Applying the standard Cournot equations, we know that the post merger equilibrium outputs of the two firms downstream are:

$$q_1^D = \frac{A - 2(c^U + c^D) + (P^U + c^D)}{3B} = \frac{A - 2c^U - c^D + P^U}{3B}$$
$$q_2^D = \frac{A - 2(P^U + c^D) + (c^U + c^D)}{3B} = \frac{A - 2P^U - c^D + c^U}{3B} \tag{16.13}$$

and their equilibrium profits are:

$$\pi_1^D = \frac{(A - 2(c^U + c^D) + (P^U + c^D))^2}{9B} = \frac{(A - 2c^U - c^D + P^U)^2}{9B}$$
$$\pi_2^D = \frac{(A - 2(P^U + c^D) + (c^U + c^D))^2}{9B} = \frac{(A - 2P^U - c^D + c^U)^2}{9B} \tag{16.14}$$

Equation (16.13) confirms that, under our foreclosure assumption, the downstream division of the integrated firm has a greater output than its non-integrated rival.

How does $U2$ set $P^U$? We can use (16.13) to identify the derived demand, $q_2^U = q_2^D$ facing the independent upstream firm. Again writing this in inverse form we have

$$P^U = \frac{A - c^D + c^U}{2} - \frac{3B}{2} q_2^U \tag{16.15}$$

This is in the form $P = a - bq$ and we know that with this demand function the monopoly output is $(a - c^U)/2b$, where $a = (A - c^D + c^U)/2$ and $b = 3B/2$. This gives the equilibrium output for upstream firm 2:

$$q_2^U = \frac{A - c^U - c^D}{6B} \tag{16.16}$$

The equilibrium price for the intermediate product is, therefore

$$P^U = \frac{A - c^D + c^U}{2} - \frac{3B}{2} \times \frac{(A - c^U - c^D)}{6B} = \frac{(A + 3c^U - c^D)}{4} \tag{16.17}$$

Profit of the independent upstream firm is $(P^U - c^U)q_2^U$, which from (16.16) and (16.17) is

$$\pi_2^U = \frac{(A - c^U - c^D)^2}{24B} \tag{16.18}$$

Finally, we can substitute the equilibrium intermediate product price into equations (16.13) and (16.14) to identify the equilibrium outputs, prices, and profits in the downstream market:

$$q_1^D = \frac{5(A - c^U - c^D)}{12B}$$
$$q_2^D = \frac{(A - c^D - c^U)}{6B} \tag{16.19}$$

$$P^D = \frac{5A + 7c^U + 7c^D}{12} \tag{16.20}$$

$$\pi_1^D = \frac{25(A - c^U - c^D)^2}{144B}$$

$$\pi_2^D = \frac{(A - c^D - c^U)^2}{36B} \tag{16.21}$$

The downstream division of the integrated firm is noticeably larger and more profitable than its independent downstream rival. This is the result of the foreclosure of supply to $D2$, which gave $U2$ monopoly power that $U2$ thereafter exploited by setting a high upstream price. Again, using our specific numbers, the upstream price to $D2$ is \$36.5. Because the integrated retailer buys its input at cost, it sells 22.5 units downstream while its independent rival sells just 9 units. The resulting retail price is \$68.5. Prior to the merger, $D2$ earned a profit of \$144. That has now been reduced to \$81. The merging firms, however, have benefited. Their combined profit before the merger was \$360. It has risen through integration to \$506.25.

Two points need to be considered. First, does our assumption of foreclosure make sense? Is it profit-maximizing for the integrated firm not to sell any inputs to its independent downstream rival? This is where Salinger's (1988) argument comes into play. The integrated firm has a total input cost of $c^U + c^D$. It therefore earns $P^D - (c^U + c^D)$ on each unit that it sells downstream. Further, we know that for the rival $D2$ to be in business, it must be the case that $P^D > (P^U + c^D)$. Suppose that the integrated firm did sell one unit of its intermediate good to its independent rival $D2$ at price $P^U$. What would happen if instead it withdrew this unit and sold it internally to the downstream division so that the total output and therefore the price in the downstream market remain unchanged? In withdrawing the unit originally sold to $D2$, the integrated firm loses profit $P^U - c^U$. However, it then gains a profit $P^D - (c^U + c^D)$ that it makes on every internal sale. It will therefore be profitable to stop selling to the downstream rival or to foreclose if $P^D - (c^U + c^D) > P^U - c^U$. This condition simplifies to $P^D > (P^U + c^D)$, which we know has to hold given that the downstream rival is in business. In other words, if the integrated firm were selling to $D2$ then it could always do better by withdrawing those units and instead sell them internally to increase its own downstream production. In our numerical example, the integrated firm ultimately earns \$68.5 − \$23 − \$23 = \$22.5 for every upstream unit sold internally. By contrast, it would earn only \$36.5 − \$23 = \$13.5 on upstream sales to $D2$. Therefore, foreclosure of sales to downstream rivals does seem to be optimal.

