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Loss Aversion in a Durable Goods Market with Resale

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Motivation

- Neo-classical model (expected utility maximization) is not descriptively accurate. Systematic violations from lab and field
  - Loss Aversion; Time Inconsistency; Probability weighting; Framing/reference effects
- Sunstein-Thaler position supports regulations to "nudge" consumers towards neo-classical behavior.
- Presumption is that market outcomes are worse than neo-classical benchmarks given boundedly rational consumers. True?

Prior Work

- Seeks to understand interaction of *boundedly rational consumers* with *rational firms* in marketplace

- Some prominent examples
  - Time-inconsistency and contracts (DellaVigna and Melmendier 2004)
  - Consumer inattention and add-on pricing (Gabaix and Laibson 2004)
  - Loss aversion and pricing (Heidues and Koszegi 2008)

Prior Work (Marketing)

- Reference dependence and product line design (Orhun 2009)
- Time inconsistency and design of mail-in rebates (Gilpatric 2009)
- Time inconsistency and package size design (Jain 2010, this session)

The Message so far …

- Biases are proxies for consumer naiveté
- Rational firms exploit these biases and improve their profits
- Policy prescription: Consumers need to be "debiased" (Gabaix and Laibson 2006)/ "nudged" away (Thaler and Sunstein, 2008) from such behaviors

Our Aim

- To analyze a market wherein reference dependence and loss aversion are important
- Durable good markets fit the bill
- For the buyer of a new good, the future quality and prices are *ex-ante* uncertain
- Study consumer behavior in conjunction with equilibrium price and profit outcomes

Preliminaries

- Single Producer of a durable good that lasts for two periods
- A continuum of consumers with differing willingness to pay
- Active resale market outside the control of producer
- No impediments to trade like information asymmetries or transaction costs

Notation: Set-up

- Monopolist sells a new good that lasts two periods
- New good provides a "service flow" of q
- New good stochastically depreciates to either a "cream-puff" of quality $(1+t_s)$ with prob. a or to a "clunker" of quality $(1-t_c)$ prob. $1-a$
- Consider an infinite period game in which new good price p_t is set by producer and the used prices $p_{s,t}$ and $p_{c,t}$ are determined in the active resale market
- Consumers' willingness to pay (θ) for service flow is distributed uniformly between 0 and 1

Equilibrium

- At the beginning of each period consumers decide to buy/ no buy/ hold
- At the end of each period, markets clear whereby new good buyers could sell the used good
- Market clearing determines used good prices
- Producer maximizes profits considering present value of the current and future streams of profits
- Employ the notion of stationary (steady-state) equilibrium (Konishi and Sandfort 2002)

Benchmark

- **Lemma 1**: *In stationary equilibrium with no reference dependence, a new good buyer never holds a used good. Consumers sort themselves into four distinct segments - segment 1 consumers buy a new good every period, segment 2 consumers buy a cream-puff every period, segment 3 consumers buy a clunker every period and segment 4 consumers buy nothing.*
  - Consumers self-select into buying different products based on willingness to pay similar to Mussa-Rosen product line model (1978)

Reference-Dependent Utility

$$U_t(c \mid r) = \underbrace{m_t(c)}_{\text{Consumption utility}} + \underbrace{n_t(c \mid r)}_{\text{Reference utility}}$$

$$m_t(c) \equiv \sum_k m_t(c^k{}_t)$$

$$n_t(c \mid r) \equiv \sum_k n_t(c^k{}_t \mid r^k{}_t)$$

Total Utility in any dimension consists of sum of consumption and reference Utilities. Utilities are then summed over different dimensions (Koszegi and Rabin 2006)

Reference-Dependent Utility

$$n(c \mid r) \equiv n(m(c) - m(r))$$

- Gain/ Loss Utility is determined by departure from a reference point
- Satisfies properties of Kahneman and Tversky's Prospect Theory Value Function

