Search, Design, and Market Structure

Heski Bar-Isaac, Guillermo Caruana and Vicente Cuñat

NYU Stern, CEMFI and LSE

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Bottom Line

As it becomes easier for consumers to find quirky stuff that they will love, more firms will provide such quirky stuff (or information that allows people to figure out that they love it or not).
This has equilibrium effects on profits and sales distributions.

Motivation: The effect of the Internet

- Lower search costs were expected to lead to harsher competition and lower profits
- What do the empirical studies show? On sales:
  - **Long tail:** Anderson (2004,6,9), Brynjolfsson, Hu and Smith (2006) etc.
  - **Superstars:** , Goldmanis, Hortacsu, Onsel and Syversson (2010)
  - **Both?** Elberse and Oberholzer-Gee (2006), Tucker and Zhang (2007), Oestreicher-Singer and Sundararajan (2008)
- Radical changes to existing industries/new industries?
  - book publishing, eBay stores

Long tails AND superstars??

"Both the hits and the tail are doing well," says Jeff Bewkes, the head of Time Warner, an American media giant. Audiences are at once fragmenting into niches and consolidating around blockbusters. Of course, media consumption has not risen much over the years, so something must be losing out. That something is the almost but not quite popular content that occupies the middle ground between blockbusters and niches. The stuff that people used to watch or listen to largely because there was little else on is increasingly being ignored. The Economist, November 24, 2009

Search and Design

- Standard search model, random sequential search to obtain price-quotes and learn match realizations
  - Ceteris paribus, lower search costs lead to lower prices
- Model introduces firm design choices
  - marketing/information
  - type of product ranging from broad (lowest common denominator) to niche (very specialized)
- Search costs affect pricing but also product variety

Niche and Broad Designs

broad design

niche design

Results and Contributions

- Modelling contribution
  - Bring together models of search and models of design/information provision
  - design in a search model/competition in design model
- Characterization of Equilibrium
  - Prevalence and coexistence of very different design strategies
  - "Low-type" firms specialize, "high-type" firms go mass-market
- Comparative Statics
  - Profits and prices can be non-monotonic in search costs
  - Model delivers **coexistence** of long-tail and superstar effects

Model

- Continuum of firms of measure 1, endowed with a production technology $v \sim H(\cdot)$ on V.
- Continuum of consumers of measure m.
- Consumer l when consuming good from firm i at price p_i gains utility (not including any search costs)

$$u_{li}(p_i) = v_i + \varepsilon_{li} - p_i$$

  where $\varepsilon_{li} \sim F_s(.)$ is the value of the firm-consumer specific match and is i.i.d. across l and i.
- The cost of visiting an additional firm is $c > 0$
- If consumer l buys product i at price p_i after visiting k firms she gets