The second feature worth noting is that the vertical merger brings benefits to consumers despite the foreclosure that also accompanies it. In our numerical example, the vertical integration of firms $U1$ and $D1$ causes the price in the downstream market to fall from \$76 to \$68.5. The elimination of double marginalization by the integrating firms benefits consumers. Salinger (1988) shows, however, that this need not be the case. The competitive effect of a vertical merger is determined by the balance between two forces. On the one hand, vertical merger and market foreclosure reduce the number of independent upstream suppliers and so reduce the competitive pressure on upstream—and downstream—prices. On the other hand, a vertical merger eliminates double marginalization for the merged firms and, by reducing their input costs, makes them fiercer competitors in the downstream market, tending to reduce consumer prices. It is difficult to predict how this will play out.

What is likely to be the case is that the anticompetitive effect will be weak if the number of independent upstream competitors remains large.

Moreover, there is an important strategic issue that is not addressed by the Salinger (1988) model. The independent downstream firms that are foreclosed upon may well have an incentive to react to integrated rivals by merging with upstream firms themselves. If vertical integration brings business advantages, then all firms should have an incentive to pursue them. Policy should not penalize any one firm because it happens to be first in line in this process. To address this point, as well as to explore other features of vertical mergers, we now consider the model of Ordover, Saloner, and Salop (1990) (OSS).

### 16.3.2 Vertical Mergers in a Differentiated Products Setting

The OSS model is in some ways simpler and in others more complex than the Salinger model. It is simpler in that we assume Bertrand competition with homogenous upstream products implying marginal cost pricing. It is more complex in that we treat the relationships between upstream and downstream firms more strategically.

The upstream firms incur constant marginal cost $c^U$. One unit of the upstream product is needed for every unit of downstream production; the downstream firms have no other production costs. In contrast to the Salinger model, firms sell differentiated products and compete in prices in both markets. The upstream product of the two firms is homogeneous but the downstream products are differentiated. We capture this feature by letting the demand for downstream products 1 and 2 be respectively:

$$\begin{aligned} q_1^D &= A - p_1^D + B(p_2^D - p_1^D) \\ q_2^D &= A - p_2^D + B(p_1^D - p_2^D) \end{aligned} \quad (0 < B < \infty) \tag{16.22}$$

In equation (16.22), $B$ is an inverse measure of the degree of product differentiation in the downstream market. If $B = 0$, the two products are totally differentiated. However, as $B$ approaches infinity the two products become increasingly similar. To keep the analysis as simple as we can, we normalize $A = 100$ and $c^U = 0$ without loss of generality, and we assume that $B = 1$.[4]

In order to consider the explicitly strategic aspects of vertical mergers, OSS develop a four-stage game. In the first stage, one of the downstream firms can choose to acquire one of the upstream suppliers. If such a merger takes place we assume, without loss of generality, that it is between $U1$ and $D1$ and results in the merged firm $F1$.

In the second stage, input prices are set. If no merger occurs then the upstream firms compete in prices. If a merger has occurred then in the second stage two possibilities are considered. First, $F1$ refuses to supply $D2$, i.e., foreclosure. Second, $F1$ sets an upper bound on the input price to be paid by $D2$ by offering to supply it at price $c_{12}$, with $F1$ setting $c_{12}$ before $U2$ sets its input price. This allows $U2$ to undercut $F1$ in this stage by setting its price "just less" than $c_{12}$. In the third stage, if there has been a merger in the first stage firms $U2$ and $D2$ decide whether or not to merge. We then proceed to the fourth stage. Here, downstream prices are set given the input prices and organizational structures that have been determined in the previous stages. As usual, we solve this game by working backwards from stage 4.

