Introduction to Reference-Dependent Preferences
Economics for Neuroscientists Lecture, 2010

Botond Kőszegi, UC Berkeley

October 15, 2010
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Happiness on the Medal Stand

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Won silver medal.  Won bronze medal.
Happiness on the Medal Stand

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Won silver medal.

Counterfactual outcome: winning gold medal.

Won bronze medal.

Counterfactual outcome: missing medal stand.
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A Few Words About Me and the Talk

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I’ll go fast, but everything will be completely informal.
Properties of Reference-Dependent Preferences
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• Kahneman, Knetsch, and Thaler (1990,1991):
  ① Randomly give half of the subjects (“owners”) mugs, and half of the subjects (“non-owners”) nothing.
  ② Owners and non-owners are both allowed to examine the mug.
  ③ Elicit buying and selling prices using the Becker-DeGroot-Marschak procedure.

• Finding: selling prices are significantly higher than buying prices.

• This is called the *endowment effect*: endowing someone with a good makes her value it more highly.
• We can conceptualize the endowment effect as a combination of reference dependence and loss aversion.
  
  • Owners’ reference point: having one mug.
  • Non-owners’ reference point: having zero mugs.
  
  Thus, selling entails a loss of the mug, while buying entails a gain of the mug.
  
  Since people are more sensitive to losses than they are to same-sized gains, the sellers “value” the mug more.
  
  What about money?
  
  If there’s a difference, spending money is a loss for non-owners, and getting money is only a gain for owners.
  
  This reinforces the endowment effect.
  
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- Diminishing sensitivity is the less important of the two main properties of reference-dependent preferences.
- The primary original evidence for diminishing sensitivity comes from attitudes toward monetary gambles.
• Kahneman and Tversky (1979):

In addition to whatever you own, you have been given 1000. You are now asked to choose between receiving 500 for sure or 1000 with probability 0.5.

In addition to whatever you own, you have been given 2000. You are now asked to choose between losing 500 for sure or 1000 with probability 0.5.

Diminishing sensitivity provides a natural explanation:

• Most subjects are more sensitive to gaining $500 than to gaining an extra $500, so they’re not willing to risk losing the first $500 for the extra $500.

• Many subjects are more sensitive to losing $500 than to losing an extra $500, so they’re willing to risk losing the second $500 to avoid losing the first $500.

• Much like reference dependence, diminishing sensitivity is a general feature of human perception:

  visual
  101 ft. vs. 100 ft.
  1 ft. vs. 0 ft.

  time
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Prospect Theory
Loss aversion combined with diminishing sensitivity are key ingredients of Kahneman and Tversky’s (1979, 1991) prospect theory. They posited that an outcome is evaluated relative to a reference point according to a value function \( v(c - r) \) illustrated in Figure 1. This function incorporates the key properties of reference-dependent preferences we have discussed so far.

Notice first that it has a kink at zero. That captures the loss-aversion part of reference-dependent preferences, that losses resonate much more than similar-sized gains. Also, the function is concave in the positive range and convex in the negative range. That is, it gets flatter as it gets further and further away from zero in either direction. That is diminishing sensitivity.

### III.C Non-Linearity in Probabilities

All the evidence on reference dependence so far had to with how preferences over outcomes depend on comparisons to reference points in addition to absolute judgments. All this evidence contradicts an assumption commonly used in economics, that preferences depend only on final outcomes.

But recall that the workhorse economic model of individual decisionmaking, expected-utility theory, also makes another assumption: linearity in probabilities. I will quickly give you some evidence contradicting this assumption, and indicate how the theory might be modified to account for nonlinearities in probabilities. Let us go back to another piece of evidence from the surveys. I asked half of you whether you would prefer $3,000 with probability 1 instead of $4,000 with probability 0.8; 68 percent of you prefer the former. The other half of you I asked whether you prefer $3,000 with probability 0.25 or $4,000 with probability 0.2;
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Applications of Prospect Theory
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- Most people reject small and moderate-sized favorable gambles; e.g. a 50-50 chance at winning $550 or losing $500.

Barberis, Huang, and Thaler (2006) offered the gamble to MBA students, financial analysts, and very rich investors. Most, including 71% of the investors, turn down the gamble.

