Horizontal Mergers

Introduction

- Merger mania of 1990s disappeared after 9/11/2001
- But now appears to be returning
  - Oracle/PeopleSoft
  - AT&T/Cingular
  - Bank of America/Fleet
- Reasons for merger
  - cost savings
  - search for synergies in operations
  - more efficient pricing and/or improved service to customers

Questions

- Are mergers beneficial or is there a need for regulation?
  - cost reduction is potentially beneficial
  - but mergers can "look like" legal cartels
    - ***and so may be detrimental***
- US government is particularly concerned with these questions
  - Antitrust Division Merger Guidelines
    - ***seek to balance harm to competition with avoiding unnecessary interference***
- Explore these issues in next two chapters
  - distinguish mergers that are
    - ***horizontal: Bank of America/Fleet***
    - ***vertical: Disney/ABC***
    - ***conglomerate: Gillette/Duracell; Quaker Oats/Snapple***

Horizontal mergers

- Merger between firms that compete in the same product market
  - some bank mergers
  - hospitals
  - oil companies
- Begin with a surprising result: ***the merger paradox***
  - take the standard Cournot model
  - merger that is not merger to monopoly is unlikely to be profitable
    - **unless “sufficiently many” of the firms merge**
    - **with linear demand and costs, at least 80% of the firms**
    - **but this type of merger is unlikely to be allowed**

An Example

- **Assume 3 identical firms; market demand P = 150 - Q; each firm with marginal costs of $30. The firms act as Cournot competitors.**
- **Applying the Cournot equations we know that:**

  each firm produces output q(3) = (150 - 30)/(3 + 1) = 30 units
  the product price is P(3) = 150 - 3x30 = $60
  profit of each firm is π(3) = (60 - 30)x30 = $900

- **Now suppose that two of these firms merge, then there are two independent firms so output of each changes to:**

  q(2) = (150 - 30)/3 = 40 units; price is P(2) = 150 - 2x40 = $70

  profit of each firm is π(2) = (70 - 30)x40 = $1,600

- **But prior to the merger the two firms had total profit of $1,800**

This merger is unprofitable and should not occur

A Generalization

- **Take a Cournot market with N identical firms.**
- **Suppose that market demand is P = A - B.Q and that marginal costs of each firm are c.**
- **From standard Cournot analysis we know the profit of each firm is:**

$$\pi^C_i = \frac{(A - c)^2}{B(N + 1)^2}$$

The ordering of the firms does not matter

- **Now suppose that firms 1, 2,… M merge. This gives a market in which there are now N - M + 1 independent firms.**

Generalization 2

- **The newly merged firm chooses output q_m to maximize profit:**

  $\pi_m(q_m, Q_{-m}) = q_m(A - B(q_m + Q_{-m}) - c)$

  where $Q_{-m} = q_{m+1} + q_{m+2} + ... + q_N$ is the aggregate output of the N - M firms that have *not* merged

- **Each non-merged firm chooses output q_i to maximize profit:**

  $\pi_i(q_i, Q_{-i}) = q_i(A - B(q_i + Q_{-i}) - c)$

  where Q_{-i} = is the aggregate output of the N - M firms *excluding firm i* plus the output of the merged firm q_m

- **Comparing the profit equations then tells us:**

the merged firm becomes just like any other firm in the market

all of the N - M + 1 post-merger firms are identical and so must produce the same output and make the same profits

Generalization 3

- The profit of each of the merged and non-merged firms is then:

$$\pi^C_m = \pi^C_{nm} = \frac{(A - c)^2}{B(N - M + 2)^2}$$

Profit of each surviving firm increases with M

- The aggregate profit of the merging firms pre-merger is:

$$M\pi^C_i = \frac{M(A - c)^2}{B(N + 1)^2}$$

- So for the merger to be profitable we need:

$$\frac{(A - c)^2}{B(N - M + 2)^2} \geq \frac{M(A - c)^2}{B(N + 1)^2}$$ this simplifies to:

$$(N + 1)^2 \geq M(N - M + 2)^2$$

The Merger Paradox

- **Substitute M = aN to give the equation**

  $(N + 1)^2 \geq aN(N - aN + 2)^2$

  Solving this for a $\geq$ a(N) tells us that a merger is profitable for the merged firms if and only if:

  $$a \geq a(N) = \frac{3 + 2N - \sqrt{5 + 4N}}{2N}$$

  Typical examples of a(N) are:

N	**5**	**10**	**15**	**20**	**25**
a(N)	**80%**	**81.5%**	**83.1%**	**84.5%**	**85.5%**
M	**4**	**9**	**13**	**17**	**22**

