Rational Choice with Status Quo

Yusufcan Masatlioglu

Introduction

Reference Dependence

- Human perceptions, feelings, decisions, etc. are all largely determined comparisons to reference levels rather than by absolute levels.
- How do you feel about your income?
  - You compare your income to that of your classmates, your parents, the standard of living you are accustomed to, your hopes, your expectations, and so on.

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Why does this matter for economists?

- Standard Neoclassical Theory:
  - If transactions costs are small enough, reference points should not influence rational consumers.
- In practice, defaults make an enormous difference:
  - Organ donation
  - Car insurance
  - Car purchase options
  - Consent to receive e-mail marketing
  - Savings
  - Asset allocation

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Some Evidence

- Hypothetical
  - Investment choice (Samuelson and Zeckhauser, 1988)
  - Job choice (Kahneman Tversky, 1984)
  - Fishing pier (Banford et al. 1979)
  - Postal Service, Deer Hunting (Heberlein and Bishop, 1985)
  - Gas and Electricity (Raymond and Hartman, 1991)
  - Pine Tree (Boyce et al. 1992)
  - Road Safety (Duborg et al. 1994)
- Real
  - "Mug" experiments (Knetsch, 1989, Kahneman et.al., 1990, Franciosi et al., 1996)
  - Lottery ticket (Knetsch and Sinden, 1984, Singh, (1991))
  - Candy Bars (Shogren et al., 1994, Morrison, 1997)
  - Right to avoid bitter tasting liquid (Coursey et al. 1987)
  - Soft Drinks, (Bateman et al., 1997)
  - Medical Plans (Samuelson and Zeckhauser, 1988)
  - Car Insurance (Johnson et al., 1993)
  - Retirement Plan 401(k) (Madrian and Shea, 2001)
  - Internet Privacy (Johnson, Bellman, and Lohse, 2000)
  - Organ Donation (Johnson and Goldstein, 2003)

Tversky and Kahneman [1991]

- Tversky and Kahneman [1991]
  - The "workhorse" model in behavioral economics
  - Psychologically sound
  - Tractable (effectively one additional parameter)
  - Accommodates observed behavior
- Some drawbacks
  - Unintended consequences due to modeling choice
  - Limited applicability (only consumption bundles)
  - No clear welfare criteria
  - Reference point is exogenous

An Alternative Model

- Psychologically constrained utility maximization (PCUM) model
  - Masatlioglu and Ok [2005, 2014]
- Main Idea: The status quo imposes a psychological constraint on decision makers
  - In Tversky and Kahneman [1991], status quo affects utility
  - In Masatlioglu and Ok [2005,2014], status quo affects constraint

Masatlioglu and Ok [2005,2014]

- No restriction on domain,
- Let X be the set of alternatives
- Hence, the model applies to a wide range of choice problems
  - Dimensions are observable (consumption bundles)
  - Dimensions are observable, but the decision maker only cares a strict subset of them, which is not observable (choosing between insurance or retirement policies, comparing job offers)
  - Dimensions are not observable (political candidates)

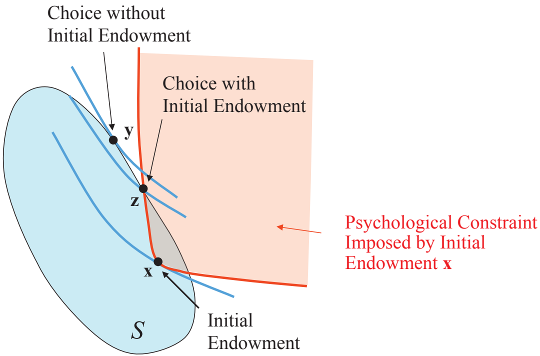
Masatlioglu and Ok [2005,2014]

Maximize $U(\omega)$ subject to $\omega \in S \cap \mathcal{Q}(r)$

- $\mathcal{Q}(r)$: psychological (mental) constraint imposed by r, [1]
- U: reference-free utility

[1] If there is no status quo, then there is no constraint.

