Where Do Reference Points Come From?

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Where do Reference Points Come From?

- Up until now, we have assumed that reference points are observable
- Where do they come from?
- Implicit in most of the early literature is the idea that reference points are either

1. What you currently **have**
   - E.g. in the endowment effect
2. Or what you get if **you do nothing**
   - E.g. in the 401k example

Where do Reference Points Come From?

- There is some experimental work trying to differentiate these different effects
- e.g. Ritov and Baron [1992], Schweitzer [1994]
- Try to separate between
  - Pure status quo bias (Preference for the current state of affairs)
  - Omission bias (preference for inaction)
- Former study found only omission bias, latter found both

Where do Reference Points Come From?

- More recent work became a bit more uncomfortable with this idea
- Shouldn't expectations matter?
  - Imagine that I am offered a job
  - If I take it I could either be paid $50,000 or $100,000
  - Wouldn't the $50,000 feel like a loss
  - Even though $100,00 is neither what I am currently getting, not what I would get if I did nothing?

Where do Reference Points Come From?

- So maybe we want a model in which preferences are expectations
- But herein lines a problem
- What should you expect to happen?
- In the above example my expectations will be different depending on whether I take the job
- But whether or not I take the job depend on my expectations

Where do Reference Points Come From?

- Koszegi and Rabin [2006, 2007] made two innovations

1. Allowed for reference points to be stochastic
    - If your reference point is a lottery you treat it as a lottery
2. Allowed for 'rational expectations'
    - Introduce the concept of 'personal equilibrium'

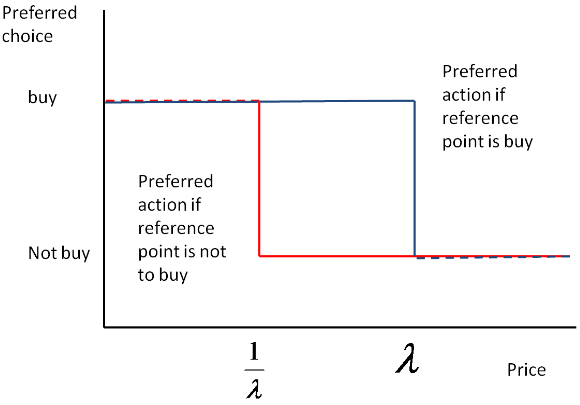
Personal Equilibrium

- 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

Preferred Personal Equilibrium

- One thing this makes obvious is that the set of possible equilibria may be large
  - Or, without further assumptions, empty
- It would be nice to have some refinement
- KR propose the concept of **preferred personal equilibrium**
- The personal equilibrium with the highest ex ante expected utility

Koszegi-Rabin and Risky Choice

- The above model can be applied to choices over lotteries
- Consider a lottery p : a probability distribution over a (finite number of) monetary amounts X
- Consider a (for now) exogenous reference lottery r
- KR propose utility functions of the form

$$U(p,r) = \sum_{x \in X} p(x)u(x) + \sum_{x \in X} \sum_{y \in X} v(u(x) - u(y))p(x)r(y)$$

  - First term: consumption utility
  - Second term: reference utility (for example $v(z) = z$ if $z > 0$ or λz if $z < 0$)

Koszegi-Rabin and Risky Choice

- This model gives an **endowment effect for risk**
  - i.e people will be more risk loving if they are expecting a lottery
- Consider the choice between
  - A 50/50 lottery between \$10 and \$0
  - And an amount $x \in (10, 0)$
- Assume u is linear

- First, if x is the reference:

$$\begin{aligned} U(x,x) &= x \\ U(p,x) &= 5 + 0.5\left[(10 - x) - \lambda x\right] \end{aligned}$$

- Break even comes at

$$x = \frac{20}{3+\lambda}$$

- If $\lambda > 1$ then $x < 5$

- Now if p is reference

$$\begin{aligned} U(x,p) &= x + 0.5[x - \lambda(10 - x)] \\ U(p,p) &= 5 + 0.25\left[(10(1-\lambda))\right] \end{aligned}$$

- Break even comes when

$$\begin{aligned} \frac{(3+\lambda)}{2}x - 5\lambda &= 7.5 - 2.5\lambda \\ \frac{(3+\lambda)}{2}x &= 2.5(3+\lambda) \\ x &= 5 \end{aligned}$$

