

Distracted from Comparison: Product Design and Advertisement with Limited Attention

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Junior Theory Workshop

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- Context: complex products.
 - Go deeper in or expand the consideration set.
 - Study match values or browse prices.
- Design influences what consumers pay attention to.
 - Food labels: Dubois et al (2021), Crosetto et al. (2020).
 - Ad bans: Dubois et al. (2018).

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- Design (Johnson and Myatt (2006)) influences dispersion of consumers' match values. More dispersion captures...
 - ...product design focused on niche consumers.
 - ...taste-based features more salient than quality.
 - ...more precise info about match values.
- **Limited attention** (Heidhues et al. (2021)): tradeoff between depths and breadth of search.

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Informational Interventions:

- More-detailed info relax competition.
 - E.g. exposure to sales force, classic nutrient tables.
 - ...can even harm consumers.
- To distract consumers, firms obfuscate info.
- Coarser and easily-available info reinforce comparison shopping and benefit consumers. (e.g. nutriscores, ad bans)

Related Literature

- **Consumer search and limited attention**
 - Wolinsky(1986), Anderson and Renault(1999), Bar-Isaac et al.(2012),...
 - Anderson and De Palma(2012), Bordalo et al.(2016), Hefti and Liu(2020), Heidhues et al. (2021) ...
 - Spiegler and Eliaz (2011a,b).
 - Here: design impacts what consumers pay attention to.
- **Product design**
 - Johnson and Myatt(2006), Bar-Isaac et al.(2012),...
 - Here: designs direct consumer attention.
- **Obfuscation**
 - Carlin(2009), Chioveanu and Zhou(2013), Gu and Wenzel(2014), Piccione and Spiegler(2012)...
 - Here: consumer attention endogenous.
- **Information overload**
 - Anderson and De Palma(2012), Hefti and Liu(2020),...
 - Here: individual firms deliberately overload consumers.

The Model

Firms and Consumers

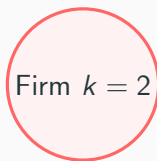
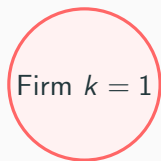


Firm $k = 1$

Firm $k = 2$

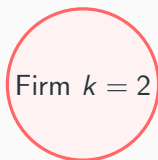
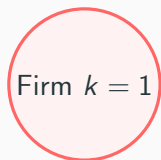
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consumers i
with unit demand

Firms and Consumers



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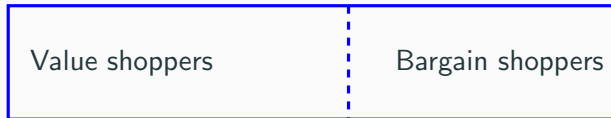
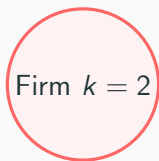
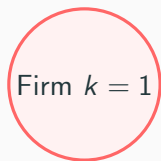
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Mass 1 of
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- mass $1 - \alpha \in (0, 1)$;
- match value $v_{ik} = v$
for both $k = 1, 2$.

Firms and Consumers



Mass 1 of consumers i with unit demand

- mass $\alpha \in (0, 1)$;
- match value v_{ik} is drawn i.i.d. from

$$v_{ik} = \begin{cases} v + s_k & \text{with probability 0.5;} \\ v - s_k & \text{with probability 0.5.} \end{cases}$$

Limited Attention (depth vs. breadth)

- Consumers randomly assigned to a firm k and learn (p_k, s_k) .
- Consumers need to learn a firm's price to buy its product.

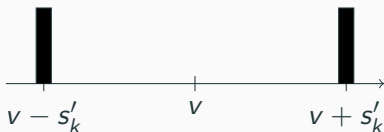
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- Consumers need to learn a firm's price to buy its product.
- Consumers can
 - either learn match value v_{ik} ,
 - or learn price p_{-k} of the other product.

- Firm $k = 1, 2$ with zero marginal cost chooses price p_k and match value design $s_k \in [0, \bar{s}]$.
- Firms cannot condition prices on v_{ik} .
- A lower s_k corresponds to a mass-market design;




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- A lower s_k corresponds to a mass-market design; a higher s_k to a niche design.



- The **design** affects dispersion of **match values** (Johnson and Myatt 2006). More dispersion can stand for
 - more **precise info**, e.g. via ads, sales force, website etc. [more](#)
 - **product design** for niche audiences.
 - making taste-based features more **salient** than quality.