Masatlioglu and Ok [2005,2014]



Psychological Constraint

$\mathcal{Q}(r)$: the set of alternatives appealing from perspective of r

- Some examples:
  - $\mathcal{Q}(r) = X$ – reference independent choice
  - $\mathcal{Q}(r) = \{r\}$ – extreme status quo bias
  - $\mathcal{Q}(r) = \{y \in \mathcal{R}^n \ |y_i \geq r_i$ for all $i\}$ – no tolerance for losses
  - $\mathcal{Q}(r) = \{y \in X \ |v_i(y) \geq v_i(r)$ for all $i\}$ – multi-self model where v_i is the utility of self i

Psychological Constraint

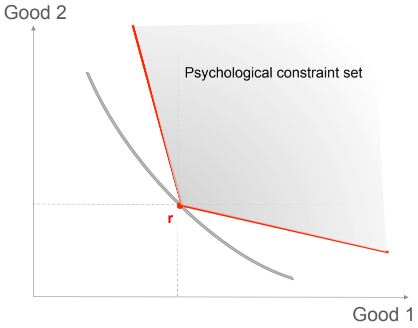
One interesting example:

- $\mathcal{Q}(r) = \{y \in \mathcal{R}^n \; | U_r(y) \geq U_r(r)\}$
  - U_r is the Tversky-Kahneman reference dependent utility

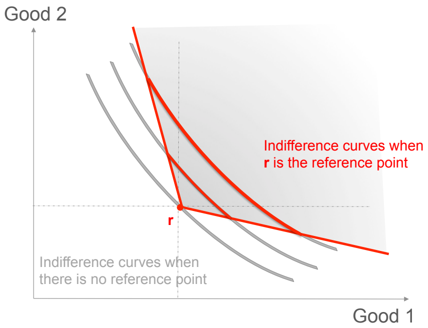
Psychological Constraint

$$\mathcal{Q}(r) = \{y \in \mathcal{R}^n \; | U_r(y) \geq U_r(r)\}$$

where U_r is constant loss aversion.



Indifference Curves



Characterization

The Basic Framework

- An arbitrary compact metric space X
- Ω_X: the set of all nonempty closed subsets of X
- (S, x): a choice problem when the status quo is x
- $\Diamond$ denotes no status quo
- $(S, \Diamond)$: a choice problem when there is no status quo
- σ: a generic member of $X \cup \{\Diamond\}$

$$\mathbf{c}(S,\sigma) \subseteq S \qquad \text{for every } (S,\sigma).$$

$y \in \mathbf{c}(S,x)$: means that the individual gives up her status quo x and switches to y.

Weak Axiom of Revealed Preference (WARP) If $T \subseteq S$ *and* $\mathbf{c}(S, \sigma) \cap T \neq \varnothing$, then

$$\mathbf{c}(S, \sigma) \cap T = \mathbf{c}(T, \sigma)$$

WARP holds for a fixed reference point.

Axioms

Weak Axiom of Status Quo Bias (WSQB). *For any* $x, y \in X$,

$$(i) \quad y \in \mathbf{c}(\{x,y\}, x) \quad \textit{implies} \quad y \in \mathbf{c}(\{x,y\}, \Diamond)$$

and

$$(ii) \quad y \in \mathbf{c}(\{x,y\}, \Diamond) \quad \textit{implies} \quad y \in \mathbf{c}(\{x,y\}, y).$$

(i) If the agent moves away from her status quo option x in favor of another alternative y, then y is at least as good as x in a reference-free sense.

(ii) if the agent reveals the superiority of y over x in a reference-free setting, then, when the endowment of the agent is y itself, y is chosen over x.

Status Quo Irrelevance (SQI). *Suppose that* $\{x\} \neq \mathbf{c}(T, x)$ *for every non-singleton subset* T *of* S *with* $x \in T$ *and that* $\{y\} = \mathbf{c}(\{x, y\}, \Diamond)$ *for some* $y \in S$. *Then,*

$$\mathbf{c}(S, x) = \mathbf{c}(S, \Diamond).$$

If a status quo x is unambiguously "undesirable" in S, then the agent views the presence of x as a status quo as irrelevant for her final choice.

