Search markets: Introduction

Caltech

Ec106

Why are prices for the same item so different across stores?

(see evidence)

A puzzle considering basic economic theory: review this.

Consider the benchmark of *perfect competition*

Review: perfect competition

The perfectly competitive firm is a **price taker**: it cannot influence the price that is paid for its product.

This arises due to consumers' indifference between the products of competing firms $\Longrightarrow$ for example, buy from store with lowest price. Consumers' indifference arises from:

- Product homogeneity
- No transactions cost
- Many firms
- *Consumers have perfect information* (relax this later)

PC firm faces horizontal demand curve at market price p

PC firm's profit maximization problem

- $\max_q \pi(p) = pq - C(q)$
- First-order condition: $p = C'(q) = MC(q)$
- Second-order condition: $C''(q) > 0$, satisfied if MC(q) is an increasing function
- If $p \uparrow$, production rises along MC(q) curve: MC(q) is the "supply curve" of the firm.

The perfectly-competitive industry: Short run

In the **short run**:

- Number of firms fixed
- Industry supply curve: sum of individual firms' supply curves. Zero supply at prices below shutdown point. Graph.
- Industry demand curve: downward sloping. Graph.
- Price determined by intersection of industry demand and supply curves. Graph.
- In short-run equilibrium: positive profits for each firm as long as $p > AC(q)$.

The perfectly competitive industry: Long-run

- Number of firms can vary
- **Free entry and exit:**
  Any short-run profits soaked up by new firms in long-run $\Longrightarrow$ Price is driven down to the minimum of the AC curve
- Long-run industry supply curve: horizontal at minimum of the average cost curve

Leaving the PC world

One important implicit assumption of PC paradigm is that consumers are aware of prices at all stores. This implies an infinitely elastic demand curve facing firms. (ie. if one firm raises prices slightly, he will lose all demand).

Obviously, this assumption is not realistic. Here we consider what happens, if we relax just this assumption, but maintain other assumptions of PC paradigm: large #firms, perfect substitutes, etc.

Search model

- Each consumer demands *one* unit;
- Starts out at one store, incurs cost $c > 0$ to search at any other store.
- Consumer only knows prices at stores that she has been to, and buys from the canvassed store with the lowest price. "free recall"
- Utility u from purchasing product: demand function is

$$\begin{cases} \text{purchase if } p \leq u \\ \text{don't purchase otherwise} \end{cases} \tag{1}$$

- What is equilibrium in this market?

Diamond paradox

- Claim: a nonzero search cost $c > 0$ leads to equilibrium price equal to u ("monopoly price")
- Assume that marginal cost=0, so that under PC, $p = 0$
- n firms, with n large. Consumers equally distributed initially among all firms.
- Start out with all firms at PC outcome. What happens if one firm deviates, and charges some p^1 such that $0 < p^1 < c$?
  - Consumers at this store?
  - Consumers at other stores?
  - How will other stores respond?
  - By iterating this reasoning ....

Now start at “monopoly outcome”, where all firms are charging u.

- What are consumers’ purchase rules?
- Do firms want to undercut? Given consumer behavior, what do they gain?
- Role for advertising?
- P. Diamond (1971), “A Theory of Price Adjustment”, *Journal of Economic Theory*

Remarks

- Diamond result quite astounding, since it suggests PC result is "knife-edge" case.
- But still doesn't explain price *dispersion*
- Assume consumers differ in search costs
- Two types of consumers: "natives" are perfectly informed about prices, but "tourists" are not.

Tourist-natives model

- Tourists and natives, in proportions $1-\alpha$ and α. L total consumers (so αL natives, and $(1-\alpha)L$ tourists).
- Tourists buy one unit as long as $p \leq u$, but natives always shop at the cheapest store.
- Each of n identical firms has U-shaped AC curve
- Each firm gets equal number of tourists $\left(\frac{(1-\alpha)L}{n}\right)$; natives always go to cheapest store.
- Consider world in which all firms start by setting $p^c = \min_q AC(q)$.
- Note that deviant store always wants to price *higher*. Demand curve for a deviant firm is kinked (graph). Deviant firm sells exclusively to tourists.

Deviant firm will always charge u. Only tourists shop at this store. If charge above u, no demand. If below u, then profits increase by charing u.

First case: many informed consumers (α large)

- Number $q^u \equiv \frac{(1-\alpha)L}{n}$ of tourists at each store so small that $u < AC(q^u)$.
- In free-entry equilibrium, then, all firms charge p^c, and produce the same quantity L/n.
- If enough informed consumers, competitive equilibrium can obtain (not surprising)

Second case: few informed consumers (α small)

- Assume enough tourists so that $u > AC(q^u)$.
- But now: hi-price firms making positive profits, while lo-price firms making (at most) zero profits. Not stable.
- In order to have equilibrium: ensure that given a set of high-price firms (charing u) and low-price firms (charging p^c), no individual firm wants to deviate. Free entry ensures this.
- Let β denote proportion of lo-price firms.
- Each high-price firm charges u and sells an amount

$$q^u = \frac{(1-\alpha)L(1-\beta)}{n(1-\beta)} = \frac{(1-\alpha)L}{n} \tag{2}$$

- Each low-price firm charges p^c and sells

$$q^c = \frac{\alpha L + (1-\alpha)L\beta}{n\beta} \tag{3}$$

- In equilibrium, enough firms of each type enter such that each firm makes zero profits. Define quantities q^a, q^A such that (graph):

$$AC(q^a) = u; \quad AC(q^c) = p^c.$$

(Quantities at which both hi- and lo-price firms make zero profits.)

- With free entry, n and β must satisfy

$$q^a = q^u = \frac{(1-\alpha)L}{n} AC(q^c); \quad q^A = q^c \frac{\alpha L + (1-\alpha)L\beta}{n\beta} \tag{4}$$

- Solving the two equations for n and β yields

$$n = \frac{(1-\alpha)L}{q^a}; \quad \beta = \frac{\alpha q^a}{(1-\alpha)(q^A - q^a)} \tag{5}$$

- N.B: arbitrary which firms become high or low price. Doesn't specify process whereby price dispersion develops.
- As $\alpha \to 0$, then $\beta \to 0$ (Diamond result)

Summary

- Price dispersion for homogeneous good a puzzle
- Benchmark: perfectly competitive industry
- Add in search costs: Diamond result
- Price dispersion can arise with heterogeneity in search costs.