Competition Policy

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Lecture 16
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Introduction

On Tuesday, basic theory of oligopoly

- Today we'll apply to main area of policy: merger control
  1. Stability in Cournot equilibrium and comparative statics
  2. Comparative statics in Cournot, benefit of entry
  3. How (Cournot) competition drives prices to cost
  4. More general ways competition drives price to cost
     - Empirical studies of effect of competition on prices
  5. Mergers in differentiated products industries
     - The concept of "Upward Pricing Pressure"
  6. Legal and institutional basis of merger policy
     - In the United States and around the world
  7. Other common approaches to merger analysis
  8. Challenges in merger policy going forward
     - As always, what is left out is most interesting...

Cournot stability

Recall that comparative statics go haywire if not stable

- What is stability in Cournot equilibrium?
- Well, recall our "reaction functions" from Thursday
- They crossed so that they converged:
  - Imagine q_j increases by small amount
  - How much does q_i rise (or fall)? R_i'
  - How much does this cause q_j to rise (or fall)? $R_i' R_j'$
  - When does this go nuts v. converge? $R_i' R_j' < 1$
- Luckily, second-order condition for monopoly enough
- So long as $MC' > MR'$ always stable
- Just make sure to check this when solving problem
- Other wise you get very silly comparative statics
  - One firm increasing production can lower total production!
- Same as in competitive equilibrium

Graph of Cournot instability

Comparative statics and quantity pass-through

One firm increasing production should always raise total

- But by how much?
  - If q_j increases, q_i changes by R_i'
  - Total change is $R_i' + 1$
  - This is the same for both firms, as symmetric
  - This number is called *quantity pass-through* ρ_q
    - Reason is that it is equal to pass-through from before ρ
    - I won't go through this, but we talked about it in Turbo
    - Stability is the same as $\rho_q < \frac{N}{N-1}$
  - What if there were three firms and one raised production?
    - Let total increase in production $\frac{dQ}{d\tilde{q}}$; each is $\frac{1}{2}\left(\frac{dQ}{d\tilde{q}} - 1\right)$
    - Must be consistent:
      $\frac{dQ}{d\tilde{q}} = \rho_q\left(1 + \frac{1}{2}\left(\frac{dQ}{d\tilde{q}} - 1\right)\right) \implies \left(1 - \frac{\rho_q}{2}\right)\frac{dQ}{d\tilde{q}} = \frac{\rho_q}{2}$
      $\implies \frac{dQ}{d\tilde{q}} = \frac{\rho_q}{2-\rho_q}$
    - More generally, with N other firms, $\frac{dQ}{d\tilde{q}} = \frac{\rho_q}{\frac{N}{N-1} - \rho_q}$

Effects of entry into Cournot equilibrium

Most important point is that this is always positive by stability

- If a new firm enters industry, raises production from 0
- How does this impact total production?
  - Must increase by argument above!
  - New firm produces some, must raise total production
- This increased production drives down the price
- Thus a new firm makes the industry more competitive
  - This is more general feature
  - As firms increase, industry more competitive

$\Longrightarrow$ Eventually, we get to perfect competition

- Let's consider a specific example

A mathematical example of Cournot's Theorem

Constant elasticity, symmetric, constant marginal cost

- We know each firm sets $P + q_i P' = c$
- $q_i = \frac{Q}{N}$ by symmetry so this is $P + \frac{P'Q}{N} = c$
- Convert this into elasticity?
  - $P\left(1 - \frac{1}{N\epsilon}\right) = c \implies \frac{P-c}{P} = \frac{1}{N\epsilon}$
  - General Cournot formula
- ϵ constant, so what happens as N increases?
  - RHS and thus mark-up driven to 0

$\implies$ As competition increases, price driven to cost

- And quantity becomes efficient

A second example of Cournot's Theorem

Just to hammer home the point, let's consider another example

- Let demand by $Q(p) = \sigma\left(1 - \frac{p}{2m}\right)$
- Then what is equilibrium equation?
  - $P = 2m\left(1 - \frac{Q}{\sigma}\right), P' = -\frac{2m}{\sigma}, q_i = \frac{Q}{N}$
  - $2m\left(1 - \frac{Q}{\sigma}\right) - \frac{2mQ}{N\sigma} = c \implies 2m\left(1 - \frac{(N+1)Q}{N\sigma}\right) = c$
  - $\frac{N+1}{N} \to 1$ so LHS $\to P$
- Again, as number of firms increase, price driven to cost

General formulation of Cournot's Theorem

This suggests more general result:

Cournot's Theorem

As the number of competing firms grow arbitrarily large, price converges to marginal cost.