Axioms

Continuity (C). *The map* $\mathbf{c}(\cdot, \Diamond)$ *is upper hemicontinuous on* Ω_X. *Moreover, for each convergent sequence* (y_m) *in* X *with* $y_m \in \mathbf{c}(S \cup \{y_m\}, x)$ *for each* m, *we have*

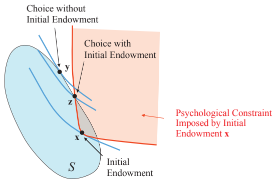
$$\lim y_m \in \mathbf{c}(S \cup \{\lim y_m\}, x)$$

Theorem 1. *A choice correspondence on* $\mathbf{c}$ *satisfies WARP, WSQB, SQI and C if, and only if, there exist a continuous (utility) function* $U : X \to \mathbb{R}$ *and a closed-valued self-correspondence* $\mathcal{Q}$ *on* X *such that*

$$\mathbf{c}(S, \Diamond) = \arg\max U(S), \tag{1}$$

and

$$\mathbf{c}(S, x) = \arg\max U(S \cap \mathcal{Q}(x)) \tag{2}$$



Proof

Define the binary relation $\succsim$ on X

$$y \succsim x \qquad \text{if and only if} \qquad y \in \mathbf{c}(\{x, y\}, \Diamond).$$

and the self-correspondence $\mathcal{Q}$ on X by

$$\mathcal{Q}(x) := \{y \in X : y \in \mathbf{c}(\{x, y\}, x)\}.$$

Proof

- WARP $\rightarrow \succsim$ is a complete and transitive
- C $\rightarrow \succsim$ is continuous
- X is a compact, and hence separable, metric space
- By the Debreu Representation Theorem, $\exists$ a continuous function U represents $\succsim$
- Therefore
$$\mathbf{c}(S, \Diamond) = \arg\max\{U(\omega) : \omega \in S\},$$

Proof

Claim 1 $\mathcal{Q}$ is closed-valued.

Proof Pick any $x \in X$, and let (y_m) be a sequence in $\mathcal{Q}(x)$ with $y_m \to y$ for some $y \in X$. Then, $y_m \in \mathbf{c}(\{x, y_m\}, x)$ for each m, so, by C, we find $y \in \mathbf{c}(\{x, y\}, x)$, that is, $y \in \mathcal{Q}(x)$ $\square$

Proof

Claim 2 $\mathbf{c}(S, x) = \mathbf{c}(S \cap \mathcal{Q}(x), x)$.

Proof

- $y \in \mathbf{c}(S, x)$ and WARP $\rightarrow y \in \mathbf{c}(\{x, y\}, x)$
- $\rightarrow y \in \mathcal{Q}(x) \rightarrow y \in S \cap \mathcal{Q}(x)$
- $\rightarrow \mathbf{c}(S, x) \subseteq S \cap \mathcal{Q}(x) \subseteq S$
- WARP $\rightarrow \mathbf{c}(S, x) = \mathbf{c}(S \cap \mathcal{Q}(x), x)$ $\square$

Proof

Claim 3 $\mathbf{c}(S \cap \mathcal{Q}(x), x) = \mathbf{c}(S \cap \mathcal{Q}(x), \Diamond)$.

Proof

- Suppose $x \in \mathbf{c}(\{x, y\}, \Diamond)$ for every $y \in S \cap \mathcal{Q}(x)$ ($\star$)
- $y \in \mathcal{Q}(x) \to y \in \mathbf{c}(\{x, y\}, x)$
- WSQB(ii) $\to x \in \mathbf{c}(\{x, y\}, x)$, and
- WSQB(i) $\to y \in \mathbf{c}(\{x, y\}, \Diamond)$
- $\to \mathbf{c}(\{x, y\}, \Diamond) = \{x, y\} = \mathbf{c}(\{x, y\}, x)$ for every $y \in S \cap \mathcal{Q}(x)$
- WARP $\to \mathbf{c}(S \cap \mathcal{Q}(x), x) = \mathbf{c}(S \cap \mathcal{Q}(x), \Diamond)$

Proof

Claim 3 $\mathbf{c}(S \cap \mathcal{Q}(x), x) = \mathbf{c}(S \cap \mathcal{Q}(x), \Diamond)$.