[4] The choice of $B$ does affect profits but does not actually affect the equilibrium that emerges from the model.

To specify the extensive form of this four-stage game, we need to identify the pay-offs under the different strategy combinations that can occur.

We begin with the most general case in which firm $D1$ pays $c_1$ and firm $D2$ pays $c_2$, respectively, for the upstream product. Our demand equations then imply marginal revenue for each downstream firm given by:

$$MR_1 = 50 + \frac{p_2}{2} - q_1$$
$$MR_2 = 50 + \frac{p_1}{2} - q_2 \tag{16.23}$$

Equating each firm's marginal revenue with its upstream marginal cost yields the best response functions:

$$p_1 = 25 + \frac{p_2}{4} + \frac{c_1}{2}$$
$$p_2 = 25 + \frac{p_1}{4} + \frac{c_2}{2} \tag{16.24}$$

Solving these for $p_1^D$ and $p_2^D$ gives the downstream prices:

$$p_1^D(c_1, c_2) = \frac{2}{15}(250 + 4c_1 + c_2)$$
$$p_1^D(c_1, c_2) = \frac{2}{15}(250 + 4c_1 + c_2) \tag{16.25}$$

As we might expect, both prices are increasing in the costs of the upstream inputs. Substituting these prices into the downstream demand functions of equations (16.22) gives the equilibrium downstream outputs of:

$$q_1^D(c_1, c_2) = \frac{2}{15}(500 - 7c_1 + 2c_2)$$
$$q_2^D(c_1, c_2) = \frac{2}{15}(500 - 7c_2 + 2c_1) \tag{16.26}$$

Each firm's downstream output is decreasing in its own costs but increasing in the rival's costs.

If we now solve for each downstream firm's profits, it is straightforward to show that these are:

$$\pi_1^D(c_1, c_2) = \frac{2}{225}(500 - 7c_1 + 2c_2)^2$$
$$\pi_2^D(c_1, c_2) = \frac{2}{225}(500 - 7c_2 + 2c_1)^2 \tag{16.27}$$

An important point to note for subsequent analysis is that the profit of downstream firm $i$ is decreasing in its own input cost $c_i$ and increasing in its rival's input cost $c_j$.

Now consider the third stage. If there is no merger in stage 1, there is no merger in stage 3 and the independent upstream firms, acting as Bertrand competitors, supply the upstream

product at marginal cost $c^U = 0$. In this case, the upstream firms just break even, while equation (16.27) with $c_1 = c_2 = 0$, implies aprofit for each downstream firm of:

$$\pi_1^D(0,0) = \pi_2^D(0,0) = 2{,}222.22 \tag{16.28}$$

Suppose by contrast that there has been a merger of $U1$ and $D1$ in stage 1 to form firm $F1$. As we noted above, we then consider two possibilities in stage 2 of the game. The first of these is that $F1$ forecloses on $D2$. The second is that $F1$ sets its input price $c_{12}$ before $U2$ sets its input price.

Suppose that $F1$ forecloses in stage 2. If in stage 3 firms $U2$ and $D2$ do not merge, this effectively makes $U2$ a monopoly supplier to $D2$ (in much the same way as we saw in the Salinger model). Because one unit of the upstream product is required to make one unit of the final product, profit of $U2$ if it sets input price $c_m$ is $\pi_2^U(c^U, c_m) = (c_m - c^U)q_2^D(c^U, c_m)$, where $q_2^D(c^U, c_m)$ is given by (16.26) with $c_2 = c_m$ and $c_1 = c^U = 0$. In other words:

$$q_2^D(0, c_m) = \frac{2}{15}(500 - 7c_m);\ \pi_2^U(0, c_m) = \frac{2}{15}c_m(500 - 7c_m) \tag{16.29}$$