A simple tractable form is:

$$n(x) = \begin{cases} \mu x^{\alpha} & if\ x > 0 \\ -\lambda\mu(-x)^{\beta} & if\ x \le 0 \end{cases}$$

Assume $\alpha = \beta = 1$

Endogeneous Reference Points

- Reference points are modeled as expectations (Shalev 2000)
- Expectations are expected utilities of all possible outcomes and each outcome consists of both consumption and reference utility
- Idea is to formulate endogenous the reference point whereby consumer is taking reference dependence and loss aversion into account when forming expectations
- The reference point that consumer uses to evaluate each outcome in turn equals the expected value of each outcome
  - Consistent reference point that embeds the notion of rational expectations

Solving the Reference Utility Level

- *n* possible outcomes in the *k*-th dimension that could occur with probabilities $l_1^k, l_2^k, \ldots, l_n^k$ then , the reference point is:

$$m(r^k) = \sum_{i=1}^{n} l^k{}_i U_{ik}(c^k{}_i / r^k)$$

The reference level of utility in a dimension k is determined by a point that is mapped into itself, i.e., a fixed point

Formulation embeds consumer sophistication

- Reference utility of quality (price) is not the same as utility of expected quality (price)
- Suppose the loss aversion goes up- the consumer realizes that she is going to get hurt more if a bad outcome occurs. She takes this into account and lowers her reference utility
- More precisely:

  Absent loss aversion, the reference utility for used-good quality (price) is identical to the utility of the expected used-good quality (price). As loss aversion increases the reference utility for quality (price) falls in comparison to the utility of the expected quality (price). ***(Lemma 2)***

Equilibrium Behavior

- *In stationary equilibrium with reference dependence, there always exists a subset of new good buyers who hold onto the realization of a cream-puff.* **(Proposition 1)**
  - The holder segment endogenously arises because a cream-puff provides an extra-bump to the service flow through gain utility
  - This "virtual" product cannot be purchased in the resale market
  - Uncertainty is the essential for this segment to exist
  - The behavior of holders is akin to "endowment effect" observed in lab studies

Loss Aversion increases Endowment Effect

- *Higher the loss aversion, larger the size of holding segment (**Proposition 2**)*

- Intuition: As loss aversion goes up, reference quality utility goes down. The realization of a *given* quality of cream-puff feels like a higher gain at higher levels of loss aversion since it is being compared against a lower level of reference utility for pre-owned products.