Proof continues

- Suppose $(\star)$ does not hold
- $\exists y \in S \cap \mathcal{Q}(x)$ s.t. $\{y\} = \mathbf{c}(\{x, y\}, \Diamond)$
- Show that $\{x\} \neq \mathbf{c}(T, x)$ for every non-singleton subsets T of $S \cap \mathcal{Q}(x)$
- $w \in T \setminus x \to w \in \mathbf{c}(\{x, w\}, x)$
- If $\{x\} = \mathbf{c}(T, x)$ then
$$\{x\} = \mathbf{c}(T, x) \cap \{x, w\} = \mathbf{c}(\{x, w\}, x)$$
- A contradiction since $w \in \mathbf{c}(\{x, w\}, x)$
- SQI $\to \mathbf{c}(S \cap \mathcal{Q}(x), x) = \mathbf{c}(S \cap \mathcal{Q}(x), \Diamond)$ $\square$

Proof

Claims 2 and 3, $\mathbf{c}(S, x) = \mathbf{c}(S \cap \mathcal{Q}(x), \Diamond)$, and hence,

$$\mathbf{c}(S, x) = \ \arg\max\{U(\omega) : \omega \in S \cap \mathcal{Q}(x)\},$$

Strong Axiom of Status Quo Bias (SSQB). *For any* $x, y \in X$,

$$y \in \mathbf{c}(\{x,y\},x) \quad \textit{implies} \quad \{y\} = \mathbf{c}(\{x,y\},\Diamond)$$

and

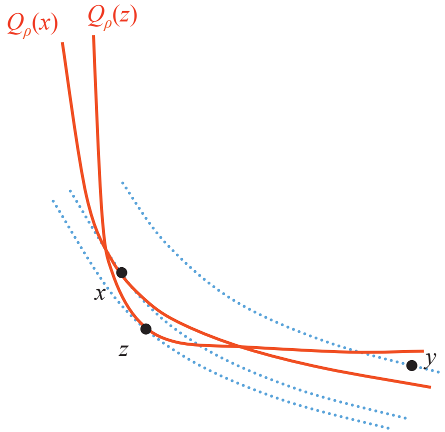
$$y \in \mathbf{c}(S,x) \quad \textit{implies} \quad \{y\} = \mathbf{c}(S,y).$$

Theorem 2. *A choice correspondence satisfies WARP, SSQB, SQI and C if, and only if, there exist a continuous (utility) function $U : X \to \mathbb{R}$ and a closed-valued self-correspondence $\mathcal{Q}$ on X such that $\mathcal{Q} \circ \mathcal{Q} \subseteq \mathcal{Q}$ and*

$$U(y) > U(x) \qquad \text{for every } x \in X \text{ and } y \in \mathcal{Q}(x) \setminus \{x\} \tag{3}$$

while (1) *and* (2) *hold.*

The transitivity of $\mathcal{Q}$ ($\mathcal{Q} \circ \mathcal{Q} \subseteq \mathcal{Q}$) is an important property, which says that if $y \in \mathcal{Q}(x)$ and $z \in \mathcal{Q}(y)$, then $z \in \mathcal{Q}(x)$. In other words, if z is not eliminated from the viewpoint of the status quo y, and y itself is not eliminated from the viewpoint of x, then z is not be eliminated from the perspective of x.



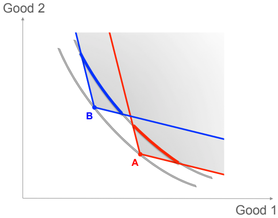
An Example: $\mathcal{Q}$ is not transitive

Masatlioglu and Ok [2005,2014]

- Masatlioglu and Ok [2005,2014] can accommodate both the endowment effect and status-quo bias.

Status Quo Bias

- Assume $U(A) = U(B)$,
  - According to reference-free utility, A and B yield the same value
  - Subjects who own nothing are indifferent
- Due to the psychological constraint, we have
- $B \notin \mathcal{Q}(A)$ and $A \notin \mathcal{Q}(B)$
  - Subjects who own bundle A choose uniquely A
  - Subjects who own bundle B choose uniquely B



Endowment Effect

- Think of Sellers in the experiment
  - $(0, w+p) \in \mathcal{Q}(1, w)$ if $p \geq \lambda u_m(1)$
  - Willing to accept (WTA)
    - WTA is the smallest amount of money to sell the mug,
  - Hence, $WTA = \lambda u_m(1)$.