Koszegi-Rabin and Risky Choice

- So where does the reference point come from?
- Again, one possibility is to apply the 'rational expectations' assumption
- In the Choice-Acclimating Personal Equilibrium model the reference lottery must be the chosen lottery

$$U(p) = \sum_{x \in X} p(x)u(x) + \sum_{x \in X} \sum_{y \in X} v(u(x) - u(y))p(x)p(y)$$

- Choose in order to maximize $U(p)$
- Notice that the reference point is no longer an argument in the utility fuction, as it is determined endogenously

Koszegi-Rabin and Risky Choice

- A natural question: what are the behavioral implications?
- Remember, we highlighted this as a problem with the deterministic version of KR in lecture 1
- Masatlioglu and Raymond provide some answers
  - CAPE is exactly the intersection of rank dependent utility and quadratic utility (Machina 1982)

$$\sum \phi(x, y) p(x) p(y)$$

Endogenous Reference Points

- One feature of the KR Personal Equilibrium model is that reference points are *endogenous*
  - i.e the choice set is a sufficient statistic to determine behavior
  - Choice set and reference points cannot be separately manipulated
- Other papers have provided alternative models of endogenous reference point formation

- Consider again the phenomenon of Asymmetric Dominance
- One way to interpret this phenomenon is that the dominated option becomes a reference point
    - Blocks some alternatives from being chosen a la Masatioglou and Ok [2005]
    - Causes the asymmetric dominance effect
- However there are some problems about generalizing this model
    - How do we, in general, determine what the reference point is for an arbitrary choice set?
    - Dimensions not generally observable and objective
- Ok et al [2015] provide a representation that solves both of these issues

Revealed P (Referece)

- **Data:** Standard choice correspondence on X $c : D \rightarrow 2^X$ where D is the set of non-empty compact subsets of X
- **Model:** There exists
  - A continuous utility function $u : X \rightarrow \mathbb{R}$
  - A set U of real maps on X
  - A 'reference map' $r : D \rightarrow X \cup \lozenge$ such that
    - $r(S) \in S / c(S)$ if $r(s) \neq \lozenge$
- Define $\bar{U}(x) = \{y \in X | U(y) \geq U(x) \; \forall \; U \in U\}$

- **Such that**

1. If $r(S) = \Diamond$

$$c(S) = \arg\max_{x \in S} u(x)$$

2. If $r(S) \neq \Diamond$

$$c(S) = \{x \in S | u(x) \geq u(y) \; \forall \; y \in S \cap \bar{U}(r(S))\}$$

3. For any $T \subset S$ such that $r(S) \in T$ and $c(S) \cap T \neq \varnothing$ then $r(T) \neq \Diamond$ and

$$c(T) = \{x \in X | u(x) \geq u(y) \; \forall \; y \in T \cap \bar{U}(r(S))\}$$

- Interpretation

1. If there is no reference point maximize u
2. If there is a reference point then maximize u amongst all alternatives that are at least as good as the reference point in all dimensions
3. If T is a subset of S that contains the referent, then the reference point must be (effectively) the same

- Note that choice from $\{x, y\}$ governed by u
    - Say $u(x) > u(y)$ but $y \in C(\{x, y\})$
    - Must be that $r(\{x, y\}) = x$ as y is chosen and by assumption $r(S) \in S/c(S)$ if $r(s) \neq \Diamond$
    - But x cannot block x
    - Implies $x \in C(\{x, y\})$- contradiction
    - so we can assume that $r(\{x, y\}) = \Diamond$

- What behavior reveals an alternative as a reference point?
  - i.e. that z favors x?

1. $x \in c(x, y, z) / c(x, y)$
2. $y \in c(x, y)$ but $\{x, y\} \cap c(x, y, z) = \{x\}$

- If either of these things occur we say that z is a **revealed reference** for x

- The above notion is about z helping x.
- Also need to define the idea that z does not harm x
- We say that z is **a potential reference** for x if, for every set $\{x, y, z\}$ such that $c(x, y, z) \neq \{z\}$

$$\begin{aligned} x &\in c\{x, y\} \Rightarrow x \in c(x, y, z) \\ y &\notin c(x, y\} \Rightarrow y \notin c(x, y, z) \end{aligned}$$

- **No Cycles**

$$\text{if } x \in c(x, y) \text{ and } y \in c(y, z) \text{ then } x \in c(x, z)$$