One of the most fundamental results in economics

- Foundation of perfect competition
- Basis of most antitrust/competition policy

Holds much more broadly than examples above

1. Firms can have non-linear costs
2. Firms can be asymmetric, any demand that is stable
3. Demand can satisfy weaker regularity conditions
4. Key is just that everyone is small eventually
5. Fails only in silly/perverse cases, broader than Cournot

Entry with a distribution of costs

Suppose Bertrand competition, but distribution of costs c_i

- May represent Bertrand competition or auction
- Optimal prices $p_i \approx E[c_2|c_1 = c_i]$
  - I "bid" my guess of second bid, conditional on me winning
  - Exactly for inelastic demand, but lower with elastic
  - I won't go through proof, but pretty intuitive
  - I "just try to beat" the next guy
- As the number of firms grow, what happens?
  - Lots of firms near the lowest cost
  - Thus lots of firms close to lowest-cost firm

  $\Longrightarrow$ $E[c_2|c_1 = c_i] \to c_i$, $c_1 \to \underline{c}$, lowest cost
  - Thus price converges to lowest constant marginal cost
  - Intuitive, as more firms, I am less necessary

$\Longrightarrow$ As firms increase, again price to lowest cost

Cournot's theorem with Bertrand competition

So again, in different setting, we obtain:

Cournot's Theorem with Bertrand competition

As firms increase, prices gradually converge to lowest constant marginal cost.

- If all costs were not constant marginal...
  - Then we would need everyone with different quantities
  - This becomes efficient too, with competition

$\Longrightarrow$ In very different model, same basic result

- Thus we can take this general rule about competition
  1. Eventually, but not immediately, competition drives to cost
  2. With "enough" firms, price should be efficient

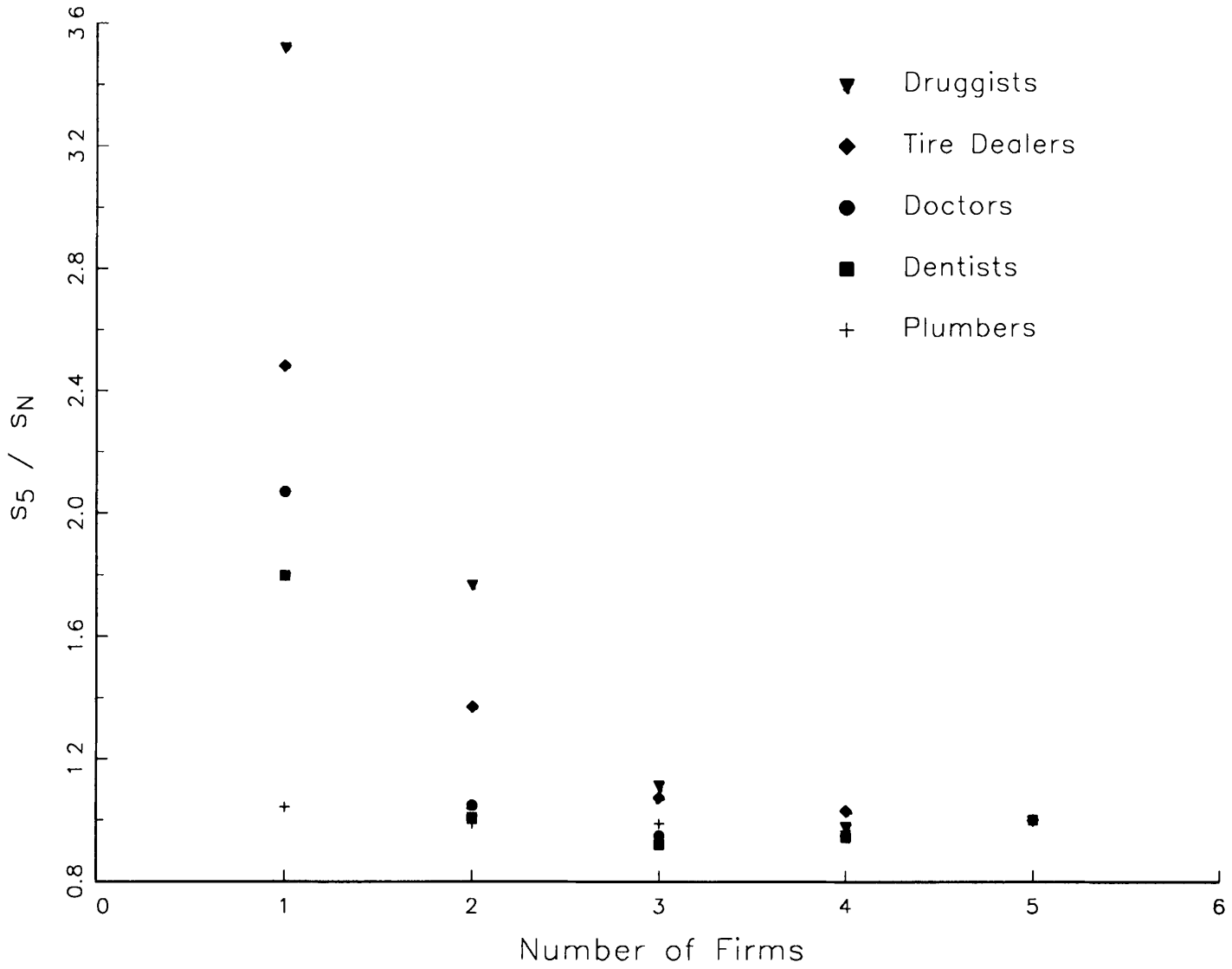
$\Longrightarrow$ Natural question: how much is enough?