Timeline



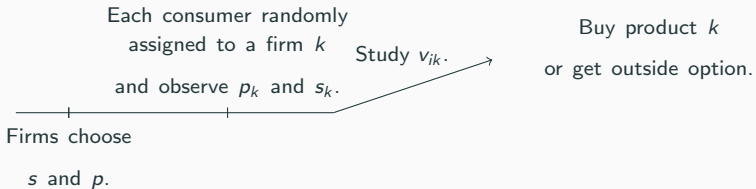
Firms choose
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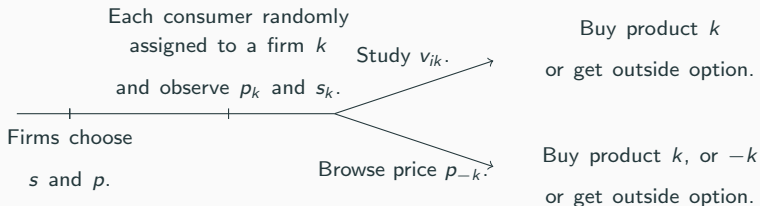
Each consumer randomly
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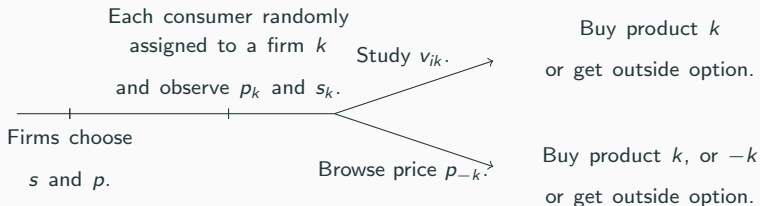
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- In generalization: outside option is continue searching

- Symmetric Perfect Bayesian Equilibrium.
- Equilibrium-selection assumption:
 - When bargain shoppers are indifferent between browsing prices and studying match values, some arbitrarily small share browses prices.
- Focus on the case where

$$\bar{s} > v$$

$$\bar{s} \in \left(v(2 - \alpha) \left[\frac{1}{\alpha} - \frac{1}{2} \log \left(\frac{4 - \alpha}{2 - \alpha} \right) \right], v \frac{(4 - 3\alpha)}{\alpha} \right).$$

Consumer Search Decision

Consumers' trade off

- Consumer assigned to firm 1 observing p_1, s_1 , and take a distribution $G(p_2)$ of firm 2.

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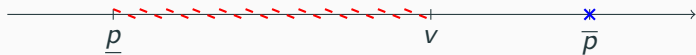
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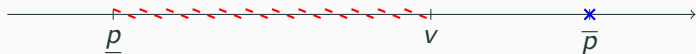
Equilibrium

Equilibrium characterization



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value shoppers study
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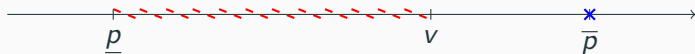
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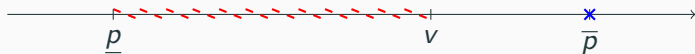
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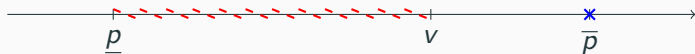
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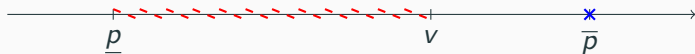
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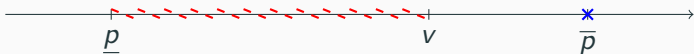
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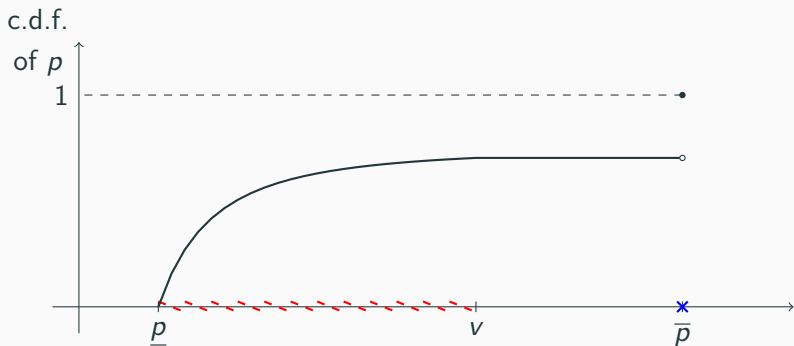