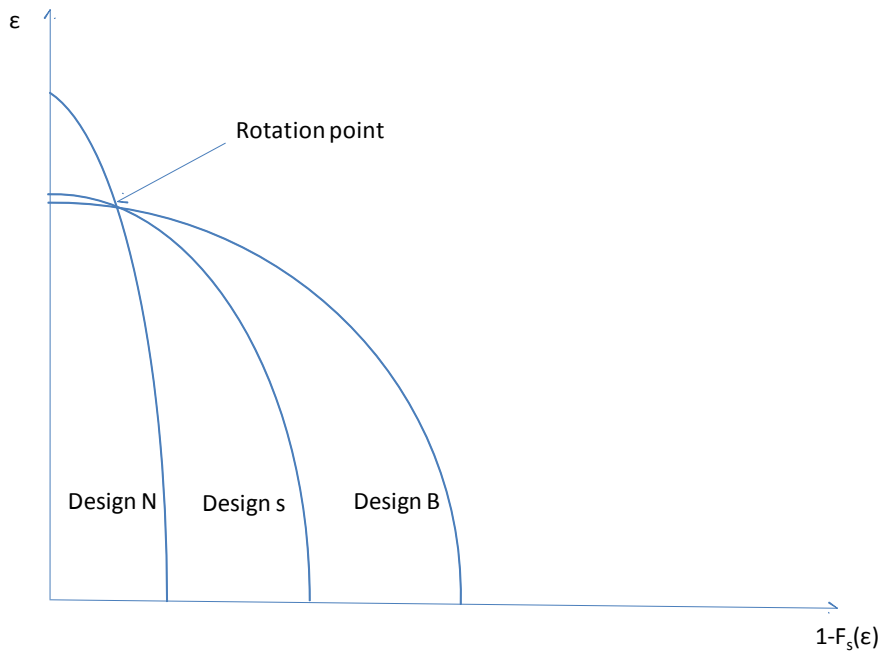
$$u_{li}(p_i) - kc,$$

Firm Strategy

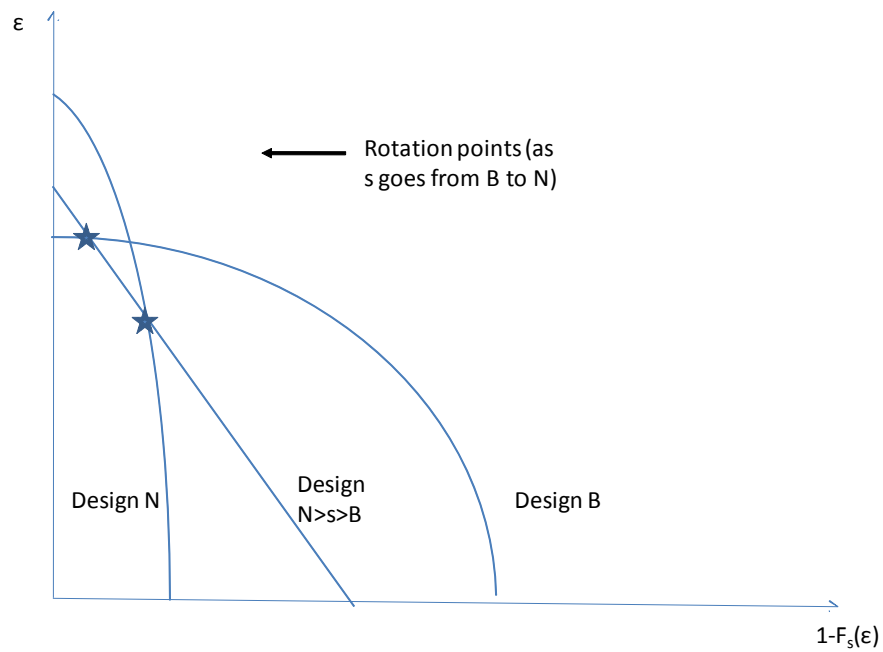
- A firm's strategy: Each v chooses a price p and a design $s \in [B, N]$
  - $\sigma : V \longrightarrow \Delta(\mathbb{R} \times [B, N])$
- Design *a la* Johnson and Myatt (2006):
  - $F_s(.)$ has support on some interval $(\underline{\theta}_s, \overline{\theta}_s)$ is continuously differentiable and the distribution has logconcave densities $f_s(\theta)$
  - $\forall s \; \exists$ a rotation point $\theta_s^\dagger$ such that $\frac{\partial F_s(\theta)}{\partial s} < 0$ for $\theta > \theta_s^\dagger$ and $\frac{\partial F_s(\theta)}{\partial s} > 0$ for $\theta < \theta_s^\dagger$; further $\theta_s^\dagger$ is increasing in s
  - interpretation as physical design or information (then restrict to mean-preserving spread)

Demand Rotations

single rotation point



differing rotation points



Consumer Strategy

- Consumer strategy: choose whether or not to continue search, choose whether or not to buy
  - Note that with a continuum firms, irrelevant whether or not consumers hold onto previous offers
- Optimal stopping rule U: a consumer continues searching until he finds an offer such that $v - p + \varepsilon \geq U$

Equilibrium

We look for Nash Equilibria in consumer and firm strategies

- There is always a class of boring equilibria, firms charging high prices and design irrelevant
- Optimal for firm to choose either a broad ($s = B$) or niche ($s = N$)
- Can characterize firm behaviour by an indifferent firm V between the two design strategies
  - firms with $v < V$ choose niche and $v > V$ choose broad

Equilibria with degenerate design

- Can characterize c_B such that if $c > c_B$ then all firms choose broad design
- Can characterize c_N such that if $c < c_N$ then all firms choose niche design
- In these cases, then when c goes down:
  - Consumer surplus U goes up
  - Prices and profits go down
- When $c_N < c_B$ then there must be co-existence of different designs in equilibrium.

