Answers to Chapter 11 Exercises

Review and practice exercises

■ 11.1. Mergers and output level. “The combined output of two merging firms decreases as a result of the merger.” True or false?

Answer: If the merger implies little or no cost efficiencies (namely at the level of marginal cost), we would expect the combined output of the merging firms to decline. If however the merger reduces the marginal cost of the combined firm significantly, then it is possible that the combined output increases as a result of the merger.

■ 11.2. Mergers in the paper industry. One of the efficiencies created by mergers in the paper industry results from reorganization of production. A machine is more efficient the narrower the range of products it produces, among other reasons because the length of each production run can be made longer.

The paper industry underwent a wave of mergers in the 1980s. Of the firms that merged, about two thirds increased their market share as a result of the merger. Assuming that (i) firms compete by setting production capacity and (ii) paper products are relatively homogeneous across firms, explain how the previous paragraph explains the pattern of changes in market shares. Which firms would you expect to increase their market share?19

Answer: According to the paragraph, there are increased cost efficiencies from mergers. Applying the analysis from Section 11.1, it seems that for two thirds of the merging firms the cost efficiencies were so big that the merging firms increased their output and market share, while for the rest the efficiencies were not big enough, resulting in a decreased market share.

■ 11.3. BAe and GE. “The renewed prospect of a link-up between British Aerospace PLC and the Marconi defense arm of General Electric Co. PLC of the U.K. as led to revived talks between the top defense companies in Germany and France.”20 Discuss.

Answer: Refer to the discussion on merger waves in this chapter.

■ 11.4. The HP-Compaq merger. In 2001, HP acquired Compaq. The merger had an
impact on two different markets: desktop PCs and servers. Pre-merger market shares in the desktop PC market were as follows: Dell, 13; Compaq, 12; HP, 8; IBM, 6; Gateway, 4. Pre-merger market shares in the servers market were as follows: IBM, 26; Compaq, 16; HP, 14; Dell, 7.21

(a) Determine the value of $HHI$ in each market before the merger.

**Answer:** Since we don’t have a complete set of market shares, the best we can do is to determine an approximate value of the $H$ indexes (in particular, a lower bound). We then have

- $H_D = 13^2 + 12^2 + 8^2 + 4^2 + 6^2 = 429$
- $H_S = 7^2 + 16^2 + 14^2 + 26^2 = 1177$

(b) Assuming market shares of each firm remain constant, determine the value of $HHI$ after the merger.

**Answer:** We now have

- $H_D = 13^2 + 20^2 + 4^2 + 6^2 = 621$
- $H_S = 7^2 + 30^2 + 26^2 = 1625$

(c) Considering the values determined above and the DoJ merger guidelines, was the Department of Justice right in allowing the merger to take place?

**Answer:** In the US, the Department of Justice has guidelines based on the HHI. As a rule of thumb, mergers that lead to an HHI of 1000 or less ordinarily lead to no further scrutiny; those that raise the HHI by 100 or more and produce a post-merger HHI between 1000 and 1800 raise significant questions; and those that raise the HHI by 50 or more and produce a post-merger HHI above 1800 raise significant concern.

According to these guidelines, the merger should be OK’s as far as the desktop market is concerned, and questions should be raised regarding the server market. Questions were raised and eventually the merging parties agreed to divest some of their assets in the server market as a precondition for the merger.

**11.5. Merger and the Herfindahl index.** Consider an industry with demand $Q = a - p$ where 3 identical firms that compete a al Cournot. Each firm’s cost function is given by $C = F + c q$. Suppose two of the firms merge and that the merged firm’s cost function is given by $C = F' + c' q$, where $F < F' < 2F$.

(a) Determine each firm’s market share before and after the merger

**Answer:** Before the merger, each firm’s market share is $1/3$ (since they are symmetric). After the merger, we have a duopoly with marginal costs $c$ and $c'$. The equilibrium output level are given by

- $q = \frac{a + c' - 2 c}{3}$
- $q' = \frac{a + c - 2 c'}{3}$

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It follows that market shares are given by
\[
s = \frac{a + c' - 2c}{2a - c - c'}
\]
\[
s' = \frac{a + c - 2c'}{2a - c - c'}
\]

(b) Suppose that \(a = 10\) and \(c = 3\). Determine the Herfindahl index after the merger takes place when (i) \(c' = 2\) and (ii) \(c' = 1\). Compare this to the post-merger Herfindahl index calculated based on pre-merger market shares. Why do these values differ?

**Answer:** If \(c' = 2\), then
\[
s' = \frac{10 + 3 - 2 \times 2}{2 \times 10 - 3 - 2} = \frac{9}{15} = .6
\]
The post-merger Herfindahl index is then
\[
H' = \left( \frac{9}{15} \right)^2 + \left( \frac{6}{15} \right)^2 = \frac{117}{225} = .52 \quad (\text{or 5,200})
\]
If \(c' = 1\), then
\[
s' = \frac{10 + 3 - 2 \times 1}{2 \times 10 - 3 - 1} = \frac{11}{16} = .6875
\]
The post-merger Herfindahl index is then
\[
H' = \left( \frac{11}{16} \right)^2 + \left( \frac{5}{16} \right)^2 = \frac{146}{256} = .5703 \quad (\text{or 5,703})
\]

