



Search when
Consumers
are Loss
Averse

Marco. A.
Haan, Wim
H. Siekman

Motivation

Literature

Search with
differentiated
products

Search and
reference
dependence

Solving

Results

Conclusion

Search when Consumers are Loss Averse

Marco. A. Haan Wim H. Siekman



university of
 groningen

Consumer search and switching cost workshop
Moscow, 2013



Increased interest in Behavioral Economics

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- Identifying behavioral biases and incorporating them into formal models.
- If we want to understand how markets function, we have to take such biases into account.



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- OFT (2010), *What does Behavioural Economics mean for Competition Policy?*
- Oxera (2013), *Behavioural economics and its impact on competition policy; A practical assessment with illustrative examples from financial services* (for Dutch ACM)
- Potentially important policy implications.
- If biases lead to higher prices (and if higher prices imply lower welfare) there may be scope for policy intervention.



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This Paper

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- We look at one specific, particularly well-documented bias: loss aversion (aka reference-dependence or gain-loss utility).
- Kahnemann and Tversky (Ectr 1979).
- If people get less than they expected, they suffer additional disutility.
- If you expect x , but you get $y < x$, your utility is $y - \lambda(x - y)$, $\lambda > 0$.
- In paper also: additional utility if you get more than you expect: if $y > x$, utility is $y + \gamma\lambda(y - x)$, $0 < \gamma < 1$.



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How to model this!?

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- Köszegi and Rabin (QJE 2006): Personal equilibrium.
- Behavior has to be consistent with expectations.
- If a random variable affects decisions, gain and loss utility are evaluated against all possible realizations of that random variable, weighed by their likelihood.
- So if you expect some $x \sim U[0, 1]$, you get y , utility is $y - \lambda \int_x^1 (\chi - y) d\chi$.



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Applications in IO

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- Notably: Heidhues and Köszegi (AER 2008). Salop circle. Loss aversion weakly increases prices.
- Karle and Peitz (RAND; forthcoming).
- Zhou (JEMS 2012) in the context of search, 2 firms, first is reference point.



Fix thoughts: Heidhues and Köszegi (simplified)

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- Hotelling line, A at 0, B at 1.
- Crucial assumption: disappointment utility is separable in price and product dimension.
- Reference point: equilibrium outcome.
- Suppose firm A defects from tentative equilibrium.
- Downward: marginal guy moves to the right, is disappointed about product if he buys A .
- Upward: marginal guy moves to the left, is disappointed about price if he buys A , but is disappointed about product if he buys B .
- Kink in profit function at tentative equilibrium.
- Continuum of price equilibria.



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But

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- Consumers observe all offers simultaneously.
- More natural: disappointed by the offer of the particular firm you're currently visiting.
- Hence we incorporate it in a model of sequential search and differentiated products.
- What is the effect of consumer loss aversion on equilibrium prices?
- A priori: unclear.
 - More reluctant to continue searching.
 - More easily disappointed by an offer.



Search with differentiated products

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- A single consumer has utility $u(p_i) = v + \varepsilon_i - p_i$ when buying from firm i .
- Match values $\varepsilon_i \sim F$, with $1 - F$ log-concave.
- Firms cannot observe ε_i , the consumer does not know them in advance.
- Sequential search (for match values and prices)
- Searches cost s per shop.
- Firms are visited randomly.
- Covered market.
- Perfect recall.
- Infinitely many firms.



The search decision

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- At equal prices, expected benefits from search when current best match is x :

$$b(x) = \int_x^{\infty} (\varepsilon - x) f(\varepsilon) d\varepsilon$$

- Implicitly define $\hat{\varepsilon}$ by $b(\hat{\varepsilon}) = s$.
- In equilibrium, consumers continue search whenever $\varepsilon < \hat{\varepsilon}$.
- Probability of additional search: $F(\hat{\varepsilon})$.



Equilibrium pricing

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- Suppose a firm defects to some p_i .
- A consumer that visits i still buys if $\varepsilon_i > \hat{\varepsilon} - p_i + p^*$.
- This allows us to write down expected profits for such a defector.
- Maximizing profits and imposing symmetry yields p^* .
- Equilibrium price: $p^* = \frac{1-F(\hat{x})}{f(\hat{x})}$, for uniform: $\sqrt{2s}$.