Superstars and Longtails

Definition

We say that a *superstar effect* is present if the firm with the highest sales captures an increasing market share as search costs fall.

Definition

We say that a *long tail effect* is present if the firm with the lowest sales captures an increasing market share as search costs fall.

Uniformly Distributed Firms and Linear Demands

- Niche and Broad demand curves are linear
  - $\varepsilon_N \sim U[\underline{\theta}_N, \overline{\theta}_N]$.
  - $\varepsilon_B \sim U[\underline{\theta}_B, \overline{\theta}_B]$.
- Uniformly distributed firm types $v \sim U[L, H]$.

Comparative Statics

Proposition

Under the assumptions above, when all firms are active then

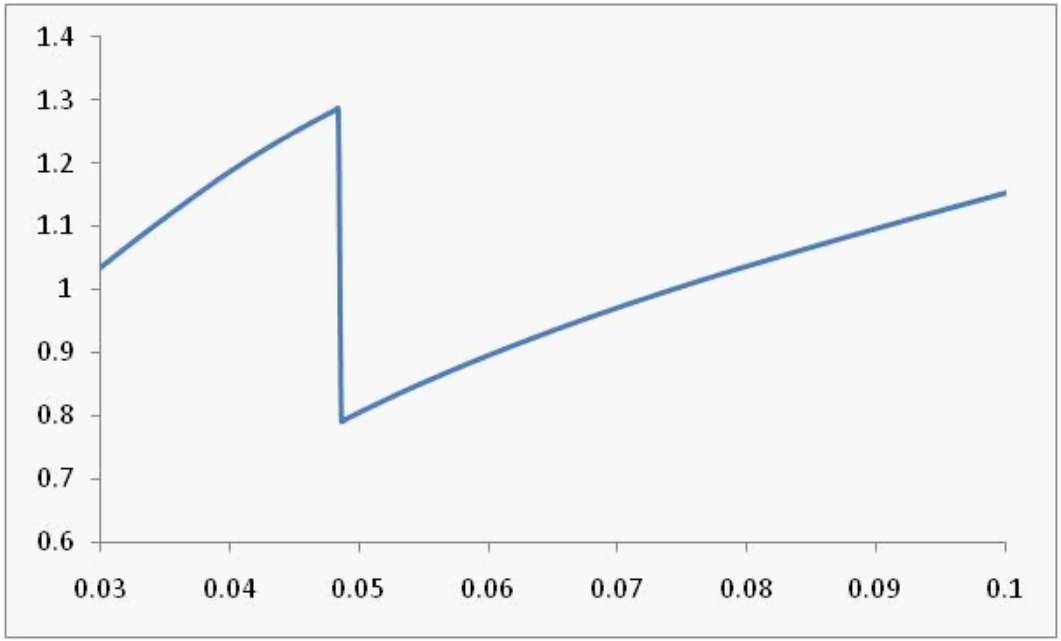
1. *There is a unique equilibrium (U, V) for each search cost c. When different firms choose different design strategies then as the search cost decreases*
2. *Consumer surplus (U) increases*
3. *There are more niche firms (V increases);*
4. *Profits of the highest and lowest quality firms increase if and only if $\overline{\theta}_N - \overline{\theta}_B > H - L$;*
5. *The superstar effect arises; and,*
6. *The long tail effect can, but need not, arise; a sufficient condition for the long tail effect to arise is $\overline{\theta}_N - \overline{\theta}_B > H - L$.*

