

# Competition Policy

E. Glen Weyl

University of Chicago

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# Introduction

On Tuesday, basic theory of oligopoly

- Today we'll apply to main area of policy: merger control
  - 1 Comparative statics in Cournot, benefit of entry
  - 2 How (Cournot) competition drives prices to cost
  - 3 More general ways competition drives price to cost
    - Empirical studies of effect of competition on prices
  - 4 Mergers in differentiated products industries
    - The concept of "Upward Pricing Pressure"
  - 5 Estimating the effects of mergers on welfare
  - 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...

## Comparative statics of Cournot equilibrium

We are interested in effect of increased competition

- Classic “comparative static”: effect of structural change
- As always, getting these right depends on?
  - Second-order/stability conditions!
- Let's consider simplest case of  $n$  identical, CMC firms
- What is marginal revenue for individual firm?
  - $q_i P'(Q) + P(Q)$
- Sum over industry gives  $QP'(Q) + nP(Q)$ ;  $MC$  constant
- When is this stable? Like before right slope...
  - When  $QP'(Q) + nP(Q)$  decreases in  $Q$ :  
 $MR' + (n - 1)P' < 0$
  - For simplicity, so we can change  $n$ , assume  $MR' < 0$

⇒ We can do reasonable comparative statics

- We can change  $n$  and see what happens
- This let's determine effects of competition

## Effect of entry in a Cournot market

Equilibrium is given by  $QP'(Q) + nP(Q) = nc$

- $n$  has to be an integer, but we can ignore this for today
- Just take derivative w.r.t.  $n$  and use implicit function?

$$\bullet \quad MR' \frac{dQ}{dn} + (n-1)P' \frac{dQ}{dn} + P = c \iff P - c = -[MR' + (n-1)P'] \frac{dQ}{dn} \implies$$

$$\frac{dQ}{dn} = \frac{P-c}{-[MR' + (n-1)P']} > 0; \text{ why?}$$

- $MR', P' < 0$ 
    - Entry just like our exogenous competition: raises quantity
- $\implies$  Entry/competition increases quantity, lowers price...
- Intuitive; whenever  $P > c$  and proportional
- $\implies$  Effect more gradual as more firms

## A simple case of Cournot's theorem

As  $n$  grows larger,  $P \rightarrow c$ :

$$\frac{dP}{dn} = P' \frac{dQ}{dn} = \frac{P-c}{-\left[\frac{MR'}{P'} + (n-1)\right]} = \rho \frac{-(P-c)}{1+(n-1)\rho}$$

- Another way to see is equation  $P - c = \frac{P'Q}{n}$
- As long as  $P'Q$  is finite (at  $P = c$ ) goes to 0 as  $n \rightarrow \infty$
- Finally, we also derived that  $\frac{P-c}{P} = \frac{1}{n\epsilon}$   
 $\implies$  As long as  $\epsilon$  bounded above 0 at  $P = c$ , again

### 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

# General conditions for Cournot's theorem

Cournot's theorem hold more generally than this:

- 1 Firms can have non-linear costs
  - 2 Demand can satisfy weaker regularity conditions
  - 3 Key is just that everyone is small eventually
    - This should almost always happen
  - 4 Fails only in silly/perverse cases
- ⇒ In Cournot, competition always, gradually drives to cost
- But this basic, fundamental intuition much broader
  - Let's consider the heterogeneous cost Bertrand model

## Entry with a distribution of costs

Remember: distribution of constant marginal 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

⇒  $E[c_2 | c_1 = c_i] \rightarrow c_i, c_1 \rightarrow \underline{c}$ , lowest cost

- Thus price converges to lowest constant marginal cost
- Intuitive, as more firms, I am less necessary