The Merger Paradox 2

- Why is this happening?
  - merged firm cannot ***commit*** to its potentially greater size
    - the merged firm is just like any other firm in the market
    - thus the merger causes the merged firm to lose market share
    - the merger effectively closes down part of the merged firm's operations
      - ***this appears somewhat unreasonable***
- Can this be resolved?
  - need to alter the model somehow
    - asymmetric costs
    - timing: perhaps the merged firms act like market leaders
    - product differentiation

Merger and Cost Synergies

- Suppose that firms in the market
  - ***may have different variable costs***
  - ***incur fixed costs***
- Merger might be profitable if it creates cost savings
- An example
  - ***three Cournot firms with market demand $P = 150 – Q$***
  - ***two firms have marginal costs of 30 and fixed costs of f***
  - ***total costs are:***
  - ***$C(q_1) = f + 30q_1$; $C(q_2) = f + 30q_2$***
  - ***third firms has potentially higher marginal costs***
  - ***$C(q_3) = f + 30bq_3$, where $b \geq 1$***

Case A: Merger Reduces Fixed Costs

- Suppose that $b = 1$
  - all firms have the same marginal c
  - but the merged firms has fixed cos
- We know from the previous exa
  - pre-merger profit of each firm are 900 –
  - post-merger
    - ***the non-merged firm has profit 1,60***
    - ***the merged firm has profit 1,600 –***
- The merger is profitable for the erged firm if:
  - $1{,}600 - af > 1{,}800 - 2f$
  - which requires that $a < 2 - 200/f$

Merger is likely to be profitable when fixed costs are "high" and the merger gives "significant" savings in fixed costs

Case A: 2

- Also, the non-merged firm always gains
  - and gains more than the merged firms
- So the merger paradox remains in one form
  - why merge?
  - why not wait for other firms to merge?

Case B: Merger Reduces Variable Costs

- Suppose that merger reduces variable costs
  - assume that $b > 1$ and that $f = 0$
  - firms 2 and 3 merge
  - so production is rationalized by shutting down high-cost operations
  - pre-merger:
  - outputs are: $$q_1^C = q_2^C = \frac{90 + 30b}{4}; q_3^C = \frac{210 - 90b}{4}$$
  - profits are: $$\pi_1^C = \pi_2^C = \frac{(90 + 30b)^2}{16}; \pi_3^C = \frac{(210 - 90b)^2}{16}$$
  - post-merger profits are \$1,600 for both the merged and non-merged firms

Case B: 2

- Is this a profitable merger?
- For the merged firm's profit to increase requires:

$$1{,}600 - \left(\frac{(90 + 30b)^2}{16} + \frac{(210 - 90b}{16} \right.$$

Merger of a high-cost and low-cost firm is profitable if cost disadvantage of the high-cost firm is "great enough"

- This simplifies to: $25(7 - 3b)(15b - 1$
  - first term must be positive for firm 3 to h non-negative output pre-merger
  - so the merger is profitable if th second term is positive
  - which requires $b > 19/15$

Summary

- Mergers can be profitable if cost savings are great enough
  - but there is no guarantee that consumers gain
  - in both our examples consumers lose from the merger
- Farrell and Shapiro (1990)
  - cost savings necessary to benefit consumers are much greater than cost savings that make a merger profitable
  - so should be skeptical of "cost savings" justifications of mergers
  - and the paradox remains
    - ***non-merged firms benefit more from merger than merged firms***

The Merger Paradox Again

- The merger paradox arises because despite merging, merged firms are symmetric with non-merged firms?
- What kind of asymmetries might arise?
  - merged firms become Stackelberg leaders post-merger
  - By committing to merger, merged firms may induce others to merge
  - Can these alterations remedy the merger paradox?

A Leadership Game

- Suppose that there has been a set of two-firm mergers
  - market has L leaders and F followers = $N = F+L$ total
  - assume linear demand $P = A - BQ$
  - each firm has constant marginal cost of c
  - two-stage game:
    - stage 1: each leader firm chooses its output $\boldsymbol{q_l}$ independently
    - gives aggregate output $\boldsymbol{Q_L}$
    - stage 2: each follower firm chooses its output q_f independently, but in response to the aggregate output of the leader firms
    - gives aggregate follower output $\boldsymbol{Q_F}$
    - clearly, leader firms correctly anticipate $\boldsymbol{Q_F}$