Loss Aversion and Profits

- *Higher the loss aversion, lower the profits* (**Proposition 3**)
- Intuition

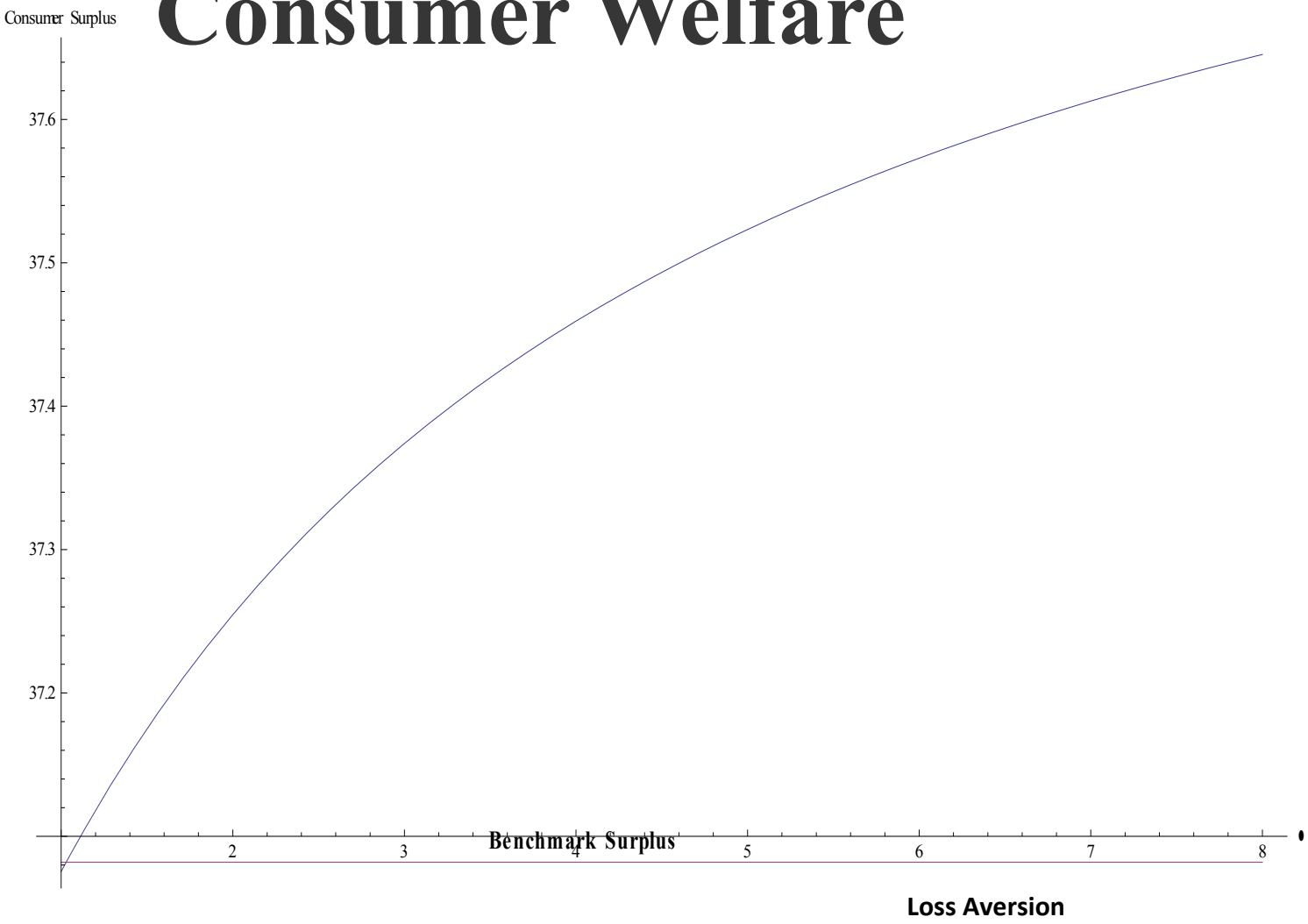
1) *Substitution Effect* increases as tendency to hold onto to cream-puff increases as loss aversion goes up (hurts producer)

2) *Resale Price Effect* decreases since:

A) For buyers who always consumer new, the reference utility of used price goes down as loss aversion goes up

B) For holders who always sell clunkers, again the utility goes down (hurts producer)