Inverting U2's demand curve to solve for its marginal revenue and then setting this to its assumed marginal cost of 0 yields the optimal upstream price $c_m$:

$$c_m = 250/7 = \$35.71 \tag{16.30}$$

Substituting this price into (16.27) and (16.29) gives the profit for $U2$ of 25,000/21 and for $D2$ of 5000/9. In other words, aggregate profit of $U2$ and $D2$ if they do not merge in response to merger and foreclosure by $F1$ is

$$\pi_2^A(0, c_m) = 110{,}000/63 = \$1{,}746.03 \tag{16.31}$$

Profit to $F1$ from this foreclosure strategy is:

$$\pi_1^D(0, c_m) = 1{,}280{,}000/441 = \$2{,}902.49 \tag{16.32}$$

Now consider what happens if instead $U2$ and $D2$ merge to form firm $F2$. Both $F1$ and $F2$ then obtain the upstream product at marginal cost. As a result, the profits of $F1$ and $F2$ are each given by equation (16.28), that is, \$2,222.22. Comparison with (16.31) and (16.32) indicates that if $F1$ forecloses on $D2$ then $U2$ and $D2$ will merge, significantly reducing the profit of $F1$.

As we suggested near the end of our discussion of the Salinger model, those who belong to the club of vertically integrated firms may wish to exclude others from joining. Facing vertically integrated rivals means competing against firms with low input costs and this can lead to intense price competition. So, suppose that $U1$ and $D1$ have merged to form $F1$ but want to prevent $U2$ and $D2$ from doing the same thing. Is there a strategy that might work to achieve this goal? OSS suggest that there is, indeed, such a strategy.

Suppose that in stage 2, $F1$ does not foreclose but instead offers to supply $D2$ at unit input price $c_{12} > c^U$. As we noted above, we assume that $F1$ sets $c_{12}$ before $U2$ sets its input price, so clearly $U2$ can win $D2$'s business by just undercutting $c_{12}$ and has an incentive to do so because $c_{12} > c^U$. However, by committing to price $c_{12}$, $F1$ puts a ceiling on the

price that $U2$ can charge $D2$ and thereby limits the gains from a merger of $U2$ and $D2$. To see this more clearly consider the following analysis.

Profit to $D2$ given that $F1$ supplies its own downstream division at marginal cost $c^U = 0$ and that $U2$ just undercuts $c_{12}$ in supplying $D2$ is given by equation (16.27) with $c_1 = 0$ and $c_2 = c_{12}$:

$$\pi_2^D(0, c_{12}) = \frac{2}{225}(500 - 7c_{12})^2 \tag{16.33}$$

Profit to $U2$ given that it supplies $D2$ at input price $c_{12}$ is $c_{12}q_2^D(c^U, c_{12})$ where $q_2^D(c^U, c_{12})$ is given by equation (16.26) with $c_2 = c_{12}$ and $c_1 = c^U = 0$:

$$\pi_2^U(0, c_{12}) = \frac{2}{15}c_{12}(500 - 7c_{12}) \tag{16.34}$$

Aggregate profit of $U2$ and $D2$ is therefore is $\pi_2^A(0, c_{12}) = \pi_2^U(0, c_{12}) + \pi_2^D(0, c_{12})$ which, from (16.33) and (16.34) is:

$$\pi_2^A(0, c_{12}) = \frac{8}{225}(62{,}500 + 125c_{12} - 14c_{12}^2) \tag{16.35}$$

This aggregate profit is quadratic in $c_{12}$. It is easy to see that when $c_{12} = c^U = 0$ $\pi_2^A(0{,}0) = 20{,}000/9 = \$2{,}222.22$. Moreover, it is straightforward to show that $\pi_2^A(0, c_{12})$ is increasing in $c_{12}$ when $c_{12} = 0$. Finally, $\pi_2^A(c^U, c_m) = 110{,}000/63 < \pi_2^D(c^U, c^U)$ from equations (16.30) and (16.35). In other words, $\pi_2^A(c^U, c_{12})$ can be illustrated as in Figure 16.4.