⇒ 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.*

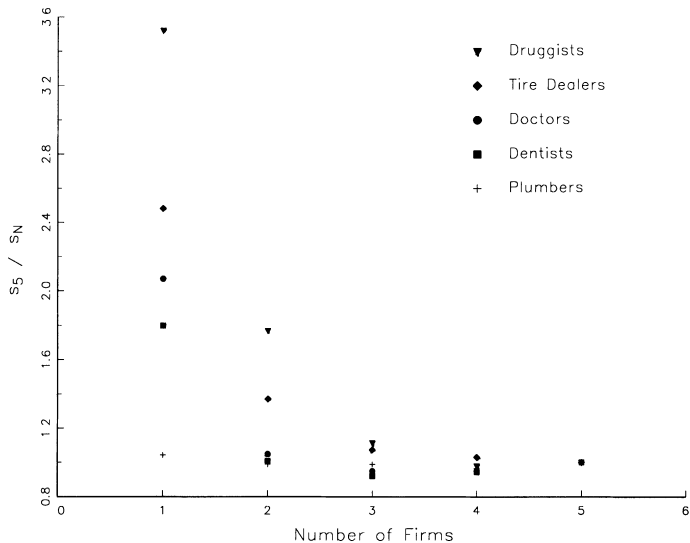
- If all costs were not constant marginal...
  - Then we would need everyone with different quantities
  - This becomes efficient too, with competition
- ⇒ In very different model, same basic result
  - Thus we can take this general rule about competition
    - 1 Eventually, but not immediately, competition drives to cost
    - 2 With “enough” firms, price should be efficient
- ⇒ 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 merger between differentiated products firms

So far we have assumed homogeneous products

- But typically competition between differentiated products  
⇒ Merger doesn't eliminate product, just consolidates
- Does competition help (merger hinder) in this case?
  - Simplest case just focus on two merging firms
    - A bit like monopoly: minimum of moving parts possible
    - Other firms later; also assume Nash-in-Prices
  - Demand  $Q^i(p^i, p^j)$ , profits  $p^i Q^i(p^i, p^j) - C^i(Q^i(p^i, p^j))$
  - Denote partial derivatives wrt own price by  $Q_1^i$  other  $Q_2^i$
  - FOC  $p^i Q_1^i + Q^i - C'^i Q_1^i = 0$ ; let  $MC^i \equiv C'^i$ , divide by  $Q_1^i$ :
    - $p^i = MC^i + \frac{Q^i}{-Q_1^i}$ : price = MC + Cournot distortion
  - If now merge, profits  $p^1 Q^1 + p^2 Q^2 + C^1(Q^1) + C^2(Q^2)$ 
    - FOC for  $p^1$ :  $Q^1 + (p^1 - MC^1) Q_1^1 + (p^2 - MC^2) Q_2^1 = 0$

## Upward Pricing Pressure and intuition

Divide by  $Q_1^1$ , obtain:  $p^1 = MC^1 + \frac{Q_1^1}{-Q_1^1} + (p^2 - MC^2) \frac{Q_2^2}{-Q_1^1}$

- First two terms on right-hand side exactly as before
- Third term is new (effect of merger) so let's focus on that:

$$UPP_{2 \rightarrow 1} \equiv \underbrace{p^2 - MC^2}_{\text{mark-up on partner's product: } M^2} \times \underbrace{\frac{Q_2^2}{-Q_1^1}}_{\text{"diversion ratio" from 1 to 2: } D_1^2}$$

- Called the “Upward Pricing Pressure” from product 1 to 2
    - Always positive if substitutes:  $Q_2^2$  is positive if substitutes
    - $D$ : every burger BK sells, how many sales does MD lose?
    - If they merge, BK internalizes the profits lost:  $M^2 D_1^2$
    - Exactly UPP: new opportunity cost created by merger
      - Like any other cost, passed-through to prices!
- ⇒ All else equal, merger of competitors raises prices

## A general model of oligopoly

This gives us basic flavor but we left out:

- Other firms in the industry, conjectures (non-NiP)

Adding these is relatively simple given our work:

- Define my *residual demand* taking into account conjectures

- $Q_i^j \equiv \frac{dQ^j}{dp^i} = \frac{\partial Q^j}{\partial p^i} + \sum_{j \neq i} \frac{\partial Q^j}{\partial p^i} \frac{dp^j}{dp^i}$