Loss Aversion Improves Consumer Welfare

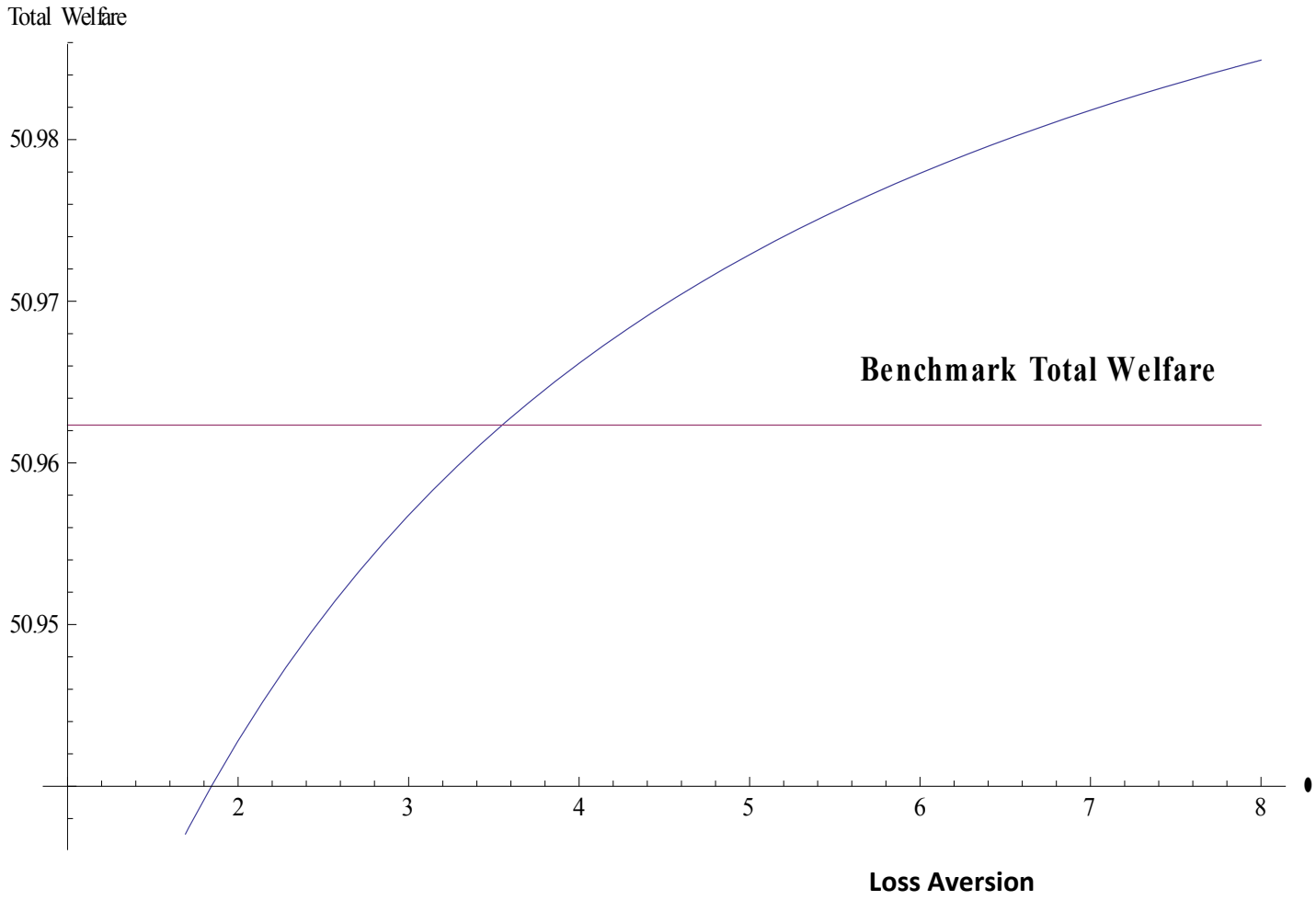


Consumer Welfare Intuition

- Loss aversion constrains a producer's ability to charge higher prices – as loss aversion goes up; both new product and pre-owned product prices ***fall***

- Implication for policy: Nudging consumers towards neo-classical benchmark (not be loss averse) would ***hurt*** their welfare

Total Welfare Change



Total Welfare Intuition

- At low values of loss aversion, social welfare is higher in the benchmark case
- Beyond a point, at high levels of loss aversion, an increase in loss aversion improves the overall welfare
- Driven largely by gain to consumers at cost of firm

Concluding Remarks

- Endogenizing reference points is more realistic, but we get more complex results. Contrasts with other work (e.g., Malmendier and Della Vigna) showing firms exploit heuristic decision-making by consumers to make them worse off

- Supports rule-of-reason policy arguments (e.g., Rizzo and Whitman, 2009) that require a fine-grained understanding of specific situations, unlike the Sunstein-Thaler position for generalized presumption that nudging consumers towards neo-classical behavior is good policy