Consumer Search and Shopping Malls

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Motivation

- Practice
  - In many markets firms concentrate in large marketplaces despite tough competition
    - Souvenir sellers in San Francisco.
    - Internet retailers on eBay, Amazon, etc.
- Theory
  - Ordered consumer search models, e.g. (Zhou, IJIO 2011) assume exogenous search order. This paper endogenises it with marketplaces of different sizes.
  - Shopping mall literature, e.g. (Dudey, AER 1990) and (Fischer and Harrington Jr., RAND 1996), predict that all firms will end up in the same location. Yet, malls of different sizes coexist.

This Paper

- We consider a general model of search with an arbitrary number of marketplaces of arbitrary sizes.
- There is a positive search friction between the marketplaces, but zero within (can be generalized to sufficiently small cost).
- Consumers might go back costlessly without sampling all the marketplaces.
- We look for an equilibrium in which consumers go to larger malls first, and then use a stopping rule to decide whether to visit smaller malls.
- Larger malls provide larger variety, and in equilibrium charge lower prices. This equilibrium is robust to any market configuration.

Timeline

0. Location game: discussion section.
1. Firms simultaneously set prices.
2. Consumers search for the optimal price and match.
3. Payoffs are realized.

Players and Market Configuration

Unit mass of Consumers

- Consumer i has unit demand, searches for price and match, obtains utility
$$U_i = u_{ij} - p_j$$
when buys from firm j.
- Match values u_{ij} are independently and uniformly distributed on $[0, 1]$, outside option is zero.

Firms:

- Sell a differentiated product, compete in prices, have zero production cost.

Market Configuration (exogenous):

- Shopping malls of sizes $N_1 > N_2 > \ldots > N_K$.
- Every cohort k has M_k malls of size N_k.

Optimal Search Rule

- When facing a mall with N_k firms, consumer is indifferent if

$$\int_{a_k}^{1} (u - a_k) N_k u^{N_k - 1} du = s,$$

where a_k is reservation surplus level.

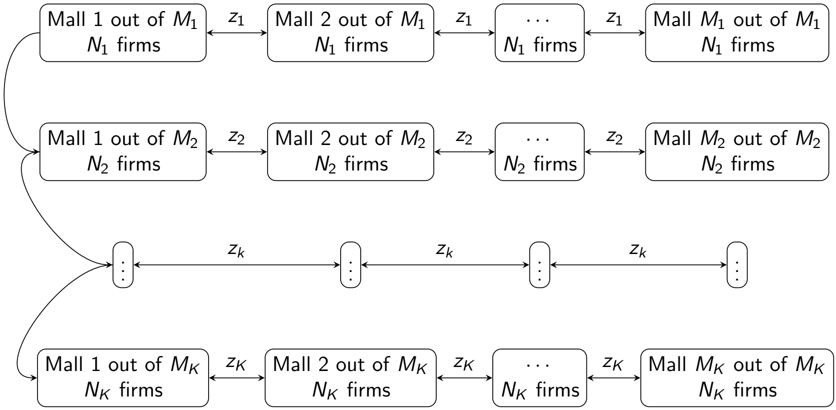
- Define reservation utility level as

$$z_k = a_k - p_k^e,$$

where p_k^e is expected price in cohort k.

- Note that z_k is decreasing because a_k is decreasing and expected prices are increasing in mall size.

Illustration



Proposition (Optimal Search Rule)

The optimal search rule is to start sampling from (one of) the marketplaces of size N_1. Suppose that after sampling several malls, the best sampled option gives utility $\overline{U}$ and there are L unsampled marketplaces with the reservation value z which is highest among remaining marketplaces. Then,

1. *if $\overline{U} < z$, sample one of these marketplaces with probability $1/L$;*
2. *if $\overline{U} \geq z$, buy at the firm which gives utility $\overline{U}$.*

Properties of Optimal Search

- Consumers search from largest malls to the smallest.
- Search across malls of the same size is random.
- Consumers never come back until they have searched all marketplaces of the same size: once they moved to a cohort of size N_k they are bound to either stop or to sample all M_k marketplaces.

Firms

- Let $\{p_i\}_{i=1}^{K}$ be equilibrium price sequence.
- Consider firm in cohort k, let it charge $\hat{p}_k$ instead.
- Firm maximizes profit

$$\pi_k(\hat{p}_k) = \hat{p}_k \cdot D(\hat{p}_k)$$

- In equilibrium, $\hat{p}_k = p_k$.