Consumers choose insurance policies with low deductibles at a high extra cost. E.g. Sydnor (2010) calculates how homeowners choosing lower deductibles would have done with a $1,000 deductible:

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• Classical explanation: diminishing marginal utility over wealth.

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• Graphical illustration:
  - Say your lifetime wealth is between $1.8 million ($60K times 30) and $3.6 million ($120K times 30).
  - Let’s graph your utility in this range.
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  • Say your lifetime wealth is between $1.8 million ($60K times 30) and $3.6 million ($120K times 30).
  • Let’s graph your utility in this range.
• Intuition:
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• Reference-dependent utility isn’t vulnerable to the same critique because it doesn’t require preferences over risk to be described by a single function.
  • That is, how a person’s utility function looks over a large range puts little restriction on how it looks over a small range.
Suppose a worker is in the following situation:

- She can freely choose how many hours she works every day.
- There are frequent *temporary* changes in her hourly wage.

In this situation, one might expect a positive relationship (or maybe no relationship) between wages and hours.

Suppose the wage is $5/hr on Day 1 and $10/hr on Day 2.

- 8 hours on both days makes $120.
- 6 and 9 is fewer hours of work, and still makes $120.
- 9 and 6 makes $105—seems really suboptimal.
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• Basic finding: hours are \textit{negatively} related to wages.
• Explanation: *daily income targeting*.
  - Drivers’ evaluation of their daily income is reference-dependent.
  - The reference point is some reasonable daily income target.
Daily Income Targeting

- Explanation: *daily income targeting*.
  - Drivers’ evaluation of their daily income is reference-dependent.
  - The reference point is some reasonable daily income target.
  - Loss aversion implies that it might make sense for drivers often stop at the daily income target.
  - A driver with a higher wage reaches his target faster, so he works fewer hours.
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An Explanation Based on Loss Aversion

- Why are prices sticky?
  
  Raising your price above the past price will lead many consumers not to buy. Lowering your price below the past price won't generate that much extra demand. So in many situations, you don't want to change the price.

- Why are prices focal?
  
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Application IV: The Disposition Effect

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\text{PLR} = \frac{\# \text{ of realized losses}}{\# \text{ of total losers}},
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and similarly for the proportion of gains realized (PGR).
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The tendency to sell winners and hold on to losers is called the disposition effect. Explanation:

- Investors' evaluation of the stock's sale price is reference-dependent.
- The reference point is the purchase price.
- Due to reference-dependent utility, it's pleasant to sell a winner and unpleasant to sell a loser (Barberis and Xiong 2008).
- Furthermore, due to diminishing sensitivity, individuals are willing to take more risks with losing stocks than with winning stocks.

The disposition effect has also been observed in the housing market (Genesove and Mayer 2001).
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Open Questions
Why There’s Much More to Do

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What’s the Reference Point?

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Furthermore, if we want to predict in advance what individuals will do, we better be able to predict their reference point.

Unfortunately, research on reference-point determination is much less developed than research on preferences given a reference point.
Three Candidates for the Reference Point

1. *Status Quo*: The original (hesitant) assumption in prospect theory was that the reference point is the status quo or endowment.

2. *Social Preferences*: People compare their outcomes to those of others around them. This is another central theme in the psychology and economics literatures. Controlling for their own income, hours of work, etc., people's reported happiness is decreasing in the income of those working in similar jobs. Neumark and Postlewaite (1998) provide evidence suggesting that social comparisons affect the labor-supply decisions of women.

3. *Goals or Aspirations*: A somewhat less coherent literature in psychology argues that goals or aspirations can also serve as the reference point.
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- Students perform a boring task for a piece rate.
- They can work as long as they want.
- After they finish working, they flip a coin.
  - Heads: receive what they earned.
  - Tails: receive a predetermined amount $x$.
- Two conditions: $x = 3.50$ and $x = 7.00$. (Known in advance.)
- For $x = 3.50$, lots of subjects stop working when they've earned $3.50$, and for $x = 7.00$, lots of subjects stop when they've earned $7.00$.
- Interpretation: the expected possibility of earning $x$ becomes part of subjects' reference point, so they stop working at $x$. 