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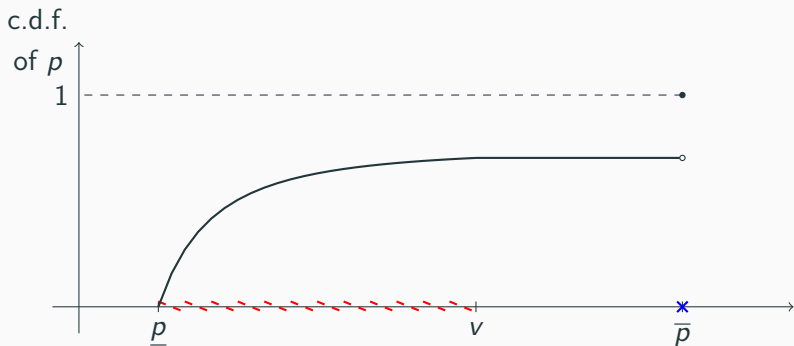
Comparative Statics and Surplus Analysis

- Larger \bar{s} can capture
 - More niche designs. (deregulation, innovation, etc)
 - More precise product info. (e.g. new ad technology, disclosure requirements, etc)

More-detailed product info raise prices

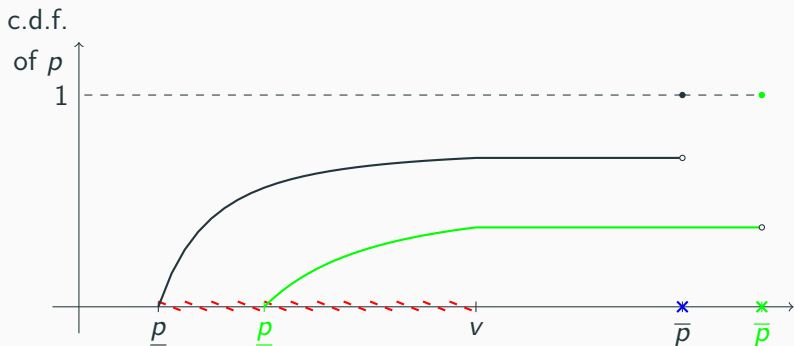


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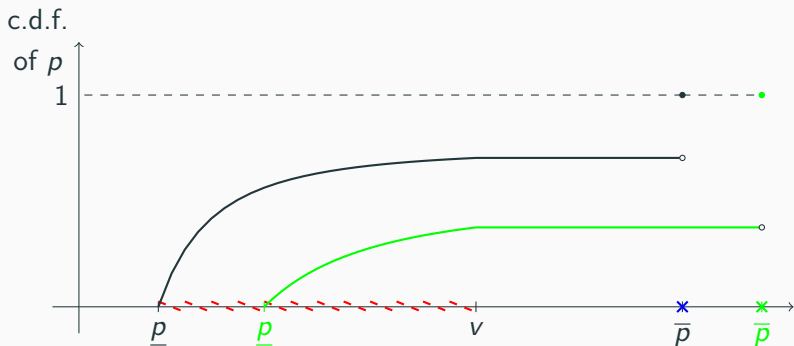
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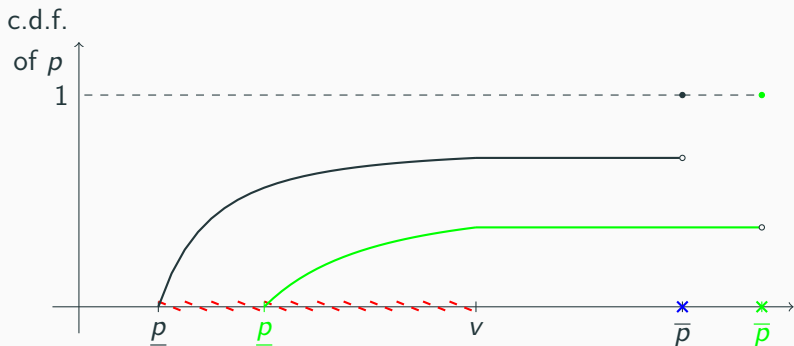
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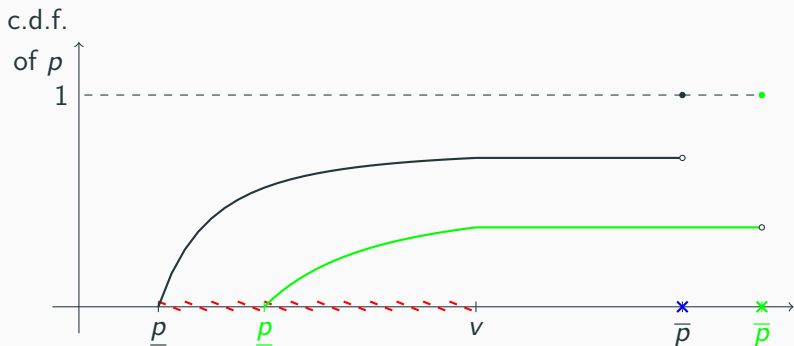
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- A larger \bar{s} raises prices in a FOSD sense.
- Reinforce distraction effect:
 - Distract consumers more effectively from browsing. \Rightarrow raise prices.
- **Result:** More-precise info reduce competition.