Based on the pre-merger market shares, the post-merger Herfindahl index is given by
\[
H' = \left( \frac{1}{3} \right)^2 + \left( \frac{1}{3} + \frac{1}{3} \right)^2 = \frac{5}{9} \approx .56 \quad (\text{or 5,600})
\]

We conclude that, if marginal cost efficiencies are not very significant (e.g., \(c' = 2\)), then the post-merger estimate of \(H\) based on pre-merger market shares is likely to over-estimate the post-merger value of \(H\). The reason is that by simply using pre-merger market shares we are not accounting for the equilibrium adjustment following the merger, namely the fact that the merging parties will produce a total output that is lower than the combined output of the two pre-merging firms. By contrast, if marginal cost efficiencies are very significant (e.g., \(c' = 1\)), then the post-merger estimate of \(H\) based on pre-merger market shares is likely to under-estimate the post-merger value of \(H\). The reason is that by simply using pre-merger market shares we are not accounting for the equilibrium adjustment following the merger, namely the fact that the merging parties, by becoming more efficient, will produce a total output that is higher than the combined output of the two pre-merging firms.

In other words, there are two effects to consider regarding the merging firms’ post-merger output level: first, to the extent that there are fewer competitors, there is a tendency to reduce output level; second, to the extent that marginal cost is lower, there is a tendency to increase output level.
11.6. Merger wave. Consider an industry where firms compete by setting output levels (Cournot). Market demand is given by \( D = 150 - P \), marginal cost is constant and equal to 50, and fixed cost is 150 (the same for all firms).

(a) Show that profits per firm are given by 961, 475 and 250 as the number of firms is equal to 2, 3 or 4. 

Suppose that a merger leads to a new firm with the same fixed cost and the same marginal cost.

(b) Suppose that initially there are four firms. Show that a merger between Firms 1 and 2 is unprofitable.

(c) Suppose that Firms 3 and 4 decide to merge, forming Firm 3&4. Show that now a merger between Firms 1 and 2 is profitable.

Challenging exercises

11.7. Entry by acquisition. A large fraction of industry entry corresponds to acquisition of incumbent firms. For example, from a sample of 3,788 entry events, about 70% were acquisitions. Econometric analysis suggests that entry by acquisition is more common in more concentrated industries. Can you explain this observation?

Suggestion: Consider a Cournot oligopoly with \( n \) symmetric firms. Determine the maximum that an entrant would be willing to pay for one of the incumbent firms. Determine also the minimum that an incumbent would require from a buyer, knowing that the alternative to selling the firm is for the entrant to create a new firm. Show that the difference between the two values above is greater when the industry is more concentrated.

What other factors would you expect to influence the “build or buy” decision when entering an industry?

Answer: Suppose that the inverse demand and cost functions are given by \( p = a - bQ \) and \( C(q) = F + cq \), respectively. By an appropriate change of units, I can make \( b = 1 \). I will thus work with an inverse demand \( p = a - Q \). Each firm maximizes

\[
\pi = (a - c - Q) q - F
\]

which leads to

\[
q = \frac{a - c}{n + 1}
\]

Equilibrium profits if there are \( n \) competitors are given by

\[
\pi(n) = \left( \frac{a - c}{n + 1} \right)^2 - F
\]

Suppose that a potential entrant, if it enters by creating a new firm, does so with the same cost function as the incumbents. For a potential entrant, there are two choices: (a) to buy an incumbent for a price \( x \), which leads to net profits of \( \pi(n) - x \); and (b) to create a new firm, which leads to profits \( \pi(n + 1) \). The potential entrant prefers acquisition if and only if \( \pi(n) - x > \pi(n + 1) \). In other words, the potential entrant is willing to pay at most \( \pi(n) - \pi(n + 1) \) for an incumbent firm.
For an incumbent firm, either you sell out to a potential entrant, in which case you get \( x \), or you turn down the offer, in which case entry takes place and profits are \( \pi(n + 1) \). It follows that an incumbent should ask for at least a payment of \( x = \pi(n + 1) \).

The condition that what the entrant is willing to pay is more than what the incumbent requires to sell is therefore given by

\[
\Delta = \left( \pi(n) - \pi(n + 1) \right) - \pi(n + 1) \\
= \pi(n) - 2\pi(n + 1) \\
= F + \frac{(a - c)^2 \left( 2 - n^2 \right)}{(n + 2)^2 (n + 1)^2}
\]

If \( n = 1 \) (the lowest possible value), \( \Delta \) is equal to \( F \) plus a positive value. If \( n \geq 2 \), then we have \( \Delta \) plus a negative value. This suggests that, if \( n = 1 \), then the acquisition path looks more attractive. This seems broadly consistent with the empirical evidence that acquisition is more likely when the number of incumbents is smaller (more concentrated industries).

One other reason why acquisition may be a better strategy is time to build: acquisition provides the entrant with quicker entry than the alternative of creating a new firm.

### Applied exercises

#### 11.8. Merger event study. Find time-series stock market data for all firms in an industry where a (horizontal) merger has taken place. Determine whether and how stock price reacts to merger announcements as well as the actual merger. Are these movements consistent with the theory presented in this chapter? How can you use changes following merger announcement as well as changes following merger consummation to tease out various effects from the merger? What limitations do you think an event study of this type has, in general and in the specific merger application under consideration? Extra credit: find data on prices and costs pre- and post-merger; use it to refine your analysis of merger impact.