Search

- what differentiates one company's cell phone (or credit card) from another?
- Limited information, costly search can lead to markups

- N firms
- Constant $MC = c$
- Continuum of consumers, each having dmd $D(p)$
- assume $(p-c)D(p)$ concave with monopoly price p^m

Stage 1:

- Firms choose $p_1, \dots, p_N$

Stage 2:

- Consumers search optimally, then buy
- Cost s per quote

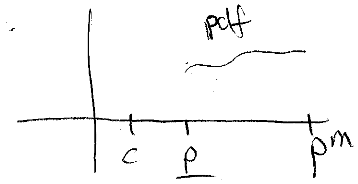
Prop (Diamond 1971)

Suppose all consumers have cost of search $0 < s < CS(p^m)$. The unique PBE has $p_1^* = \dots = p_N^* = p^m$.

Proof: To see this is a PBE, suppose eq. strategies are $p_1^* = \dots = p_N^* = p^m$. Then consumers visit one firm and buy if $p \le p^m$. Given this, a price cut attracts no extra consumers. Thus, p^m is optimal.

- To see there are no other PBE, start with pure strategy PBE: $p_1^* \le p_2^* \le \ldots \le p_N^*$.
  If $p_1^* \ne p^m$, firm 1 can deviate to $\min\{p^m, p_1^* + \frac{s}{2D(p_1^*)}\}$.
  Claim: all consumers who visit firm 1 still buy. Max payoff if they don't is $CS(p_1^*) - s$.
  If ignore price increase and buy $D(p_1^*)$, then payoff is $CS(p_1^*) - \frac{s}{2D(p_1^*)} \cdot D(p_1^*) = CS(p_1^*) - \frac{s}{2}$
  If buy optimally $CS > CS(p_1^*) - \frac{s}{2} > CS(p_1^*) - s$.
  If $p_N^* > p^m$, firm N benefits from cutting p_N to p^m.
- Mixed equilibria with support $[\underline{p_i}, \overline{p_i}]$. Can't have $\overline{p_i} > p^m$ (always better off charging monopoly price.) Cannot have $\underline{p_i} < p^m$, because want to raise price to $\underline{p_i} + \frac{s}{2D(\underline{p_i})}$.

Prop (Stahl): Suppose a fraction μ of consumers have $s < 0$ and fraction $1-\mu$ have $0 < s < CS(p^m)$. Then a) The model has no pure strategy equilibrium and b) there exists a symmetric mixed strategy equilibrium where firms choose prices from some atomless distribution F with support not containing c.



Pf: For part a), suppose $p_1^* \leq p_2^* \leq \ldots \leq p_N^*$ is an equilibrium. Then can find deviation:

e.g.: ◦ Spse $p_1^* < p_2^*$ and $p_1^* < p^m$. Consider deviation by 1 to $\min\{p_1^* + \frac{s}{2D(p_1^*)}, p^m, p_2^* - \varepsilon\}$

◦ Spse $p_1^* < p_2^*$ and $p_1 > p^m$. Then firm 1 deviates to p^m

◦ Spse $p_1^* < p_2^*$ and $p_1 = p^m$. Then firm 2 deviates to p^m.

◦ Spse $p_1^* = p_2^* > c$. Then firm 1 deviates to $p_1^* - \varepsilon$ for some $\varepsilon > 0$. Capture the entire mkt of $s < 0$ shoppers.

◦ Spse $p_1^* = p_2^* \leq c$. Then firm 1 deviates to $p_1^* + \varepsilon$.

For part b), general existence thms $\Rightarrow \exists$ a NE to firm pricing game. e.g. Dasgupta - Maskin.

◦ The support $[\underline{p}, \bar{p}]$ cannot contain c. If c is in support, profit must be zero, but we know that $\underline{p} \geq c$. This implies that charging $c + \frac{s}{2D(c)}$ gives positive profits

- There are no atoms. Suppose $\hat{p}$ is played with positive probability. Then,
  $E[\pi(\hat{p}-\varepsilon)] > E[\pi(\hat{p})] > E[\pi(\hat{p}+\delta)] \ \forall \delta \in [0, \bar{\delta}]$
  - Even without symmetry assumption, this result still holds.
- $\pi(\underline{p}) = D(\underline{p})[\mu + \frac{1-\mu}{N}](\underline{p} - c)$ (*) $\bar{p}$ must be s.t. all nonshoppers still buy at $\bar{p}$.
  - mixing $\Rightarrow \pi(p) = \pi(\underline{p}) \ \forall p \in [\underline{p}, \bar{p}]$
    $\Rightarrow \pi(p) = D(p)\left[\mu(1-F(p))^{N-1} + \frac{1-\mu}{N}\right](p-c)$
  - can solve for $F(p)$ point by point
  - find $\bar{p}$ by assuming that $F(\bar{p}) = 1$
    - Need to check that consumers at $\bar{p}$ are willing to buy and not strictly willing to buy.
      - ie there is no deviation to mixing on $[\underline{p}, \bar{p}+\varepsilon]$.

Sorensen: "Equilibrium Price Dispersion in Retail Markets for Prescription Drugs," JPE 2000

Retail prices for roughly 200 prescription drugs at all the pharmacies in two small New York towns: Middletown[10] and Newburgh.[11] ← \# pharmacies

Motivations: identical products; price poster; cross-drug heterogeneity in search costs

Findings: [1] Substantial price dispersion (range is \$13 on average) 10th %tile: \$5, 90th %tile: \$25.

[2] Dispersion is not a pharmacy effect.

[3] There is less dispersion for frequently purchased drugs. The range is 28% smaller for montly purchased vs. 1-time use.

[4] average markups lower for repeat purchase drugs.

- Markups were 37 percent lower for monthly vs. one-time use

[5] Drugs with unexpectedly low margins have unexpectedly low dispersion.

Second paper from other cities which includes quantity data.

Next class: Remaining starred articles in "search" section.