Empirical study of the effect of entry

Bresnahan and Reiss (1991) proposed clever way to study

- As market grows larger, can support more firms
  - Call number of people to support N firms S_N, $s_N = \frac{S_N}{N}$
  - Represents customers per firm at different numbers
- If prices same, only fixed cost, constant in N
- If price falls, then should decline, more for second guy
  - $s_3 < s_2 < s_1$, etc.
- Could be other reasons as well: heterogeneity
- But pretty smart first pass, easy to implement
  1. Found 5 professions in many rural towns
  2. How many people and professionals in each town?
  3. When does s start to level out?
     - Interpret as convergence to perfect competition
     - Around 3-5 professionals

Bresnahan and Reiss (1991)'s data



A model of differentiated products

So far just one, common product for all firms

- "Homogeneous product"
- But in reality, most competition from imperfect substitutes
- How does (removal of) this competition affect prices?
  - What do we even mean by competition here?
  - If differentiated products, new product changes offerings
  - Simplest way to think about it is a *merger*
    - Previously two products were separate, now owned together
- Let's consider simplest model of this situation
  - Linear demand, two firms: $Q^i = \alpha - \beta p^i + \gamma p^j$
  - Optimal price for each firm? Common cost c, $\beta > \gamma$
    - $p^i - c = \frac{\alpha - \beta p^i + \gamma p^j}{\beta} = \frac{\alpha + \gamma p^j}{\beta} - p^i \implies p^i = \frac{\beta c + \alpha + \gamma p^j}{2\beta}$
  - By symmetry, $p = p^i = p^j$ so $p\left(1 - \frac{\gamma}{2\beta}\right) = \frac{\beta c + \alpha}{2\beta}$?

An example of merger effects

Pre-merger price is:

$$p_{\text{pre-merger}} = \frac{\beta c+\alpha}{2\beta-\gamma}$$

- After merger, by symmetry, treat as one product
- Demand now $Q = 2\left[\alpha - (\beta - \gamma)p\right]$; optimal price?
  - Just half way up demand curve: $\frac{\alpha}{2(\beta-\gamma)} + \frac{c}{2} = \frac{(\beta-\gamma)c+\alpha}{2(\beta-\gamma)}$
- Difference (by Mathematica) is

$$\Delta p_{\text{merger}} = \frac{1}{2} \times \frac{\gamma}{\beta-\gamma} \times \frac{\alpha-(\beta-\gamma)c}{2\beta-\gamma}$$

- Indicates three crucial factors:
  1. $\frac{\gamma}{\beta-\gamma}$ *intensity/closeness of competition*; how?
  2. $\frac{\alpha-(\beta-\gamma)c}{2\beta-\gamma}$ is *pre-merger markup*; why?
  3. $\frac{1}{2}$ is pass-through rate

Upward Pricing Pressure: framework and intuition

These factors show up much more broadly, and intuitive

- Let's focus on first two for the moment
- Imagine Burger King (BK) buys McDonalds (MD)
- Why would this lead BK to raise its price on burgers?
  - Every time BK sells burger, satisfies potential MD customer
    - Let's call fraction that would otherwise by MD is $D_{BK \to MD}$
    - *Diversion ratio* from BK to MD
  - This loses MD its marginal profit, its mark-up M_{MD}
  - Once they merge, this is loss to BK as well!