Endowment Effect

- Think of Buyers in the experiment
  - $(1, w) \in \mathcal{Q}(0, w + p)$ if $p \leq \frac{1}{\lambda} u_m(1)$
  - Willing to pay (WTP)
    - WTP is the largest amount of money to buy the mug,
  - Hence, $WTP = \frac{1}{\lambda} u_m(1)$.

Endowment Effect

- Think of Choosers in the experiment
  - Chooser is indifferent between buying the mug or getting the cash
  - Hence, p_c must satisfy

$$U(1, w) = U(0, w + p_c)$$

Endowment Effect

- In this example,

$$WTP < p_c < WTA$$

- The WTA-WTP gap
  - However, it is possible to generate examples where there is no gap.
  - Hence, the model allows both presence and absence of WTA-WTP gap

More Applications

- The Equity Premium Puzzle
- The Disposition Effect
- House Pricing

A Comparison

- How do Tverksy and Kahneman's model and Masatlioglu and Ok's model differ in terms of applications?
  - Both predict the status quo bias and the endowment effect,
  - In all three applications on previous slide they make similar predictions

- Difficult to find an application where they make opposite predictions.

- One application: Law of Compensated Demand

Application

- Does the law of compensated demand hold in Masatlioglu and Ok's model?
- If so, how does the substitution effect compare to the one in the standard case (without status quo)
- Focus on compensated demand

Application

- What is the law of compensated demand?
  - First, define compensated price change: A compensated price change gives the consumer enough income so that at the new prices she can still purchase the bundle she chose before.
  - Eliminates income effect
  - Isolates substitution effect
- Hence, if the price of a normal good decreases, consumers tend to buy more of that good

Application

- Intuition with loss averse consumers, two normal goods x, y, and the price of x decreases.
  - An increase in the consumption of x implies a reduction in the consumption of y.
  - If she is very loss averse, she might find not to increase the consumption of x to avoid losses on y
  - Hence it could be beneficial to stick to the status quo.
  - However, we DO NOT EXPECT the consumer consumes less of x because
    i) This will induce losses, and
    ii) She consumes more of expensive good
  - Hence, if the price of a normal good decreases, we expect either no change or an increase of that good.

Law of Compensated Demand

- Two goods
- Income is denoted by $w > 0$
- The initial prices $\mathbf{p}$
- There is no status quo
- The initial demand $\mathbf{x}(\mathbf{p}, w)$

Law of Compensated Demand

- The price of the first good decreases
  - The new price $\mathbf{q}$ such that $p_1 > q_1$ and $p_2 = q_2 = 1$.
- We need to adjust income so that the initial consumption exhaust one's budget in the new prices
  - $w' := \mathbf{q}\mathbf{x}(\mathbf{p}, w)$
- $w' - w < 0$ is the Slutsky compensation.
- We assume $\mathbf{x}(\mathbf{p}, w)$ acts as the reference point

Law of Compensated Demand

- Let $\mathbf{x}(\mathbf{q}, w')$ be the new demand,

$$\text{Fact 1:} \quad x_1(\mathbf{q}, w') \geq x_1(\mathbf{p}, w)$$

  - The Law of Compensated Demand holds!

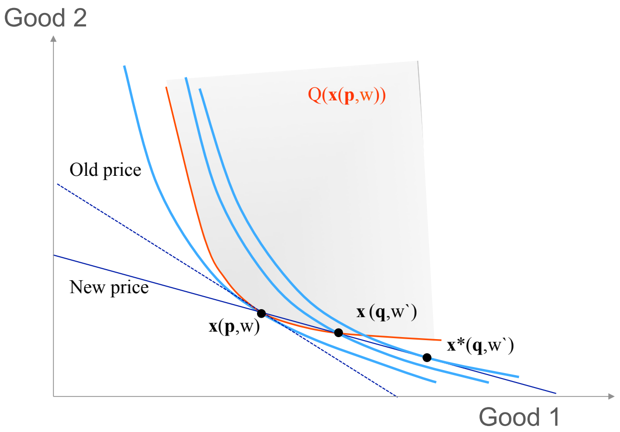
Law of Compensated Demand

How does the magnitude of the substitution effect we found compare with the substitution effect the consumer would exhibit if she did not have a status quo bias?