- Then pre-merger optimum just like before:  $p^i = MC^i + \frac{Q_i^i}{Q_i^i}$

- Post-merger, though, we want to hold fixed other price

- If FOC's for price, partial derivative makes us hold fixed
  - But conjectures don't allow this; need to define to shut down

⇒ If  $i$  and  $j$  merger, let  $\tilde{Q}_i^j, \tilde{Q}_j^j$  hold fixed  $p^j$ ; skip messy math

- Then FOC as above:  $p^i = MC^i + \frac{Q_i^i}{-Q_i^i} + (p^j - MC^j) \frac{\tilde{Q}_i^j}{-Q_i^i}$

# Generalized pricing pressure

What are differences now? Well, two rather than one:

$$g^j \equiv \underbrace{\tilde{D}_j^i (p^j - MC^j)}_{\text{generalized UPP (GUPP)}} - \underbrace{\left[ \frac{1}{\tilde{\epsilon}^i} - \frac{1}{\epsilon^i} \right] p^j}_{\text{end of accommodating reactions (EAR)}}$$

Two changes:

- 1 GUPP:  $\tilde{D}_j^i (p^j - MC^j)$  where  $\tilde{D}_j^i$  holds fixed
  - Merging prices  $p^j$  and whatever firm believes for others
- 2 EAR: merger partner reaction no longer anticipated
  - More accommodating reactions  $\implies$  offsets GUPP more
  - First term larger with reactions, but second more negative

Different from (simplifies to) UPP: GUPP - EAR but...

- Result relatively robust to conjectures because offset

# Measuring pricing pressure

How can we actually measure all this? Several approaches:

- 1 Internal company documents
  - If we can get access, may discuss reactions, diversion
  - Companies have to think about these things
- 2 Surveys and internet data
  - Ask consumers about their second choice; like diversion
  - Better: data from online, what other people bought etc.
- 3 Win-loss studies for auctions
  - Who are most common first and second in auction?
- 4 Econometrics
  - Estimate demand using changes in cost
  - Difficult under NiP: need changes to all firms' costs
- 5 Consistent conjectures (Baker and Bresnahan 1986)
  - With consistent conjectures, residual demand for partners
  - Thus only need changes in merging firm costs

## Pass-through and price impact

We may want not just opportunity cost, but also price change

- But we know very well how to translate!
- If only one firm raised price, just multiply by pass-through
- This is basically right, but two (small) complications
  - ① Merger pushes up both merging firms' prices
  - ② Rise (strategically or otherwise) affects other firms' prices
- All this covered by *pass-through matrix*  $\rho$ 
  - Each element is effect of one firm's cost on another's price
- Then if  $\mathbf{g}$  is GePP for merging firms, 0 elsewhere:  
$$\Delta \mathbf{p} \approx \mathbf{g}^T \times \rho$$
- Don't worry, you don't really need to follow these matrices
  - Key point is pass-through can be used to covert here
  - This is lucky, because we use it for everything else
  - Makes easy to measure: same cost shocks as for diversion

# Prices and welfare impact

How much do these changes in price hurt consumers?

- As always, by envelope, just multiply by quantity
- $\Delta CS \approx -\mathbf{g}^T \times \boldsymbol{\rho} \times \mathbf{Q}$
- Quantities particularly easy to measure
- Price index (percent increase) by dividing by  $\mathbf{p} \times \mathbf{Q}$

How about social welfare?

- Need to find *quantity* changes:  $\Delta \mathbf{Q} \approx \mathbf{g}^T \times \boldsymbol{\rho} \times \frac{\partial \mathbf{Q}}{\partial \mathbf{p}}$
- Then multiply by mark-ups:  $\Delta SS \approx \mathbf{g}^T \times \boldsymbol{\rho} \times \frac{\partial \mathbf{Q}}{\partial \mathbf{p}} \times \mathbf{M}$
- Longer, but all stuff we had from before (demand, etc.)

Just like monopoly comparative statics, simple principles

- Very nice, but why to we care?
  - Governments all over the world control mergers
  - Say when companies are (not) allowed to merge

⇒ Need to be able to predict effect

# 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!