Example

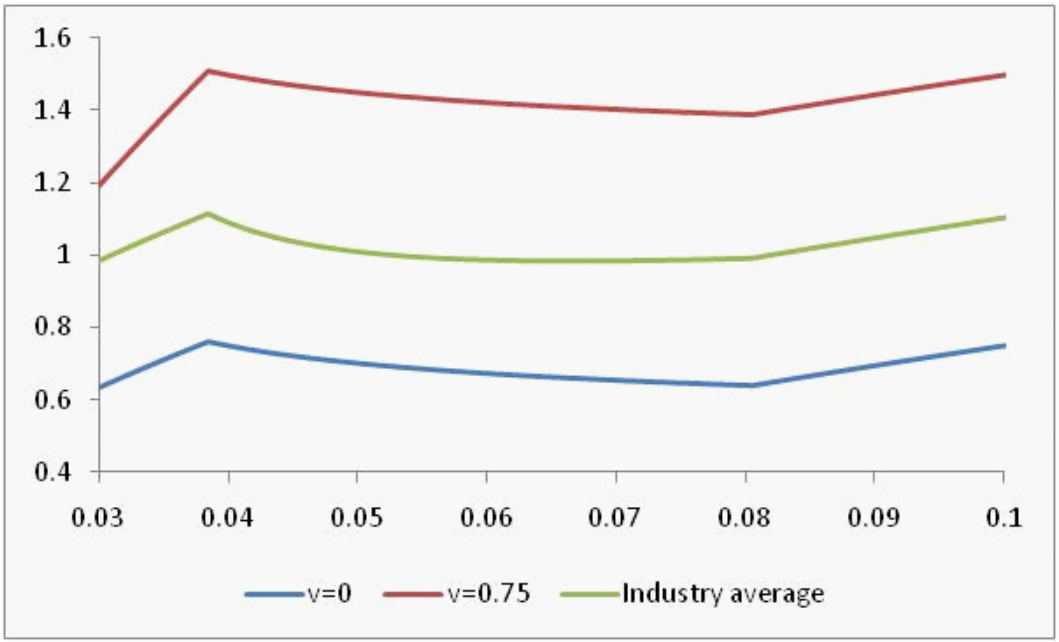
- Linear demands
  - niche distribution uniform on $[-12, 4]$
  - broad distribution uniform on $[-3, 3]$
- Types uniformly distributed on $[0, 0.75]$