Leadership Game 2

- **Recall that**
  - **if the inverse demand function is $P = a - bQ$**
  - **there are n identical Cournot firms**
  - **and all firms have marginal costs c**
  - **then each firm's Cournot equilibrium output is:**

$$q_i^C = \frac{a - c}{(n+1)b}$$

- **In our example**
  - **if the leaders produce Q_L then inverse demand for the followers is $P = (A - BQ_L) - bQ_F$**
  - **there are $N - L$ identical Cournot follower firms**
  - **so that $a = (A - BQ_L)$, $b = B$ and $n = N - L$**

Leadership Game 3

- So the Cournot equilibrium output of each follower firm is:

$$q_f^* = \frac{A - BQ_L - c}{B(N - L + 1)} = \frac{A - c}{B(N - L + 1)} - \frac{Q_L}{(N - L + 1)}$$

- Aggregate output of the follower firms is then:

$$Q_F = \frac{(N - L)(A - c)}{B(N - L + 1)} - \frac{(N - L)Q_L}{(N - L + 1)}$$

- Substituting this into the market inverse demand gives the inverse demand for the leader firms:

$$P = \frac{A + (N - L)c}{(N - L + 1)} - \frac{B}{(N - L + 1)}Q_L$$

- **in this case *a* = (*A* + (*N* – *L*)*c*/(*N* – *L* + 1); *b* = *B*/(*N* – *L* +1) and *n* = *L***

Leadership Game 4

- So the Cournot equilibrium output of each leader firm is:

$$q_l^* = \frac{A - c}{B(L+1)}$$

- Note that when $L = 1$ this is just the standard Stackelberg output for the lead firm.
- Substitute into the follower firm's equilibrium and simplifying gives the output of each follower firm:

$$q_f^* = \frac{A - c}{B(L+1)(N - L + 1)}$$

- Clearly, each leader has greater output than each follower
  - merger to join the leader group has an advantage

Leadership Game 5

- Substituting the equilibrium outputs into the inverse demand gives the equilibrium price-cost margin and profits for each type of firm:

$$P - c = \frac{A - c}{(L+1)(N-L+1)}$$

$$\pi_L(N,L) = \frac{(A-c)^2}{B(L+1)^2(N-L+1)}; \pi_F(N,L) = \frac{(A-c)^2}{B(L+1)^2(N-L+1)^2}$$

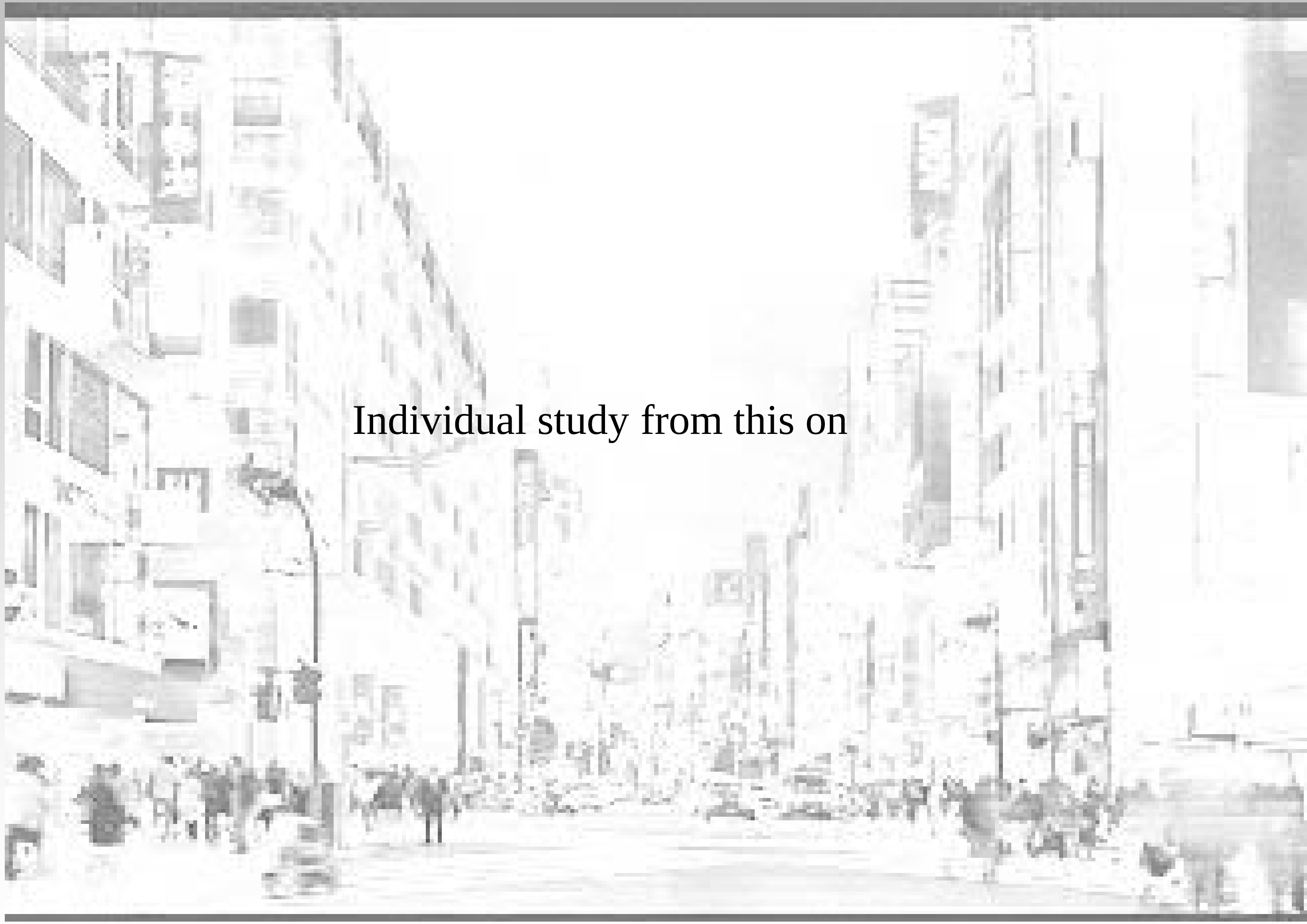
- The leaders are more profitable than the non-merged followers
- Is one more merger profitable for the merging firms?
- Such a merger leads to there being ***L*** + 1 leaders, ***F*** – 2 followers and ***N*** – 1 firms in all