Demand

There are two sources of demand:

- Fresh demand: consumers who came to the mall, and immediately bought from this firm:

$$\prod_{j\leq k-1}(z_k+p_j)^{N_jM_j}\times\frac{1}{M_k}\sum_{j=1}^{M_k}(z_k+p_k)^{(j-1)N_k}$$
$$\times\int_{z_k+\hat{p}_k}^{1}(\min\{u-\hat{p}_k+p_k,1\})^{N_k-1}du.$$

- Returning demand: consumers who walked away but then came back:

$$\sum_{i=k}^{K}\int_{z_{i+1}}^{z_i}\left[\prod_{j\leq i,j\neq k}(u+p_j)^{N_jM_j}\right](u+p_k)^{N_kM_k-1}du$$

Equilibrium

Theorem (Equilibrium)

There exists a market equilibrium, in which each firm in cohort k sets a price such that $p_k \in \left[\frac{1-a_k^{N_k}}{N_k}, \frac{1-a_k^{N_k}}{N_k}\frac{1}{1-a_k}\right] \subset \left[0, \frac{1}{2}a_k\right]$*. In this equilibrium, prices are increasing with cohort number, and consumers follow the stopping strategy defined in Optimal Search Rule Proposition.*

Proposition (Profits)

In this equilibrium firms at larger marketplaces obtain higher profits, i.e. $\pi_i > \pi_j$ *for* $1 \leq i < j \leq K$.

Equilibrium: Discussion

There are three forces ensuring the optimality of the stopping rule:

1. Larger variety in large marketplaces.
2. Lower prices in large marketplaces due to stronger competition.
3. Lower prices in large marketplaces due to more elastic demand (more options to be searched later).

The presence of these forces is not sufficient for the uniqueness of our equilibrium, however, it is the only "robust" one.

Proposition (Robustness)

For any $s > 0$ there exists a market configuration such that there is no equilibria in which smaller marketplaces are sampled before the larger ones.

Comparative statics

Proposition (Comparative Statics)

For all $k, l \leq K$ the equilibrium price p_k increases in s, and decreases in N_l and M_l.

Limit results:

$$\lim_{N_k \to \infty} p_k = 0, \qquad \lim_{M_k \to \infty} p_k \neq 0$$

Price is bounded away from zero in some cases even if total number of firms goes to infinity!

Market structure is crucial.

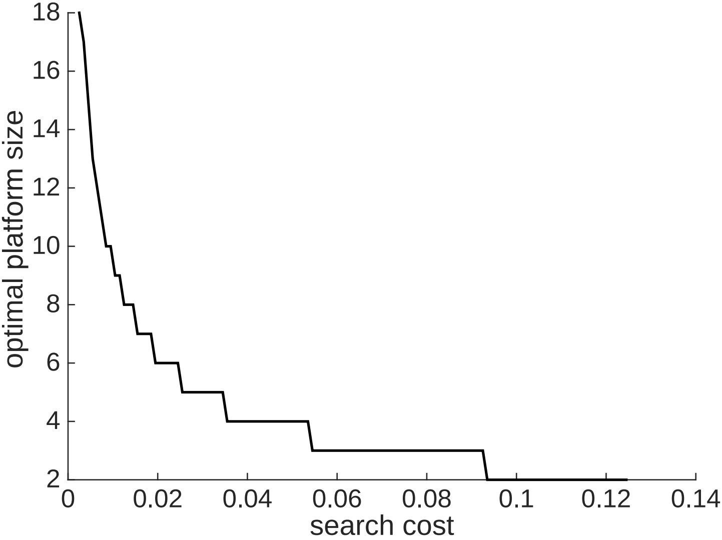
Platforms

- Suppose there is one platform (shopping mall) with N firms, and M stand-alone firms.
- SA firm earns $\pi^{SA}(N, M)$, it could earn $\pi^{Platform}(N+1, M-1)$ if it decides to join the platform.
- Then, the platform can charge $\pi^{Platform}(N, M) - \pi^{SA}(N-1, M+1)$ for each of the retail spaces.
- Equilibrium total profit of the platform is then

$$\Pi^{Platform} = N[\pi^{Platform}(N, M) - \pi^{SA}(N-1, M+1)].$$

- What is the optimal size of the platform?

Optimal Platform Size



Conclusion

- We have a general model of consumer search with marketplaces of different sizes.
- We show that there is an equilibrium in which consumers search from largest marketplaces to the smallest ones.
- This is the only robust equilibrium.
- Firms in large malls set lower prices, but earn higher profits.
- If the mall can sell retail space, it wants to be large for small search costs and small for large search costs.