Reference Dependence Lecture 2

Mark Dean

Princeton University - Behavioral Economics

The Story So Far

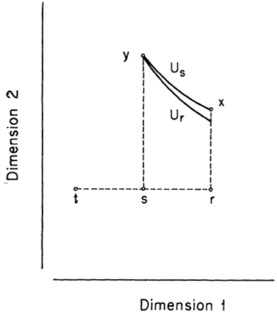
- Defined reference dependent behavior
  - Additional argument in the choice function/preferences
- Provided evidence for reference dependent behavior
  - Change in risk attitudes
  - Endowment effect
  - Status quo bias
- Introduce the 'Standard Model' of reference dependent behavior
  - Prospect Theory

Plan for Today

- Prospect theory for riskless choice
- Alternative models of reference dependent preferences
    - Koszegi and Rabin [2006, 2007]

Prospect Theory for Riskless Choice

- Extended to Riskless choice by assuming that objects of choice have a number of dimensions



- if $x \sim y$ when reference point is s, then $x \succeq y$ when reference point is r

- Assume that utility is additively separable, so utility of $\{x_1, x_2\}$ from reference point r_1, r_2 is given by

$$V_1(x_1 - r_1) + V_2(x_2 - r_2)$$

where

$$\begin{aligned} V_i(y) &= U_i(y) \text{ for } y \geq 0 \\ &= -\lambda U_i(-y) \text{ for } y \leq 0 \end{aligned}$$

for $\lambda > 1$

Can This Explain Status Quo Bias?

- Yes: consider a good to be a bundle $\{p, c\}$ of pens and chocolate bars
- When reference point is $\{1, 0\}$ then utility of $\{1, 0\}$ and $\{0, 1\}$ are
$$0 \text{ and } -\lambda U_1(1) + U_2(1)$$
- Whereas, when the reference point is $\{0, 1\}$ the respective utilities are
$$U_1(1) - \lambda U_2(1) \text{ and } 0$$
- Clearly it is possible for $0 > -\lambda U_1(1) + U_2(1)$ and $U_1(1) - \lambda U_2(1) < 0$
- Also, if $U_1(1) - \lambda U_2(1) > 0$ then $0 > -\lambda U_1(1) - U_2(1)$, so if $\{1, 0\}$ is chosen when it is not the status quo will definitely be chosen when it is the status quo

WTP/WTA Gap

- Assume initially endowed with good of utility u, and find P_{WTA}, P_{WTP} such that

$$\begin{aligned} 0 &= P_{WTA} - \lambda u \\ u - \lambda P_{WTP} &= 0 \end{aligned}$$

- Implies

$$\frac{P_{WTA}}{P_{WTP}} = \lambda^2$$

Is there Really An Endowment Effect

- Plott and Zellner [2005] argue that WTP/WTA gap may be due to subject misconceptions
- While most papers control for some sources of misconception, none control for all of them
  - Incentive compatible elicitation mechanism
  - Training on the properties of the mechanism
  - Paid Practice rounds
  - Anonymity

Is there Really An Endowment Effect

TABLE 4—INDIVIDUAL SUBJECT DATA AND SUMMARY STATISTICS

Experiment	Treatment	Individual responses (in U.S. dollars)	Mean	Median	Std. dev.
Experiment 1: (USC/practice)	WTP (n = 15)	0, 1, 1.62, 3.50, 4, 4, 4.17, 5, 6, 6, 6.50, 8, 8.75, 9.50, 10	5.20	5.00	3.04
	WTA (n = 16)	0, 0.01, 3, 3.75, 3.75, 3.75, 5, 5, 5, 6, 6, 6, 7, 11, 12, 13.75	5.69	5.00	3.83
Experiment 2: (USC/no practice)	WTP (n = 12)	1, 2, 3.50, 5, 5, 5, 8, 8.50, 9, 11.50, 13, 23	7.88	6.50	6.00
	WTA (n = 14)	0.50, 1, 2, 2.50, 2.50, 4.50, 4.50, 5.70, 6.25, 8, 8, 8.95, 12, 13.50	5.71	5.10	4.00
Experiment 3: (PCC/practice)	WTP (n = 9)	2.50, 5.85, 6, 7.50, 8, 8.50, 8.50, 8.78. 10	7.29	8.00	2.23
	WTA (n = 8)	3, 3, 3.50, 3.50, 5, 5, 7.50, 10	5.06	4.25	2.50
Pooled data	WTP (n = 36)		6.62	6.00	4.20
	WTA (n = 38)		5.56	5.00	3.58

Notes: Experiments 1 and 3 used the BDM mechanism to elicit responses and employed paid practice, training, and anonymity. Experiment 2 used the BDM mechanism to elicit responses and employed training and anonymity (without paid practice rounds).

Does Market Experience Remove the Endowment Effect

	Number of Subjects Choosing Candy Bar	Number of Subjects Choosing Mug	Pearson χ^2
Panel A. Nondealers (Private)			
Treatment $E_{candybar}$	25 (81%)	6 (19%)	19.21 (3 df)
Treatment E_{both}	18 (60%)	12 (40%)	
Treatment $E_{neither}$	15 (45%)	18 (55%)	
Treatment E_{mug}	7 (23%)	23 (77%)	
Panel B. Nondealers (Public)			
Treatment $E_{candybar}$	29 (88%)	4 (12%)	34.79 (3 df)
Treatment E_{both}	16 (57%)	12 (43%)	
Treatment $E_{neither}$	17 (59%)	12 (41%)	
Treatment E_{mug}	6 (17%)	29 (83%)	
Panel C. Dealers (Private)			
Treatment $E_{candybar}$	14 (47%)	16 (53%)	.54 (3 df)
Treatment E_{both}	14 (44%)	18 (56%)	
Treatment $E_{neither}$	18 (51%)	17 (49%)	
Treatment E_{mug}	14 (44%)	18 (56%)	