More info reduce consumer surplus - Only with Limited Attention

- Consider again an increase in \bar{s} .

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Result: Coarser info benefits consumers.

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 - Need scarce attention to distract consumers.

Result: To exploit the distraction effect, firms offer detailed and obfuscated product info.

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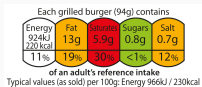
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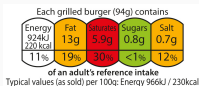
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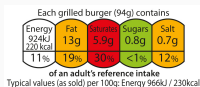
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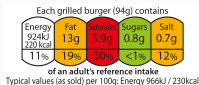




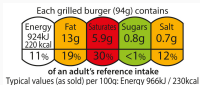
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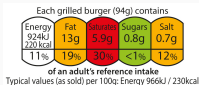
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 - Consumers focus less on nutrition tables.
- Lobby for labels with more-detailed info.
 - Julia et al. (2018a,b)

Extensions

- Brand proliferation to distract consumers. [details](#)
- More firms and search multiple attributes. [details](#)
- Larger parameter range. [details](#)
- Continuous match-value distribution.

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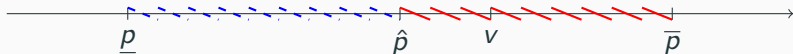
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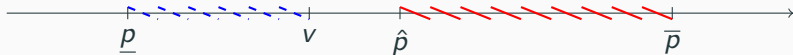
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- **Result:** Brand proliferation to distract consumers. Congest attention with varieties to distract consumers from price comparison.

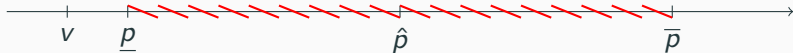
Larger parameter range



(a) $\frac{1}{2}$ -study equilibrium.



(b) $\lambda > \frac{1}{2}$ -study equilibrium.



(c) All-study equilibrium.

Figure 2: Red: Study & Blue: Browse

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- In this equilibrium, consumers who draw a mismatch may search on.

Continuous match value distribution

$$E_{F_s}(v) = \mu > 0 \quad \text{for all } s.$$

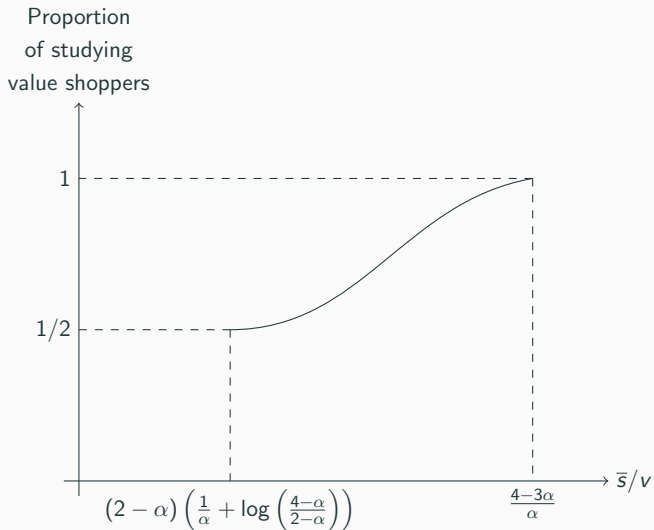
$$\frac{\partial F_s(v)}{\partial s} \begin{matrix} \leq \\ \geq \end{matrix} 0 \quad \text{if and only if} \quad v \begin{matrix} \geq \\ \leq \end{matrix} \mu. \quad (1)$$

$$F_0(v) = 1 \quad \text{if and only if} \quad v \geq \mu.$$

Thus, increasing s inducing a mean preserving spread on the distribution of v .

