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 $100,000 is neither what I am currently getting, not what I would get if I did nothing?
So maybe we want a model in which preferences are expectations.
But herein lies 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.
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’
• 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
• 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 $p < \frac{1}{\lambda}$
Preferred choice

- Buy
  Preferred action if reference point is not to buy
- Not buy
  Preferred action if reference point is buy

\[ \frac{1}{\lambda} \rightarrow \lambda \rightarrow \text{Price} \]
One thing this makes obvious is that the set of possible equilibria may be large. 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.
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 $\lambda z$ if $z < 0$)
• 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:

\[ U(x, x) = x \]

\[ U(p, x) = 5 + 0.5 [(10 - x) - \lambda x] \]

Break even comes at

\[ x = \frac{20}{3 + \lambda} \]

If $\lambda > 1$ then $x < 5$
Now if $p$ is reference

\[
U(x, p) = x + 0.5[x - \lambda(10 - x)]
\]

\[
U(p, p) = 5 + 0.25[(10(1 - \lambda)]
\]

Break even comes when

\[
\frac{(3 + \lambda)}{2}x - 5\lambda = 7.5 - 2.5\lambda
\]

\[
\frac{(3 + \lambda)}{2}x = 2.5(3 + \lambda)
\]

\[
x = 5
\]
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 \( U(p) \)
A natural question: what are the behavioral implications?

Remember, we highlighted this as a problem with the deterministic version of KR in lecture 1.

Massatlioglu and Raymond provide some answers:

- CAPE is exactly the intersection of rank dependent utility and quadratic utility:
  \[ \sum \phi(x, y)p(x)p(y) \]
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
• **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' $r : D \rightarrow X \cup \{\Diamond\}$ such that
    • $r(S) \in S / c(S)$ if $r(s) \neq \Diamond$

  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 \( c(S) \cap T \neq \emptyset \) 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 $c(x, y, z) \neq \{z\}$

\[
\begin{align*}
x & \in c \{x, y\} \Rightarrow x \in c(x, y, z) \\
y & \notin c(x, y) \Rightarrow y \notin c(x, y, z)
\end{align*}
\]
• **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 \(x_1, \ldots, x_N\) such that \(x_n\) is a revealed reference for \(x_{n+1}\) then \(x_1\) must be a potential reference for \(x_N\)
• **Definition:** $T$ is a $c$-cover of $S$ if it is
  • A cover of $S$
  • For every $T \in T$, $c(T) \cap S \neq \emptyset$

• **Reference Consistency:** Let $T$ be a $c$-cover of $S$ with $|T| = 2$ for some $T \in T$. Then for some $T' \in T$

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

• Why $|T| = 2$ for some $T \in T$?
  • Deals with the case in which $r(S) = \diamond$
  • $r(T) = \diamond$ as well, so WARP must hold
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
• 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
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
• 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 ⇒ 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
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?
- It's 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**
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
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 $p=0.5$