

Lecture 9 - Price Search

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This semester so far

- started with monopoly –provided a good benchmark for firm behavior but, obviously, incomplete description (firms are affected by and do react to rivals' actions)
- moved onto static competition and started with Bertrand –simple, reasonable set-up, crazy results in a sense, but did point out the important and strong forces of intense competition that firms must always deal with
 - Bertrand Paradox tells us that when firms have identical products, price competition can be very fierce
 - a number of critiques and limitations though:
 - * products are identical
 - * firms play 1-shot game
 - * everyone knows prices
- since then, we've been trying to modulate the Bertrand result, incorporating characteristics of markets that might soften competition and would allow firms to escape from the Bertrand Paradox
- Cournot can be interpreted as competition in capacities and then competition in prices, resulting in $p > mc$
- Hotelling shows how firms that are differentiated can charge $p > mc$, function of consumers' transportation costs
- when firms interact repeatedly with no end in sight, there are equilibria where $p > mc$, as high as $p = p^m$
- today: search –what if there is a positive cost to consumers to learn about prices that firms charge? how does that change the equilibrium of price competition games? We'll see that in the presence of price search, firms can charge above mc)
- we'll try to address the areas where none of the explanations so far seem too plausible but firms still are able to charge above mc : mattresses, electronics, long-distance telephones, credit cards, etc.
- of particular interest to those studying commerce –the internet was sort of a laboratory for what happens when cost of price search goes down.

Price Search**Model**

- N firms produce homogeneous goods
- constant, common mc and c
- continuum of consumers, each with $D(P)$

- assume $(P - c)D(P)$ concave (true for linear demand)
- firms simultaneously choose prices: P_1, \dots, P_N
- consumers then search optimally, getting some number of price quotes before stopping and purchasing $D(P)$ from the firm with the lowest price among those sampled

Proposition (Diamond, 1971)

- Diamond in 1971, first applied to search in labor markets, part of the reason he won the Nobel Prize
- if all consumers have cost c of obtaining a price quote with $0 < s < CS(P_m)$, then the unique NE is $P_1^* = P_2^* = \dots = P_N^* = P_m$

Proof

- this is NE:
 - if $P_1^* = \dots = P_N^*$, then optimally searching consumers will just obtain one price quote.
 - if a firm prices below P^m , they get no additional customers
 - if firm prices above P^m , they don't lose consumers to other firms but do lose sales and sees Π decrease
- this is unique:
 - assume without loss of generality that P_1^* is the lowest price.
 - if $P_1^* \neq P_m$, then firm 1 can deviate and change its price to $\min(P_1^* + \epsilon, P_m)$
 - any consumer who searches firm 1 will buy, as the possible gain from another price quote is less than or equal to $\frac{s}{2}$
 - so firm 1 sells to some number of consumers and makes more on each because $P_1^* + \epsilon < P^m$
 - if $P_1^* = P^m$ and some other firm is charging more, it will benefit from cutting price to P^m
- consider potential equilibrium \ni

$$P_1 < P^m \text{ is lowest price}$$
- does firm 1 want to deviate? can retain all of its customers and make more money if it charges $P_1 + \epsilon$ when ϵ is small enough relative to s that no search behavior changes. everyone who votes store 1 buys from it.
- consider potential equilibrium \in

$$P_N > P_m \text{ is highest price}$$
- does firm N want to deviate? can retain all of its customers and make more money if it charges $P_N - \epsilon$ and, in fact, could make more money still if it charges P^m and maybe even attract additional customers
 - if firm N had any customers, going to P^m makes it better off
 - if firm N had zero customers, then should charge $\min\{P_1, P^m\}$
- *Q.E.D.*

This seems like a very stark and surprising result –the mirror image of Bertrand. Introducing a minuscule search cost causes the market to flip from marginal cost pricing to monopoly pricing!

Recent experience

- my family and I decided to enter the 21st century and purchase smartphones with data plans.
- after exhaustive research (in which I did not participate) my family decided on the unlimited text, 1000 shared minutes of talk, 2GB data plan with HTC Sensation phone.
- costs:
 - Best Buy: \$75/phone, \$180/month
 - T-Mobile store: \$500/phone, \$110/month
 - Internet: \$200/phone, \$180/month
 - Target: \$100/phone, \$180/month
- even holding fixed the monthly fee, there's a wide range of prices for the phones!
- it takes a fair amount of time to search for each price quote –suspect search costs could be important in this market

More systematic empirical evidence (Baye, Morgan, & Scholten)

- look at 1000 consumer electronics products on shopper.com
- find evidence of very significant price dispersion
 - some search costs, not huge because internet makes search for these products easier
 - 10W, firms not all charging P^m
- idea of paper is to document situations characterized by relatively large and relatively small amounts of price dispersion
- # of firms listing prices affects dispersion:
 - 2 firms: 22% price “gap” (where “gap” is the difference between the lowest & second-lowest prices)
 - 17 firms: 3.5% price “gap”
- the dispersion does not go away over time.
- price dispersion is a ubiquitous feature of markets with costly price search.
- empirical evidence is not consistent with Diamond model
- also there is an unappealing feature of the Diamond model that prices do not go down as search costs go to zero –as long as there is a positive search cost of even a penny, everyone prices at P^m
- an important feature of markets with costly price search that is not capture in a diamond model is that some people love to hunt for bargains
- we can set up a model which has a fraction of consumers who love to shop (negative cost or positive utility) and that model has two appealing results:
 - price dispersion in equilibrium
 - overall price levels are a function of the search costs of those consumers that have positive search costs

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