$$\begin{aligned} p(1 - F_s(p)) &\text{ is strictly quasi-concave in } p, \text{ and;} \\ p \max_s (1 - F_s(p)) &\text{ is strictly quasi-concave in } p. \end{aligned} \quad (2)$$

Proportion of studying consumers



Firms' profit and consumers' welfare

Firms' profit:

$$\frac{\alpha}{4}\bar{p}$$

Equal-profit condition for $p \leq v$:

$$\left[\left(\frac{\alpha}{2} + (1 - \alpha) \right) (1 - G(p)) + \frac{\alpha}{2} (G(v) - G(p)) \right] p = \frac{\alpha}{4} \bar{p}$$

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$$1 - G(p) = \frac{\alpha \bar{p} + 2(1 - G(v))p}{4p}$$

$$1 - G(v) = \frac{\alpha}{2(2 - \alpha)} \frac{\bar{p}}{v}$$

$1 - G(p)$ increases in the sense of F.O.S.D. in \bar{p} .

Firms' profit and consumers' welfare

Bargain shoppers' welfare:

$$\int_{\underline{p}}^v \left[\int_{\underline{p}}^{p'} (v - p)g(p) dp + (v - p)g(p)(1 - G(p)) \right] dp'$$

Value shoppers' welfare:

$$(1 - G(v)) \int_{\underline{p}}^v (v - p)g(p) dp + \int_{\underline{p}}^v \left[\int_{\underline{p}}^{p'} (v - p)g(p) dp + (v - p)g(p)(1 - G(p)) \right] dp'$$

Back

A more “general” product/information design technology

- v_{ik} continuously distributed in $[\underline{v}, \bar{v}]$ according to F_s where $\underline{v} < 0$.

-

$$E_{F_s}(v) = \mu \quad \text{for all } s.$$

$$\frac{\partial F_s(v)}{\partial s} \begin{matrix} \leq \\ > \end{matrix} 0 \quad \text{if and only if} \quad v \begin{matrix} \geq \\ < \end{matrix} \mu. \quad (3)$$

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$$\begin{aligned} p(1 - F_s(p)) &\text{ is strictly quasi-concave, and;} \\ p \max_s (1 - F_s(p)) &\text{ is strictly quasi-concave.} \end{aligned} \quad (4)$$

Micro-foundation of information disclosure

- Suppose \tilde{v}_{ik} follows $U[0, 1]$.
- Consider a truth-or-noise signal which tells consumers whether their match value is bigger or smaller than the mean with probability ξ , and send a completely random signal with probability $1 - \xi$.
- Denote $\Delta = E_F(\tilde{v}_{ik} - \frac{1}{2} | \tilde{v}_{ik} > \frac{1}{2})$.
- Upon receiving a good signal, the expectation of \tilde{v}_{ik} is:

$$\xi\left(\frac{1}{2} + \Delta\right) + (1 - \xi)\frac{1}{2} = \frac{1}{2} + \xi\Delta$$

while upon receiving a bad signal, the expectation of \tilde{v}_{ik} is:

$$\xi\left(\frac{1}{2} - \Delta\right) + (1 - \xi)\frac{1}{2} = \frac{1}{2} - \xi\Delta$$

Equilibrium Proposition

Proposition

In equilibrium, prices are distributed in $[\underline{p}, v] \cup \{\bar{p}\}$ with no gaps and mass points in $[\underline{p}, v]$. Value shoppers study match value for high price \bar{p} and browse for low price $p \in [\underline{p}, v]$; bargain shoppers browse prices with probability 1.

Corollary

In equilibrium, firms mix $(p, s(p))$ where $s(p) \in S_p$ where S_p follows:

- $S_p = \{\bar{s}\}$ for $p = \bar{p}$ that value shoppers study;
- $S_p = [0, s_p)$ for $p \in [\underline{p}, v]$ such that value shoppers browse.

where s_p is the threshold such that value shoppers are indifferent between studying and browsing.