainty equivalence of
  - 50% chance of gaining \$10
  - 50% chance of gaining \$0
- x such that

$$\begin{aligned} u_c(x) &= 0.5 \times u_c(10) + 0.5 \times u_c(10) \\ x &= 0.5 \times 10 + 0.5 \times 0 \\ &= \$5 \end{aligned}$$

- What is the certainty equivalence of
  - 50% chance of gaining \$5
  - 50% chance of losing \$5
- y such that

$$\begin{aligned} -\lambda u_c(-y) &= 0.5 \times u_c(5) + 0.5 \times (-\lambda)) \, u_c(5) \\ -\lambda y &= 0.5 \times 5 - \lambda 0.5 \times 5 \\ y &= \frac{(1-\lambda)}{\lambda} < 0 \end{aligned}$$


U(-x)
-x
x
U(-x)

Where do Reference Points Come From?

- Up until now, we have assumed that we get to observe what reference points are observable
- Where do they come from?
  - Current consumption?
  - Status quo?
  - Consumption of others?
- In many cases we may not know what a person's reference point is
- Koszegi and Rabin [2006] introduce an endogenous model of references points

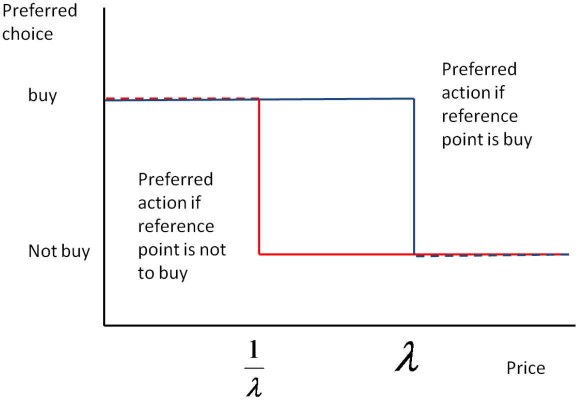
Personal Equilibrium

- Consider an option x
- What would I choose if x was my reference point?
- If it is x, then I will call x a *personal equilibrium*
- If I expect to buy x then it should be my reference point
- If it is my reference point then I should actually buy it

Example

- Consider shopping for a pair of earmuffs
  - The utility of the earmuffs is 1
  - Prices is p
  - Again, assume that utility is linear in money
- What would you do if reference point was to buy the earmuffs?
  - Utility from buying earmuffs is 0
  - Utility from not buying earmuffs is $p - \lambda$
  - Buy earmuffs if $p < \lambda$
- What would you do if reference point was to not buy the earmuffs?
  - Utility from not buying the earmuffs is 0
  - Utility from buying earmuffs is $1 - \lambda p$
  - Would buy the earmuffs if $p < \frac{1}{\lambda}$

Example

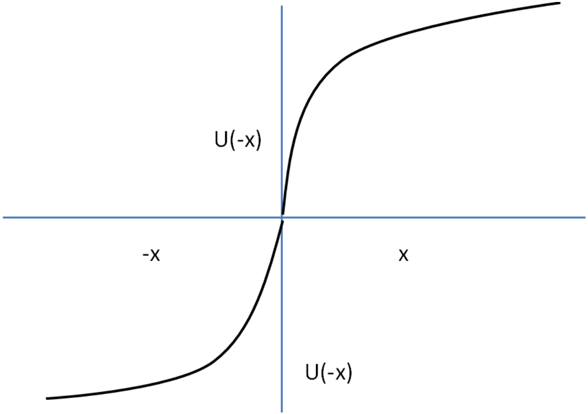


Preferred choice
buy
Not buy
Preferred action if reference point is buy
Preferred action if reference point is not to buy
$\frac{1}{\lambda}$
λ
Price

Prospect Theory

- Prospect Theory: Kahneman and Tversky [1979]
- 'Workhorse Model' of choice under risk
- Combines
    - Loss Aversion
    - Cumulative Probability Weighting
    - Diminishing Sensitivity

Loss Aversion in Risky Choice



- Diminishing sensitivity:
  - Differences harder to distinguish as you move away from reference point (similar to perceptual psychology)
  - Leads to risk aversion for gains, risk loving for losses

- Let p be a lottery with (relative) prizes

$$x_1 > x_2..x_k > 0 > x_{k+1} > .. > x_n$$

- p_i probability of winning prize x_i
- Utility of lottery p given by

$$\begin{aligned}
&\pi(p_1)u(x_1) \\
&+ (\pi(p_2) - \pi(p_1))\, u(x_1) \\
&+ ... \\
&+ (\pi(p_1 + .. + p_k) - \pi(p_1 + .. + p_{k-1}))\, u(x_k) \\
&- (\pi(p_1 + .. + p_{k+1}) - \pi(p_1 + .. + p_k))\, \lambda u(-x_{k+1}) \\
&- ... \\
&- (\pi(p_1 + .. + p_n) - \pi(p_1 + .. + p_{n-1}))\, \lambda u(-x_n)
\end{aligned}$$

A Unified Theory of Loss Aversion

- We have claimed that loss aversion can explain
  - Increased Risk aversion for 'mixed' lotteries
  - Endowment Effect
- Is the same phenomena responsible for both behaviors?
- If so we would expect to find them correlated in the population
- Dean and Ortoleva [2014] estimate
  - λ
  - WTP/WTA gap

  In the same group of subjects
- Find a correlation of 0.63 (significant p=0.001)

Narrow Bracketing

- In applications, loss aversion is often combined with *Narrow Bracketing*
- Decision makers keep different decisions separate
- Evaluate each of those decisions in isolation
- For example, evaluate a particular investment on its own, rather than part of a portfolio
- Evaluate it every year, rather than as part of lifetime earnings
- Losses and gains calculated within the narrow bracket
  - Did my portfolio win or lose money this year?
  - Did this particular stock win or lose money?