Leadership Game 6

- So for an additional merger to be profitable for the merging firms we need $\pi_L(N - 1, L + 1) > 2\pi_F(N, L)$
- This requires that $(L + 1)^2(N - L + 1)^2 - 2(L + 2)^2(N - L - 1) > 0$
- Note that this does not depend on any demand parameters ***A, B*** or ***c***
- It is possible to show that this condition is *always* satisfied
- No matter how many leaders and followers there are an additional two follower firms will always want to merge
  - ***this squeezes profits of the non-merged firms***
  - ***so resolves the merger paradox***

Leadership Game 7

- What about consumers?
- For an additional merger to benefit consumers N – 3(L + 1) > 0
- An additional merger benefits consumers only if the current group of leaders contains fewer than one-third of the total number of firms in the market.
- Admittedly this model is stylized
  - ***how to attain leadership?***
  - ***distinction between leaders and followers not necessarily sharp***
- But it is suggestive of actual events and so qualitatively useful



Individual study from this on

Sequential Mergers

- It is possible to think of the merger paradox as a coordination problem. What does this mean?
- It may be the case that if enough firms complete mergers each merger will be profitable but that for small group to merge by itself is not profitable
- Consider a market with potential merger pairs:
  - Merger Pair 1 (Firm A and Firm B)
  - Merger Pair 2 (Firm A’ and B’)
- The game may have two Nash Equilibria, one where both pairs merge and one where neither merges

Sequential Mergers 2

Ideally, the merger pairs would like to coordinate their decisions and arrive at the ***Both Merge*** equilibrium. However, with simultaneous play, it is not clear how such coordination will happen.

This is a Nash Equilibrium in simultaneous play

This is also a Nash Equilibrium in simultaneous play

		Merger Pair 2	
		Don't Merge	Merge
Merger Pair 1	Don't Merge	**($772, $772)**	($1063, $752)
	Merge	($752, $1063)	**($1100, $1100)**

Sequential Mergers 3

Sequential play with Merger Pair 1 going first solves the coordination problem. Merger Pair 2 will realize that if they merge, Merger Pair 2 will do the same

This will make Merger Pair 1's merger profitable

This is a Nash Equilibrium in sequential play

		Merger Pair 2	
		Don't Merge	Merge
Merger Pair 1	Don't Merge	($772, $772)	($1063, $752)
	Merge	($752, $1063)	**($1100, $1100)**

Sequential Mergers 4

- The sequential merger analysis may solve the merger paradox if the source of that paradox is a coordination problem
- The analysis has an advantage over the Stackelberg leader model because it is explicitly sequential, i.e., mergers happen in chronological sequence. In the leader model, every firm wants to become a leader simultaneously
- Cost breakthroughs or changes in transportation and trade barriers can create the setting for the sequential merger analysis
- Such events can therefore lead to merger waves