- **Rationality of Indifference**

$$\text{if } \{x, y\} \subset c(S) \text{ then } \{x, y\} = c\{x, y\}$$

- **Reference Acyclicity**: if there is $x_1, ..., x_N$ such that x_n is a revealed reference for x_{n+1} then x_1 must be a potential reference for x_N

Axioms

- **Definition:** $\mathbf{T}$ is a c-cover of S if it is
  - A cover of S
  - For every $T \in \mathbf{T}$, $c(S) \cap T \neq \emptyset$
- **Reference Consistency:** Let $\mathbf{T}$ be a c-cover of S with $|T| = 2$ for some $T \in \mathbf{T}$. Then for some $T' \in \mathbf{T}$

$$c(T') = c(S) \cap T'$$

  - Why $|T| = 2$ for some $T \in \mathbf{T}$?
  - Deals with the case in which $r(S) = \lozenge$
  - $r(T) = \lozenge$ as well, so WARP must hold

Endogenous Reference Points

- Think back to our original stylized facts about reference dependence
  - Endowment effect?
  - Diminishing Sensitivity?
  - Increased risk aversion for gains and losses?
- Can models of endogenous reference points explain this behavior?
- Arguably not easily
  - These are examples in which the choice set is kept the same, but the reference point changes

Endogenous Reference Points and the Endowment Effect

- Endowment effect?
- Choice is always between the mug and some money
- Change only what you are **endowed with**
- This is consistent with PE if trading and not trading are both PE
    - Those with the mug select equilibrium where they expect to keep mug
    - Those without mug select equilibrium where they expect to keep money
- But also consistent with opposite

Endogenous Reference Points and the Endowment Effect

- Diminishing Sensitivity
- Choice is always over the same lotteries defined in terms of final outcomes
- Change what counts as **'zero'**
- Again could be consistent with PE model
  - But only if people select the right equilibrium
  - Seems a bit unsatisfactory

Expectations as Reference Points

- So the PE model (or any model of purely endogenous reference points) unlikely to be the whole story
  - And indeed KR acknowledge this in their article
- One can still ask whether expectations play an important role as reference points
- This is part of an active (and hotly debated) experimental literature

Evidence

- Endowments as Expectations (Ericson and Fuster [2011])
  - Experiment in which subjects were endowed with a mug
  - Would be allowed to trade for a pen **with some probability**
  - Higher probability of being forced to keep the mug $\Rightarrow$ lower probability of trade if allowed
- Heffetz and List [2013] find exactly the opposite!
  - Reference effects driven by assignment
  - Not obvious what drives the differences
- For a nice review see
  - Marzilli Ericson, Keith M., and Andreas Fuster. "The Endowment Effect." Annu. Rev. Econ. 6.1 (2014): 555-579.

Evidence

- Cerulli-Harms et al [2019] suggest that these experiments were designed the wrong way round
  - Expectations based EE requires seller to be expecting to keep and buyer expecting not to buy
  - Reducing the probability of being allowed to trade should not affect these expectations
- Solution?
- With some probability subjects are **forced to trade**
- As the probability of forced trade increases
  - WTP should increase
  - WTA should decrease
- Should be the same at p=0.5

Evidence

- Results?
- Its complicated....
- Experiment 1:
  - Endowment first, then forced exchange mechanism explained
  - Market prices
  - **Endowment effect at p=0**
  - **No impact of probabilities**
- Experiment 2:
  - Forced exchange mechanism explained, then endowment
  - Market prices
  - **Endowment effect at p=0**
  - **Probabilities respond in predicted direction**
- Experiment 3:
  - Forced exchange mechanism explained, then endowment
  - BDM prices
  - **Endowment effect at p=0**
  - **No effect of probabilities**

Evidence

- Follow up paper: Goette et al [2019]
  - Maybe heterogeneity is important
- Chapman et al [2018] - between 22% and 50% of the population may be gain loving
- Loss averse and loss loving subjects should respond in the opposite direction to changes in probabilities
- Tests on aggregate data maybe very noisy and underpowered

Evidence

- Run a two stage experiment
- Stage 1: Estimate loss attitude using ratings
  - 36% loss averse
  - 40% loss neutral
  - 24% gain loving
- Stage 2: Estimate endowment effect at $p=0$ and $p=0.5$
  - Loss averse subjects: 33% trade at $p=0$, 49% at $p=0.5$
  - Gain loving subjects: 43% trade at $p=0$, 18% at $p=0.5$