Applications: Loss Aversion and Narrow Bracketing

- Equity Premium Puzzle [Benartzi and Thaler 1997]
  - Average return on stocks much higher than that on bonds
  - Stocks much riskier than bonds - can be explained by risk aversion?
  - Not really - calibration exercise suggests that the required risk aversion would imply

$$\begin{aligned} & 50\% \ \ \$100,000 + 50\% \ \$50,000 \\ \sim \ & 100\% \ \$51,329 \end{aligned}$$

  - What about loss aversion?
  - In any given year, equities more likely to lose money than bonds
  - Benartzi and Thaler [1997] calibrate a model with loss aversion and narrow bracketing
  - Find loss aversion coefficient of 2.25 - similar to some experimental findings

Applications: Evaluation Period, Risk Aversion and Information Aversion

- Imagine that you have linear utility with $\lambda = 2.5$
- Say you are offered a 50% chance of 200 and a 50% chance of -100 repeated twice
- Two treatments:
  - The result reported after each lottery
  - The result reported only after both lotteries have been run.
- What would choices be?
- In the first case

$$
\begin{aligned}
& \frac{1}{4}(200+200)+\frac{1}{2}(200-\lambda 100)+\frac{1}{4}(-\lambda 100-\lambda 100) \\
= \;& -200
\end{aligned}
$$

- In the second case

$$
\begin{aligned}
& \frac{1}{4}(400)+\frac{1}{2}(100)+\frac{1}{4}(-\lambda 200) \\
= \;& 25
\end{aligned}
$$

Applications: Evaluation Period, Risk Aversion and Information Aversion

- With loss aversion and narrow bracketing, risk aversion depends on evaluation period
- The longer period, the less risk averse
- This prediction holds up experimentally
  - Gneezy and Potters [1997]
- This also provides an 'information cost'
- A similar argument shows that if you owned the above lottery, you would prefer only to check it after two flips rather than every flip
- May explain why people check their portfolios *less* in more turbulent times
  - See Andries and Haddad [2015] for a discussion

Applications: Evaluation Period, Risk Aversion and Information Aversion

- One Important implication of this is **information aversion**
- If you are holding a risky asset, you would prefer to check on it less often
  - Every time you check on it you may see a loss, which is unpleasant
- May explain why people check their portfolios *less* in more turbulent times
  - See Andries and Haddad [2015] for a discussion
  - Also see work by Michaela Pagel here at Columbia

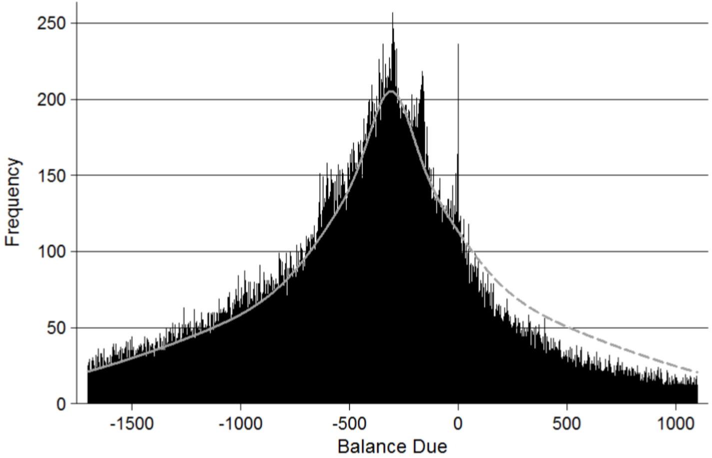
Applications: Diminishing Sensitivity

- Disposition Effect [Odean 1998]
  - People are more likely to hold on to stocks which have lost money
  - More likely to sell stocks that have made money
- Losing stocks held a median of 124 days, winners a median of 104 days
  - Is this rational?
- Hard to explain, as winners subsequently did better
  - Losers returned 5% on average in the following year
  - Winners returned 11.6% in subsequent year
- Buying price shouldn't enter into selling decision for rational consumer
- But will do for a consumer with reference dependent preferences
  - Diminishing sensitivity

Applications: Loss Aversion and Narrow Bracketing

- Taxi driver labor supply [Camerer, Babcock, Loewenstein and Thaler 1997]
  - Taxi drivers rent taxis one day at a time
  - Significant difference in hourly earnings from day to day (weather, subway closures etc)
  - Do drivers work more on good days or bad days?
  - Standard model predicts drivers should work more on good days, when rate of return is higher
  - In fact, work more on bad days
  - Can be explained by a model in which drivers have a reference point for daily earnings and are loss averse

Applications: Reported Tax Balance Due [Rees-Jones 2014]



Reference Dependent Preferences

- Strong evidence that people evaluate options relative to some reference point
- Change in reference point can change preferences
  - Endowment Effect
  - Risk aversion
- One robust finding is loss aversion
  - Losses loom larger than gains
  - Can explain the endowment effect and increased risk aversion for mixed choice
- One open question is where reference points come from
- Prospect theory is a workhorse model of choice under risk
  - Loss Aversion
  - Probability Weighting
  - Diminishing Sensitivity
- Has been used to explain many 'real world' phenomena
  - Choice of financial asset
  - Labor supply