It follows from these results that there is always an input price $c_{12} < c^*$ that $F1$ can set to make $U2$ and $D2$ jointly more profitable as separate firms than they would be if they merged: in our example $c^* = \$8.83$. In preventing their merger, $F1$ not only preserves itself as the lone vertically integrated firm but also ensures that it continues to face a high-cost rival in the downstream market rather than the low cost one it would face if $U2$ and $D2$ merged. In other words, $F1$ has an incentive to set $c_{12}$ as high as possible while preventing

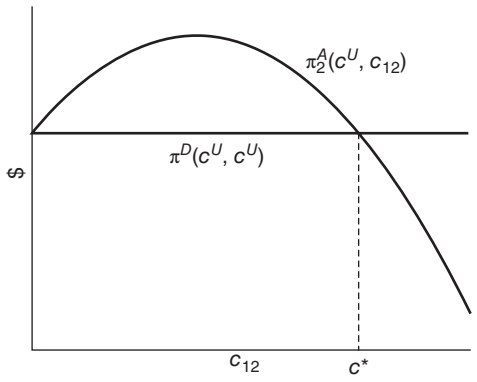


**Figure 16.4** Strategic supply price

If $F1$ offers to supply $D2$ at any input price less than $c^*$, Firms $U2$ and $D2$ will prefer not to merge.

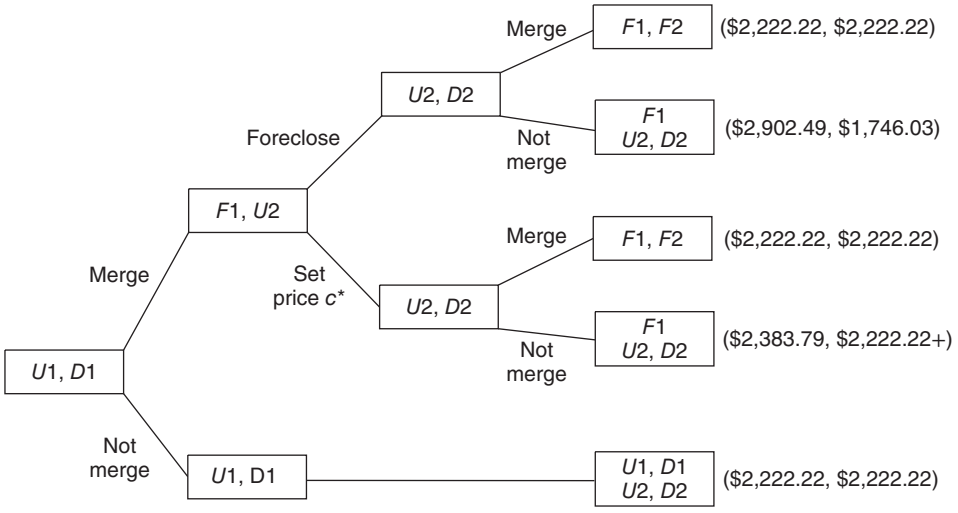


**Figure 16.5** The OSS extensive-form game with $c_{12} = c^*$

the merger of $U2$ and $D2$. From equation (16.27) profit of $F1$ when it offers to supply $D2$ at input price $c^*$ (which is just undercut by $U2$) is $\pi_1^D(0, c^*) = \$2{,}383.79$.

The OSS analysis just outlined is illustrated in Figure 16.5 where we show the extensive form of the four-stage game.

Suppose that $U1$ and $D1$ merge in stage 1 to form $F1$. If $F1$ chooses to Foreclose in stage 2 then $U2$ and $D2$ will choose to merge in stage 3 as a result of which $F1$ has profit $\pi_1^D(c^U, c^U) = \$2{,}222.22$. Suppose, by contrast, that $F1$ sets $c^*$, which $U2$ just undercuts. By construction of $c^*$ we know that $\pi_2^A(c^U, c^* - \varepsilon) > \pi_2^D(c^U, c^U)$ so $U2$ and $D2$ choose not to merge. As a result, $F1$ has profit \$2,383.79. It follows that $F1$ prefers to set price $c_{12} = c^*$ than to Foreclose. So if $U1$ and $D1$ Merge in stage 1 the merged firm will offer to supply $D2$ at price $c^*$ in stage 2, as a result of which $U2$ and $D2$ choose not to merge in stage 3 and $F1$ earns $\pi_1^D(c^U, c^*) = \$2{,}383.79$.

Now suppose that $U1$ and $D1$ choose not to merge in stage 1. Then the upstream firms compete in prices and set input price at marginal cost $c^U$, as a result of which the downstream firms, in competing in prices, earn $\pi_1^D(c^U, c^U) = \pi_2^D(c^U, c^U) = 2{,}222.22$. Clearly, $U1$ and $D1$ prefer to merge.

