Reference Dependence and Market Competition

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Introduction

Sequential consideration and reference dependence (RD):

- people often encounter and consider options **sequentially**
- the **order** matters: the **first** option could be favored disproportionately
  - the status quo bias (e.g., Samuelson and Zeckhauser (88))
  - the default effect (e.g., Madarian and Shea (01))
  - the ballot order effect (e.g., Ho and Imai (06))

- RD as an explanation:
  - the first option may become the reference point
  - later options’ relative disadvantages are over weighed (loss aversion)
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This paper examines the implications of such consumer RD in market competition:

- pricing: RD can cause the high-low promotional pricing strategy
- advertising: RD can cause differentiated ad intensities
Related literature

- Reference-dependent consumers in the market:
  - early marketing literature: Putler (92), Hardie et al. (93)
  - monopoly: Fibich et al. (07), Heidhues and Koszegi (05)
  - competition: Heidhues and Koszegi (08)

- Behavioral IO: see Ellison (06) for a survey

- Non-random consumer search and market competition:
  - Arbatskaya (07), Armstrong, Vickers, and Zhou (09), Haan and Moraga-Gonzalez (09)
Two firms (1 and 2):

- supply horizontally differentiated products
- no systematic quality difference
- zero production cost
- set prices $p_i$ simultaneously
Model (Cont’d)

Consumers:

• product match values for a consumer with taste parameter $x \sim U[0, 1]$:
  
  \[ u_1 = v - x; \quad u_2 = v - (1 - x) \]

• product match values and prices are initially unknown

• encounter and consider products sequentially:
  
  1. $1/2 + \theta$ consider product 1 first and find out $(u_1, p_1)$
  2. then consider product 2 with product 1 as the reference point
  3. $1/2 - \theta$ consider products in the opposite order

• firm 1 is more “prominent” if $0 < \theta \leq 1/2$
Reference-dependent preferences (if consider product 1 first):

- standard valuation of product 1:
  \[ v - x - p_1 \]

- reference-dependent valuation of product 2:
  \[
  v - (1 - x) - p_2 - (\lambda_p - 1) \max\{0, p_2 - p_1\} - (\lambda_t - 1) \max\{0, 1 - 2x\}
  \]

- \( \lambda_p > 1 \): loss aversion parameter in the price dimension
- \( \lambda_t > 1 \): loss aversion parameter in the product (or taste) dimension
- \( \lambda_p = \lambda_t = 1 \) corresponds to the standard Hotelling model
Demand

Consider the case $\theta = 1/2$

Suppose $p_1 < p_2$:

- consumers at $x \leq 1/2$ buy 1; consumers at $x > 1/2$ buy 1 iff

$$\frac{2x - 1}{\lambda_p(p_2 - p_1)}$$

- gain from 2

$$\frac{\lambda_p(p_2 - p_1)}{\text{“amplified” loss from 2}}$$

- so firm 1’s demand is

$$q_1(p_1 < p_2) = \frac{1}{2} + \frac{\lambda_p}{2}(p_2 - p_1)$$

- cheap reference product makes consumers more price sensitive
Demand (Cont’d)

Suppose now $p_1 > p_2$:

- consumers at $x \geq 1/2$ buy 2; consumers at $x < 1/2$ buy 1 iff

$$p_1 - p_2 < \lambda_t (1 - 2x)$$

- so firm 1’s demand is

$$q_1(p_1 > p_2) = \frac{1}{2} + \frac{1}{2\lambda_t} (p_2 - p_1)$$

- expensive reference product makes consumers less price sensitive

Firm 2’s demand is affected in the opposite way: $q_2 = 1 - q_1$
Demand (Cont’d)

\[ q_1(p_1, p_2) \]

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Pricing equilibrium

There is **no** pure-strategy equilibrium.
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There is a mixed-strategy equilibrium:

- firm 1 randomizes its price:

  \[ p_{1}^{L} = \sqrt{\frac{\lambda_{t}}{\lambda_{p}} \frac{1 + 1/\sqrt{\lambda_{p} \lambda_{t}}}{2}}; \quad p_{1}^{H} = \sqrt{\frac{\lambda_{t}}{\lambda_{p}} \frac{1 + \sqrt{\lambda_{p} \lambda_{t}}}{2}} \]

  and

  \[ \Pr(p = p_{1}^{L}) = \frac{1}{1 + \sqrt{\lambda_{p} \lambda_{t}}}. \]

- firm 2 charges a certain medium price:

  \[ p_{2} = \sqrt{\frac{\lambda_{t}}{\lambda_{p}}}. \]
Equilibrium
Pricing equilibrium (Cont’d)

Similar results hold for any $\theta > 0$

At $\theta = 0$, there is a symmetric pure-strategy equilibrium with $p^* = 2/\left[\lambda_p + 1/\lambda_t\right]$. 

Consumer loss aversion can cause price variation (vs Heidhues & Koszegi (08)):

- a real product or expectation as the reference point?
- strategic manipulation of consumers’ reference points

Related evidence:
- Slade (98), Muller et al. (06): in the supermarket national brands are on sales from time to time, but private brands have relatively steady prices
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Other equilibrium properties:

- firm 1 charges the high price more frequently: \( \Pr( p = p_1^H ) > 1/2 \)
- product 1 is on average more expensive
- firm 1 on average has a (weakly) larger market share and earns more
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The impact of loss aversion:

- prices and profits ↓ with \( \lambda_p \)
- prices and profits ↑ with \( \lambda_t \)
- the reference-dependence effects in different dimensions have **opposite** effects on the price competition
Sellers’ marketing efforts can influence the order in which consumers consider products:

- advertising
- prominent positions in the store
- online paid placements (e.g. sponsor links)
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An extended model with ad competition:

- firms first choose advertising intensities \((a_1, a_2)\)
- symmetric ad technology:
  \[ \theta(a_1, a_2) > 0 \text{ iff } a_1 > a_2, \text{ i.e., the relatively more heavily advertised product is more prominent} \]
- ad cost function \(c(a_i)\)
- then compete in price
In the pricing subgame, how does prominence difference $|\theta|$ affect profits?
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- a greater prominence difference **boosts** both firms’ profits
- intuition: when a prominent firm becomes more prominent, it will charge $p_{1H}$ more frequently, which further softens price competition
No equilibrium in which both firms ad at positive intensities

Possible pure-strategy ad equilibria (depending how costly ad is):

- one advertises and the other does not
- both do not advertise

*Ex ante* identical firms may *differentiate* their ad intensities, which endogenizes asymmetric prominence.
Discussion:

Sophisticated consumers:

- consumers realize their own reference-dependent preferences
- they can fully control their own consideration orders
- there always exists a symmetric equilibrium with $\theta = 0$
- there are also two asymmetric equilibria with $\theta = 1/2$ or $-1/2$ for a range of loss-aversion parameters
  - considering the more expensive product first can prevent consumers from being over “addicted” to the low price at the expense of taste satisfaction
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More firms:

- how will consumers’ reference points evolve when they consider more products?
- if they always take the first one (e.g., the default option) as the reference point, similar results hold
Conclusion

Main messages:

- consideration order and consumer RD matter for market competition
- consumer reference dependence can cause price variation and endogenous asymmetric prominence in the market

Extensions: quality differentiation, dynamic competition ...