Prices against search costs

For a given firm at $v = 0.5$



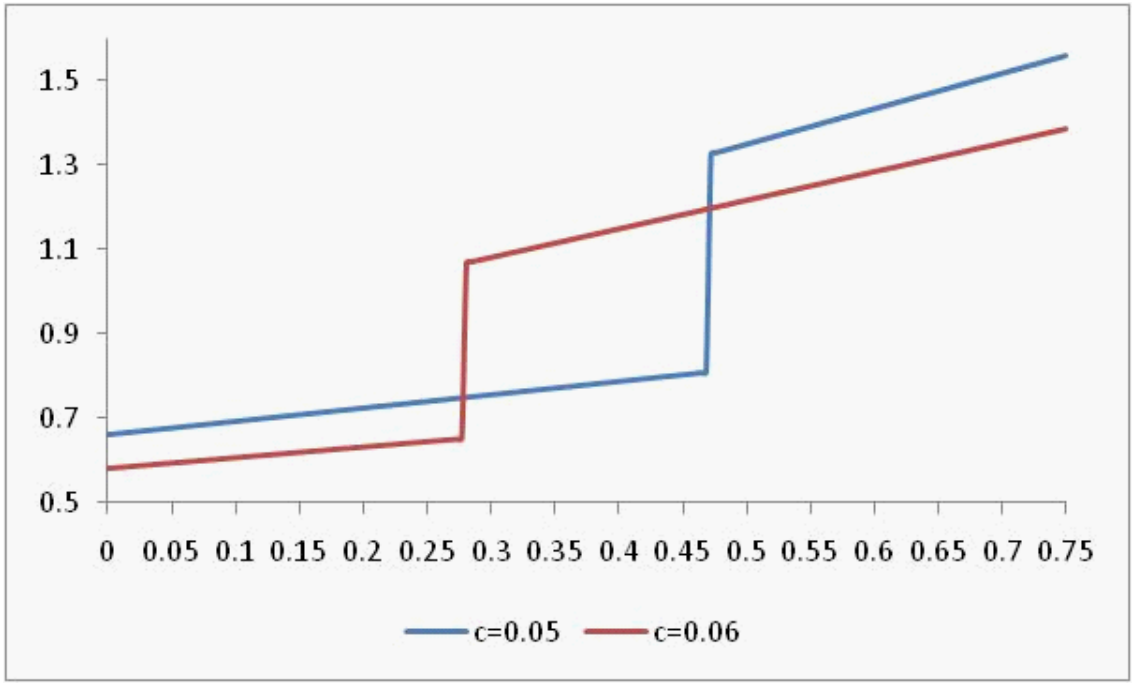
Profits against search costs



Note: We consider a fixed number of firms. We could allow free entry, then average profits would be zero and the number of firms would vary non-monotically in search costs.

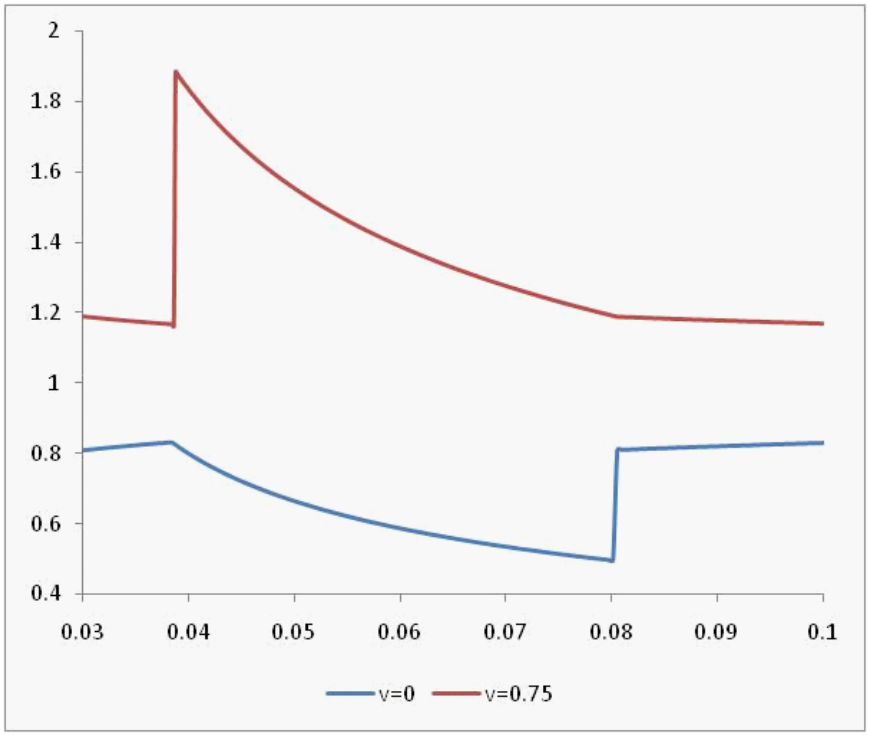
Sales against quality

Sales against quality (v) at two different search costs ($c = 0.05$ and $c = 0.06$).



- long tail and superstar effects; disappearing middle

Market share against search costs for highest and lowest firms



- superstar effects everywhere but at a single point
- longtail effects at intermediate range

Conclusions

- Simple and tractable model that integrates consumer search and firms' strategic price and product design choices.
- Search costs affect product design
- Prevalence and coexistence of very different design strategies, with rich price and sale distributions
- Firms with better technologies will tend to adopt broader strategies
- Prices and profits may be non-monotonic in search costs
- Long tail and superstar effects
- Vertical differentiation vs product designs changes bringing horizontal differentiation important for which way results go
- Paper also provides a full characterization and shows similar results when all firms are ex-ante homogeneous