To summarize, the subgame perfect equilibrium to the OSS four-stage game is that firms $U1$ and $D1$ merge in stage 1 to form $F1$. Then $F1$ offers to supply $D2$ in stage 2 at input price $c^*$, as a result of which $U2$ and $D2$ do not merge in stage 3.

Note among other things that the strategy of offering to supply its rival at price $c_{12} > c^U$ is much closer in spirit to the "squeeze" pricing that phone companies and Alcoa have been accused of than is outright foreclosure. Note too that by preventing the merger of $U2$ and $D2$, and thereby preserving the existence of double marginalization and a high cost rival, $F1$'s strategy of offering to sell to $D2$ at price $c_{12}$ leads to higher prices for consumers. It is an action designed to thwart the outbreak of competition and is therefore truly anti-competitive. In all these ways, the OSS model has an air of realism about it.

Chen (2001) extends the OSS analysis, starting from the empirical regularity that foreclosure seems to be a rarity in practice. He shows that whenever the wholesale price

offered by the integrated firm and independent producer $U2$ is the same, the independent downstream firm $D2$ will prefer to buy from the integrated producer. Why? Because in so doing, $D2$ gives the integrated firm another source of profit—a source that rises as $D2$ sells more downstream. As a result of selling to $D2$, the integrated firm will price less aggressively in the downstream market because this would cut into its profit on input sales to $D2$. Of course, less aggressive downstream pricing also helps $D2$ and that is precisely why $D2$ would prefer to buy from the integrated firm rather than from $U2$. Indeed, Chen (2001) suggests that if there are cost efficiencies associated with the vertical merger so that $c^U$ falls at the integrated firm, the merger could lead to a different sort of foreclosure altogether. Instead of cutting off independent downstream firms from a source of supply, the vertical merger may leave independent upstream firms without any customers.[5]

## 16.4 REAPPRAISAL AND APPLICATION: THE GE-HONEYWELL MERGER

Let us return to the GE-Honeywell merger described at the start of this chapter. As noted, the European Commission eventually ruled against the merger. Their reasoning is summarized in the following extract from the Commission's report (paragraph 355):

> Because of their lack of ability to match the bundle offer . . . [independent] suppliers will lose market shares to the benefit of the merged entity and experience an immediate damaging profit shrinkage. As a result, the merger is likely to lead to market foreclosure on the existing aircraft platforms and subsequently to the elimination of competition in these areas.[6]

There are several points to make in regard to this judgment. First, the "bundling" and unfair competitive advantage that the commission feared would give GE-Honeywell a competitive advantage is nothing more than the elimination of the double marginalization that we have described above. Eliminating double marginalization gave a similar advantage to the integrated firms in the oligopoly models that we have studied in this chapter. Packaging jet engines with engine starter motors is economically equivalent to combining the upstream manufacturing with the retail services of a downstream dealer. Thus, there is some legitimacy in the Commission's fear that GE-Honeywell would gain some advantage over independent rivals.

Whether the merger would lead to foreclosure and whether, if it did, this would raise prices is another matter. In part, that would depend on the nature of initial competition. If the market were very competitive with lots of jet engine firms and avionics companies, then the merger could have very little anticompetitive impact. The nature of competition in both the upstream and the downstream affects the likelihood of foreclosure and its ultimate impact. In short, some understanding of the real world market place is necessary to make an informed judgment regarding this merger.

[5] Pepall and Norman (2001) offer a similar analysis to Chen (2001) in which vertical foreclosure is never an equilibrium precisely because, again, this leads to competition between multiple vertically integrated firms.

[6] The full decision is available at: *http://ec.europa.eu/comm/competition/mergers/cases/decisions/m2220_en.pdf*.

It is fair to say that neither pre-merger market was competitively structured. Estimates of GE's share of the jet engine market for large commercial aircraft range from 28 to 52 percent, and it had just two major rivals, namely, the Pratt-Whitney division of United Technologies and the Rolls Royce Group. Likewise, Honeywell's share of the avionics market was on the order of 50 percent, and it had just three rivals: Rockwell Collins (25 percent), Thales (15 percent), and Smiths Industries (5 percent). In reaching its decision, the European Commission appears to have been persuaded that the preeminence of GE and Honeywell made subsequent integration by their rivals impossible. As a result, and as the quote above makes clear, the Commission feared foreclosure of GE's competitors and the ultimate loss of competition in the jet engine market.