	Preferred Exchange	p-Value for Fisher's Exact Test
Panel D. Trading Rates		
Pooled nondealers ($n = 129$)	.18 (.38)	$< .01$
Inexperienced consumers (< 6 trades monthly; $n = 74$)	.08 (.27)	$< .01$
Experienced consumers (≥ 6 trades monthly; $n = 55$)	.31 (.47)	$< .01$
Intense consumers (≥ 12 trades monthly; $n = 16$)	.56 (.51)	.64
Pooled dealers ($n = 62$)	.48 (.50)	.80

A Model of Reference Dependent Preferences

- Koszegi and Rabin [2006, 2007] introduce a new model of reference dependent preferences
- Two main developments
  1. Allow for 'consumption utility' as well as 'gain loss' utility
  2. Allows for stochastic reference points
  3. Generates reference point endogenously through 'personal equilibrium'
- Warning - not liked by decision theorists
  - If we do not see dimensions, utilities, then no empirical content
  - See "The Case for Mindless Economics" by Gul and Pesendorfer

- Let c be a consumption bundle and r be a reference point
- Each are m dimensional vectors

$$c = \left\{ \begin{array}{c} c_1 \\ \vdots \\ c_m \end{array} \right\}, \; r = \left\{ \begin{array}{c} r_1 \\ \vdots \\ r_m \end{array} \right\}$$

- If c and r are know with certainty, then utility is given by $u(c|r)$
- If c and r are distributed according to F and G, then $U(F|G)$ is given by

$$\int \int u(c|r) dG(r) dF(c)$$

Set Up

- Assume that utility is separable across dimensions, then

$$u(c|r) = \sum_k m_k(c_k) + n_k(c_k|r_k)$$

where

- $m_k(.)$ is the consumption utility along dimension k
- $n_k(c_k|r_k) = \mu(m_k(c_k) - m_k(r_k))$ is 'universal gain loss function'

Assumptions about Gain Loss Function

- μ assumed to have the following properties
  - Continuous, twice differentiable away from 0, and $\mu(0) = 0$
  - Strictly increasing
  - (Loss aversion 1) $y > x > 0$ implies that

$$\mu(y) + \mu(-y) < \mu(x) + \mu(-x)$$

  - (Loss aversion 2)

$$\frac{\lim_{x \to 0} \mu'(-|x|)}{\lim_{x \to 0} \mu'(|x|)} = \lambda > 1$$

  - (Diminishing Sensitivity) $\mu''(x) \leq 0$ for $x > 0$ and $\mu''(x) \geq 0$ for $x < 0$

Implications

1. For all F, G, G' such that the marginals of G' FOSD the marginals of G in each dimension, $U(F|G) \geq U(F, G')$
2. For any $c \neq c'$, $u(c|c') \geq u(c'|c') \Rightarrow u(c|c) > u(c'|c)$
3. If μ is piecewise linear then

$$\begin{aligned} U(F|F') &\geq U(F'|F') \\ &\Rightarrow U(F|F) > U(F'|F) \end{aligned}$$

Personal Equilibrium

- Where does reference point come from?
- KR suggest that it should be expectations over outcomes
- Where do expection come from?
- One extreme assumption: rational expectations
  - Let x be your reference point
  - Then x must be optimal choice given reference point x
- In other words, a reference point must be consistent

Personal Equilibrium

- Let Q be a distribution over possible choice sets
  - e.g. Q is a probability distribution over prices
  - Let D_l be the choice set available when price is l
- A choice function $\{F_l, D_l\}_{l \in \mathbb{R}}$ is a personal equilibrium if, for every l

$$F_l = \int \max_{c \in D} U(c|F_l) dQ_l$$

An Example of Shopping

- Two dimensions:
  - $c_1 \in \{0, 1\}$ whether shoes have been purchased
  - $c_2 \in \mathbb{R}$ dollar wealth
- Assume $m(c) = c_1 + c_2$
- Assume $\mu(x) = \mu x$ in gain domain $\lambda \mu x$ in the loss domain

λ

- If expecting to buy, then

$$1 - p > -\lambda\mu + \mu p$$

assuming

$$p \leq p_{\text{min}} = \frac{(1+\lambda\mu)}{(1+\mu)}$$

- If not expecting to buy then

$$0 > 1 + \mu - (1+\mu\lambda)p$$

assuming

$$p \geq p_{\text{max}} = \frac{(1+\mu)}{(1+\lambda\mu)}$$

- So between these two prices, two personal equilibria depending on expectations

- Imagine expecting price $p_l < p_{\min}$ with probability q_l and $p_h > p_{\max}$ with probability q_h
- What would happen at intermediate price p_m?
- Utility of buying is

$$
\begin{aligned}
&1 - p_m \\
&+q_h(\mu - \mu\lambda p_m) \\
&+q_l(p_m - p_l)
\end{aligned}
$$

- The utility from not buying is

$$q_l(-\mu\lambda + \mu p_l)$$

Special Case

- $P_L = 0$: Buy if and only if

$$p_m < 1 - (1 - q_l)\frac{\mu(\lambda - 1)}{1 + \mu\lambda}$$

  Increasing in q_l

- $p_l \geq 0$ and $q_l = 1$

$$p_m < 1 + p_l\frac{\mu(\lambda - 1)}{1 + \mu\lambda}$$

  Increasing in p_l

Endowment Effect for Risk

- One implication of stochastic reference point: Endowment Effect for risk
- People should be *less* risk averse when reference point is stochastic
- See Koszegi and Rabin [2007] for theory
- See Sprenger [2012] for evidence