Including reference dependence

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will affect utility in 3 dimensions:

- 1 Price dimension.
 - 2 Match value dimension.
 - 3 Search cost dimension.
- Crucial assumption: disappointment utility is separable in these three dimensions.



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Solution strategy

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- Fix a value of $\hat{\epsilon}$.
- Derive implications.
- Find the value of $\hat{\epsilon}$ that is consistent with optimal search behavior while taking possible disappointments into account: $\hat{\epsilon}_L$.
- Feed that into the firms' maximization problem.
- Loss aversion in match and search dimension will affect $\hat{\epsilon}_L$.
- Given $\hat{\epsilon}_L$, loss aversion in price dimension will affect firms' problem.



The Price Dimension

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- Consumers take equilibrium price as reference point.
- Hence they are disappointed if they find a firm that defects by setting a higher price.
- Kinked profit function, continuum of equilibria.



The Match Value dimension

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We can consider three possibilities:

- 1 Take current best match as reference point.
- 2 Take what he expects at this firm as a reference point.
- 3 Take the match value she ends up with in equilibrium as reference point.
 - The first is analytically intractable, as it yields non-stationary cut-off points.
 - The third seems most consistent with personal equilibrium.
 - The second yields the same qualitative results.



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The Match Value Dimension (ctd)

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- For a given $\hat{\varepsilon}$, H is the distribution from which the consumer expects draw her realized match value:

$$H(\xi) = \Pr(\varepsilon < \xi | \xi > \hat{\varepsilon}) = \frac{\int_{\hat{\varepsilon}}^{\infty} dF(\xi)}{1 - F(\hat{\varepsilon})}.$$

- Post-disappointment match value, for $\varepsilon \geq \hat{\varepsilon}$

$$\varepsilon_L(\varepsilon) = \varepsilon - \lambda \int_{\varepsilon}^{\infty} (\tau - \varepsilon) dH(\tau)$$

- Otherwise

$$\varepsilon_i - \lambda \int_{\hat{\varepsilon}}^{\infty} (\tau - \varepsilon_i) dH(\tau) = \varepsilon_i - [E(\varepsilon | \varepsilon > \hat{\varepsilon}) - \varepsilon_i]$$

- This defines a new “adapted match value” ε_L with distribution G .



The Search Cost Dimension

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- A priori expected to continue search when $\varepsilon < \hat{\varepsilon}$.
- Disappointment: $\lambda \int_{\hat{\varepsilon}}^1 s dx$.
- Hence, adapted search costs:

$$s_L = s + s\lambda[1 - F(\hat{\varepsilon})]$$

- Technical note: in fact, you should do this with the distribution of expected number of searches. That gives the same result.



Solving for consumer behavior

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- Finding the cut-off point $\hat{\varepsilon}_L$ now involves equating

$$\int_{\hat{\varepsilon}}^{\infty} (\varepsilon_L(\varepsilon) - \varepsilon_L(\hat{\varepsilon})) f(\varepsilon) d\varepsilon = s + s\lambda[1 - F(\hat{\varepsilon})]$$

with

$$\varepsilon_L(\varepsilon) = \varepsilon - \lambda \int_{\varepsilon}^{\infty} (\tau - \varepsilon) dH(\tau)$$

and

$$H(\xi) = \Pr(\varepsilon < \xi | \xi > \hat{\varepsilon}) = \frac{\int_{\hat{\varepsilon}}^{\infty} dF(\xi)}{1 - F(\hat{\varepsilon})}.$$

- This is a tough problem.
- Tractable if F is uniform.



Solving the Model (ctd)

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- Once $\hat{\epsilon}_L$ is derived, the firms' problem is similar to before.
- However, firms do have to additionally take into account that defecting from a tentative equilibrium to a higher price yields disappointed consumers that are hence more likely to walk away.



Results

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- Continuum of equilibrium prices; upper bound is increasing in λ , lower bound is decreasing in λ if s is small enough.
- So equilibrium prices may be decreasing in λ !
- In the search dimension: higher prices (searching becomes more costly).
- In the price dimension: weakly lower prices (consumers are more sensitive).
- In the match value dimension: higher prices (more product differentiation).



Results (ctd)

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- Consumers search more, hence settle for less.
- Prices increase in search costs and decrease in the number of firms.



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- We added reference dependence to a model of consumer search with differentiated products.
- Doing so yields more search.
- Prices may increase or decrease.