$\Longrightarrow$ New opportunity cost of sale $D_{BK \to MD} M_{MD} = P_{MD} - MC_{MD}$

- This is called *Upward Pricing Pressure* on *BK* from merger
- Exactly the two factors from our linear example

$$UPP = \text{Diversion} \times \text{Mark-Up}$$

UPP and merger effects more broadly

UPP is opportunity cost created by merger

- But how exactly does this translate into higher prices?
  - Well, costs tend to get passed-through to prices
  - At what rate...? The pass-through rate ρ of course!
  - So multiplying $UPP \times \rho$ gives change in price
    - A bit subtle as happens to both products at same time...
  - This is why our $\frac{1}{2}$ came out front of other expression
  - We want to get effect on consumer welfare; how?
    - Multiply price changes by quantities
  - Relatively simple methodology for predicting merger effects
  - Need to measure in order to make prediction:
    1. Internal documents and win-loss studies
    2. Surveys and internet data
    3. Econometrics and demand estimation

The Clayton Act and the US infrastructure

In US, authority from Clayton Antitrust Act

- Sherman prevented illegal combinations (cartels)
- Clayton regulates legal combinations

Why not block all mergers?

- Economies of scale! Efficient, may even benefit consumers
  - Growing the ATT network may make reception better
- Thus agencies have to weigh v. anticompetitive effect
- Several agencies, but two primary share by industry?
  1. Department of Justice Antitrust Division
  2. Federal Trade Commission
- Merging companies must pre-notify of intentions
  1. Agencies subpoena data in several stages
  2. Analyze with team of $\approx$ 150 PhD economists
  3. Most survive, some settle and a few go to court

Comparative international infrastructure

Perhaps most sophisticated economic regulation in world

- Has been copied by most developed countries
  1. European Commission now a major leader
  2. Also commonwealth: UK, Australia, New Zealand, etc.
- Much more primitive, unstructured in developing world
  1. In many, no law against mergers even exists!
     - Perú is leading example
  2. In others, law, but minimal infrastructure
     - Effectively no control, ineffective without cartel enforcement
  3. Others have structure, but limited economics
  4. A few aspire to developed sophistication
     - China, Brazil, Chile, etc.
- Very heterogeneous across world
  - Much to be gained by improving quality where weak

Market definition and industry concentration

Traditional evaluation based on "industry concentration"

1. Treat industry as single product; how?
   - Requires "defining" boundaries of industry: which products?
   - Start with merging products, adds closest substitutes?
     - Both geographic and type of product
     - Stop when a monopolist would raise prices by 5% for 1 year

   SSNIP: "Small but Significant and Nontransitory Increase in Price"
2. Measure industry concentration?
   - Classic measure is Herfindahl-Hirschmann Index (HHI)
   - Let $\sigma_i \equiv \frac{q_i}{Q}$, then $H = \sum_i \sigma_i^2$, sometimes multiply by 1000
   - $\frac{1}{H}$ approximate number of firms; from above $< 3-5$ danger
   - Also related to collusion (Stigler) and Cournot performance
     - $P - MC_i = P' q_i = \frac{P}{\epsilon}\sigma_i \implies \sum_i \sigma_i \frac{P-MC_i}{P} = \frac{H}{\epsilon}$
3. Mergers causing $H > 1800$ and/or raising by > 300 flagged

Current real-world merger policy

Unfortunately this approach has proved very cumbersome:

1. Market definition often quite cumbersome: totally 0-1
2. Relevance of concentration somewhat ambiguous
   - In Cournot, mergers increasing most the best (reduce cost)

Thus *merger guidelines* issued by agencies moved away

- Represent official policy, guide to merging businesses
- Issued roughly each 10 years since 1980, latest in 2010
  - I was closely involved with this, similar in UK and EU
- 1992 all based on HHI and market definition
  - New ones emphasize logic above (no need for definition!)
    - Explicitly mention diversion ratios, mark-ups (shadow UPP)
  - Designed by Carl Shapiro and Joe Farrell, creators of UPP
- Progress on-going, new guidelines may reflect ideas above
  - UK report on conjectural variations for merger review

Other criteria discussed in guidelines

A number of other key considerations left out above?

1. Efficiencies
   - These are main off-setting force
   - Directly on fixed cost...or even benefit consumers on *MC*
2. Entry
   - Analysis usually based on firms currently in industry
   - Potential entry by competitors can discipline, reduce harm
3. Non-price effects
   - Product quality, range, Spence effects, etc.
   - May either exacerbate or offset
4. Effects on innovation
   - May change firms' investment in R&D
5. Buyer power
   - If buyers have market power, not so bad?

Concerns left out of current guidelines

Yet, as usual, some of the most important issues don't show up!

1. Pass-through
   - Saw above this was crucial, but doesn't appear
2. Targeting analysis to intervention
   - Sometimes prevent, but often partial, spin-offs
   - Yet analysis does not target these specifically well
3. Schumpeterian "long-term" effects of merger policy
   - Like monopoly, profits from merger are incentive
   - On-going work on long-term effects with Jean Tirole
4. Too big to fail
   - Huge wave of bank mergers during/after crisis
   - Helps achieve bailouts, maybe not public interest
5. Political implications: you'll explore on problem set

As always, great BA possibilities!