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Our Preferred Candidate: Recent Expectations
A partially unifying theory

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- But when expectations differ from the other candidates, typically expectations provide a better theory of reference-point determination.
  - This allows us to reconcile some seemingly contradictory findings and intuitions.
• Recall:

  • Kahneman and Tversky (1979) and others find that in laboratory experiments, subjects tend to be quite risk-loving in the loss domain. The disposition effect is also a kind of risk lovingness in the loss domain.
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The Endowment Effect in the Market and in the Lab

Should we expect very little trade in the economy?

List (2003) tried to replicate the endowment effect with both inexperienced and experienced sports-card traders. He randomly gave traders one of two (similar-quality) cards in exchange for their participation in a survey. He then offered an exchange for the other card. Consistent with an endowment effect, few of the inexperienced traders switch—but 46% of the experienced traders do. Reasonable explanation: unlike inexperienced traders, experienced traders expect to possibly trade acquired items.

In a typical lab experiment, when subjects are given a mug and are told they own it, they probably don’t expect to trade it—they’re like the inexperienced traders. But when subjects are repeatedly told they’ll be able to trade their item (as in Plott and Zeiler 2004, 2007), they might expect to trade it—they’re like the experienced traders.
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While there’s agreement that some income targeting is going on, there are some puzzling additional findings:

1. Oettinger (1999) found that stadium vendors are more likely to go to work for games that’ll attract many fans.

2. Crawford and Meng (2009) find that work hours and wages are negatively related for wages above average, and unrelated for wages below average.

3. Farber (2005, 2008) finds only weak evidence for income targeting, and strong evidence that the stopping probability depends on hours worked.

Once again, we argue that expectations are key.

If a wage increase is expected in advance, workers set much higher income targets for that day, and hence work longer. So in this case labor supply responds positively to wage increases.

If the income target is already set and there is a surprise wage increase during the day, workers will reach their target faster. So in this case labor supply may respond negatively to wage increases.

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If the reference point is expectations, for a complete picture we must know where expectations come from.
Where Do Expectations Come From?

- If the reference point is expectations, for a complete picture we must know where expectations come from.
- To answer this question, one can draw on research from other domains.
  1. Theories of expectations formation in economics.
  2. Evidence on expectations formation that aren’t necessarily tied to reference-dependent utility.
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    • Preferred Personal Equilibrium (PPE): the decisionmaker chooses the best state-contingent strategy she knows she will carry through given the preferences induced by the plan.
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But We're Far From Done

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- We need careful empirical work telling us what determines the reference point in different situations, and fully fledged alternative theories of reference-point determination.
- In as much as the reference point is expectations, we need careful empirical and theoretical work on expectations formation.
Recall again the endowment effect, that subjects’ selling price for an object is higher than their buying price.

Suppose an owner of a mug is offered two choices: first whether to sell her mug for $6, and then whether to buy an identical mug for $4.

Narrow Bracketing: If she thinks of these choices separately one by one, she may refuse both trades.

Broad Bracketing: But if she thinks of them together, they amount to offering her $2, which she will certainly take.

Another example of the same issue: the breadth of income to include when income targeting.

Implication: with reference dependence, how a broadly a person brackets her choices can greatly affect what she chooses.

Yet theoretical and empirical work on how broadly people bracket decisions is almost non-existent.
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The welfare implications of reference-dependent preferences and loss aversion depend crucially on two issues:

1. Whether the tendency to want to avoid losses reflects true experienced utility or is a mistake.
2. To the extent that the former is the case, whether people take into account how their reference point affects their utility.

Although Question 2 is important and interesting, Question 1 seems to be an order of magnitude more important. I think reference dependence and loss aversion do reflect some real hedonic experiences. But there's reason to believe that behavior might be an exaggerated response to true preferences. The main reason is projection bias: people underappreciate how changes in their circumstances will change their preferences.
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Sorting out to what extent loss aversion is a mistake is difficult using choice data alone.

- In these situations, neuroscience methods may be useful.
Due to projection bias, people may underappreciate how changes in their reference point will change their utility.

This leads to an overreaction to gains and losses.

- If you currently have a mug, giving it up will feel like a loss.
- But this sense of loss will only last a short while.
- Due to projection bias, you underappreciate how quickly the sense of loss will dissipate.

Sorting out to what extent loss aversion is a mistake is difficult using choice data alone.

- In these situations, neuroscience methods may be useful.
- The same holds more generally for determining whether a particular pattern of behavior reflects a mistake.