- Let $\mathbf{x}^*(\mathbf{q}, w')$ be the standard demand (without status quo)

$$\text{Fact 2:} \quad x_1^*(\mathbf{q}, w') \geq x_1(\mathbf{q}, w')$$

Law of Compensated Demand



Law of Compensated Demand

- Substitution Effect ($\Delta\mathbf{p}\Delta\mathbf{x}$)

$$\begin{array}{c} \text{Substitution Effect} \\ \text{without} \\ \text{Status Quo Bias} \end{array} \leq \begin{array}{c} \text{Substitution Effect} \\ \text{with} \\ \text{Status Quo Bias} \end{array} \leq 0$$

Law of Compensated Demand

- In Tversky and Kahneman [1991] the Law of Compensated Demand fails for a wide specification of parameters

Law of Compensated Demand

- Consider a parametric version of loss aversion model

$$U_{\mathbf{r}}(\mathbf{x}) = u_1(x_1 - r_1) + u_2(x_2 - r_2),$$

where

$$u_1(t) := \begin{cases} t, & \text{if } t \geq 0 \\ 2t, & \text{if } t < 0 \end{cases} \quad \text{and} \quad u_2(t) := \begin{cases} t^\alpha, & \text{if } t \geq 0 \\ -2\left|t\right|^\alpha, & \text{if } t < 0 \end{cases}$$

Law of Compensated Demand

- Let $p_1 < 2 < w^{1-\alpha}$
- There is no status quo, $(0, 0)$
- The initial demand

$$\mathbf{x}(\mathbf{p}, w) = \mathbf{x}(\mathbf{p}, w) = \left(\tfrac{1}{p_1}(w - (\alpha p_1)^{\theta}), (\alpha p_1)^{\theta}\right)$$

where $\theta := 1/(1-\alpha)$

Law of Compensated Demand

- The price of the first good decreases
- Compensation: $w' := \mathbf{q}\mathbf{x}(\mathbf{p}, w)$
- We assume $\mathbf{x}(\mathbf{p}, w)$ acts as the reference point

Law of Compensated Demand

- Let $\hat{x}_1(\mathbf{q}, w')$ be the new demand for good 1,
- Under a wide specification of the parameters $(1 < q_1 < p_1 < 2 < w^{1-\alpha})$
- The Law of Compensated Demand fails.
  - $\hat{x}_1(\mathbf{q}, w') < x_1(\mathbf{p}, w)$;
- That is, in the absence of the income effect, a decrease in the price of good 1 results in decrease of the consumption of that good.[2]

[2] It can be shown that the Law of Demand may also fail in this context, at least locally.

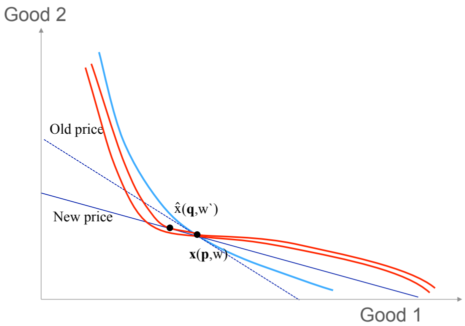
Law of Compensated Demand

- The Law of Compensated Demand may fail with Tversky and Kahneman [1991]
- Because of the interaction of loss aversion and diminishing sensitivity across different dimensions
- The shape of the indifference curves depends on whether we are in the gain-loss region or in the loss-gain region.

Law of Compensated Demand

- In the gain-loss region, the optimal point is either the status quo or a corner solution; that is, the agent either exhibits extreme status quo bias or spends all her money in the first good.
- Under the parametrization, the status quo is better for the agent than the latter solution, so, in the gain-loss region, the best thing is to stay with the status quo bundle.
- But this cannot be the overall optimum because an infinitesimal increase in the second consumption dimension increases utility
- Thus, the overall optimum must be located in the loss-gain region, which means that the substitution effect here is positive.

The Law of Compensated Demand fails.



A Comparison

- Masatlioglu and Uler [2013] provides an extensive comparison between these models
- They also compare them experimentally.

Summary

- Psychologically constrained utility maximization model: Masatlioglu and Ok [2005,2014]
    - Accommodates Status Quo Bias and Endowment Effect
    - Never allows Status Quo Aversion
    - Applicable to any choice domain (also consumption bundles)
    - Easy to use in applications (standard maximization techniques)
    - Reference-free U serves as a welfare criteria