Horizontal Mergers and Product Differentiation

- Assumption thus far is that firms offer identical products
- But we clearly observe considerable product differentiation
- Does this affect the profitability of merger?
  - affects commitment
    - **need not remove products post-merger**
  - affects the nature of competition
    - **quantities are strategic substitutes**
      - ***passive move by merged firms met by aggressive response of non-merged firms***
    - **prices are strategic complements**
      - ***passive move by merged firms induces passive response by non-merged firms***

Merger with Price Competition

- Mergers with price competition and product differentiation are profitable
- Why?
  - prices are strategic complements
  - merged firms can strategically commit to producing a *range* of products
  - with homogeneous products there is no such ability to commit
    - ***unless the merged firms can somehow become market leaders***

Merger with Price Competition 2

- Suppose there are *N* firms with linear demand

$$q_i(p_1, \ldots, p_N) = V - p_i - \gamma\left(p_i - \frac{1}{N}\sum_{j=1}^{N} p_j\right)$$

- With zero marginal cost, each firm's first order condition is $$\frac{\partial \pi_i}{\partial p_i} = V - 2p_i - 2\gamma\gamma_i + \frac{2\gamma}{N} p_i + \frac{\gamma}{N}\sum_{\substack{j=1 \\ j \neq i}}^{N} p_j = 0$$
- Using symmetry we get

$$p_0 = \frac{NV}{2N + \gamma(N-1)}$$

- **If firms 1,…M merge, it will have a new first order condition:** $$\frac{\partial \sum_{k=1}^{M} \pi_k}{\partial p_m} = \frac{\partial \pi_m}{\partial p_m} + \sum_{\substack{k=1 \\ k \neq m}}^{M} \frac{\partial \pi_k}{\partial p_m}$$

Merger with Price Competition

- Because of symmetry, the prices on all the products of the merged firms will be the same and the prices and only the nonmerged firms will bill be the same. For a not merged firm and a merged firm we have

$$\sum_{\substack{j=1\\ j\neq i}}^{N} p_j = Mp_m + \left(N-M-1\right)p_{nm} \qquad \sum_{\substack{j=1\\ j\neq m}}^{N} p_j = (M-1)p_m + \left(N-M\right)p_{nm}$$

- Using $$\sum_{\substack{k=1\\ k\neq m}}^{M} \frac{\partial \pi_k}{\partial p_m} = \frac{(M-1)\gamma p_m}{N}$$

Merger with Price Competition

- Gives first order conditions for the nonmerged firms

$$\frac{\partial \pi_i}{\partial p_{nm}} = V - (2+\gamma)p_{nm} + \frac{\gamma}{N}\left(Mp_m - (M-1)p_{nm}\right) = 0$$

- And for the merged firm

$$\frac{\partial \sum_{k=1}^{M} \pi_k}{\partial p_m} = V - 2(1+\gamma)p_m + \frac{\gamma}{N}\left((N-M)p_{nm} + 2Mp_m\right)$$

- Which gives prices

$$p_m = V\frac{2N + \gamma(2N-1)}{4N + 2\gamma(3N - M - 1) + \gamma^2\left(\frac{N-M}{N}\right)(2N - M + 2)}$$

$$p_{nm} = V\frac{2N + \gamma(2N-M)}{4N + 2\gamma(3N - M - 1) + \gamma^2\left(\frac{N-M}{N}\right)(2N - M + 2)}$$

Merger with Price Competition

- The merged firm set higher prices
  - Since prices are strategic complements, nonmerging firms also have higher prices
- The merger is profitable for the merging firms, but even more profitable for the nonmerging firms
- The greater the number of merging firms, the more profitable it is

Public Policy and Horizontal Mergers

- **Antitrust authorities consider the *unilateral effects* discussed above and *coordinate effects***
  - **A merger may make collusion easier**
- **Consider**
  - **Number of firms**
  - **Cost structures across firms**
  - **Entry barriers**

Public Policy and Surplus

- **Focus is generally on Consumer surplus**
  - **Ignores profits to merging firms**
  - **And to their competitors**
- **Most economic theory favors a measure of total surplus, but..**
  - **Distributional concerns favor consumer surplus**
  - **Firms may exaggerate cost savings, and consumers are not represented at proceedings**
- **Also, firms may have a choice among mergers**
  - **Having a criteria of consumer surplus will push them towards ones with higher total surplus since they favor ones with higher producer surplus**