The Commission is implicitly claiming that rivals could not integrate as well and this would need to be documented. More importantly, we should in this case show that even with foreclosure, the resulting market outcome is worse than the pre-merger case. This was *not* the case in our numerical example of the Salinger (1988) model. In that example, integration by one firm did lead to foreclosure of its rival. Nevertheless, the post-merger downstream price of $68.5 was still well below the pre-merger price of $76. As a review of that example will quickly reveal, even if the foreclosure eventually led the integrated firm to enjoy a complete downstream monopoly, the retail price would still decline to $73. This is, of course, a stylized example. Nevertheless, it reveals just how large the inefficiencies of double-marginalization could be, and perhaps why many economists thought the ruling a mistake.[7]

## 16.5 CONGLOMERATE MERGERS

The final type of merger to consider is a conglomerate merger. Such mergers bring under common control firms whose products are neither direct substitutes nor complements. The outcome is to join a set of firms producing a diversified range of products with little or nothing in common. While conglomerate companies have been with us for some time, the US merger wave starting in the 1960s and continuing into the early 1980s is, particularly in the earlier years, when many of the conglomerates that we see today were formed. The question is whether we can develop a convincing economic rationale for these mergers. If not, then we should think of conglomerates as an accident of history that are being gradually corrected through corporate downsizing and the focus on "core businesses," strategies that appear to characterize corporate change in the new millennium. A number of reasons have, however, been advanced to support the emergence of conglomerate firms. We examine these in turn.

### 16.5.1 Possible Economies Associated with Conglomeration

Scope economies and saving on transactions costs are two possible advantages that may accrue to conglomerate firms. By scope economies we mean that a variety of products or services are more cheaply produced by one firm than by two or more firms. By transaction

[7] Nalebuff (2004) offers a similar analysis of the GE-Honeywell case set in a framework of differentiated products. To be fair, the Commission noted other fears besides foreclosure. One was that GE also had an unfair advantage in that its large financial operations allowed it to package financing with jet aircraft in a way that Pratt-Whitney and Rolls Royce could not. There was also a horizontal element to the case as GE and Honeywell were the only two suppliers of regional jet engines.

## Reality Checkpoint

## Going Whole Hog on Vertical Integration

Nowhere have the strategic advantages of vertical integration been more aggressively pursued in recent times than in meat and poultry markets. Firms in these markets have made a concerted effort to control all aspects of production from the farm to the store counter or, as they say in the pork business, from "birth to bacon and squeal to meal."

The largest pork producer in both the United States and the world is Smithfield Industries with 26 percent of the US market. Smithfield owns or operates thousands of hog farms and has contractual decision-making rights over every single stage of the production chain. It even owns the DNA line for the hogs that it uses and the feed that they eat.

The advantages of such control are clear. Vertical integration allows Smithfield to direct insemination and breeding and thereby maintain a supply of litters without threatening its herd sustainability. Feed and genetic control allow the firm to standardize the leanness and other quality features of its hogs. Integration also permits Smithfield to design the warehouse barns in which the hogs are raised, ensuring that the hogs will mature and be ready for slaughter on a schedule that permits the most efficient plant utilization rate.

While Smithfield is the world's largest pork producer, annually slaughtering close to 20 million hogs to turn out over 5 billion pounds of pork, it is not alone in its organizational strategy. Tyson, which produces both poultry and beef as well as pork and which is the world's largest meat producer overall, is also highly integrated. So are other pork firms such as ConAgra and Swift. In the pork business, vertical integration is the swine of the times.

Source: S. Kilman, "Smithfield to Buy Hog Farmer Premium Standard," *Wall Street Journal*, September 19, 2006, p. A4; and S. Martinez, 2002. "A Comparison of Vertical Coordination in the US Poultry, Egg, and Pork Industries," *Current Issues in Economics of Food Markets* Agriculture Information Bulletin, AIB-747–05 (May).

costs we mean the costs that are incurred by firms when they use external markets in order to exchange goods and services.[8] These include, for example, the costs of searching for the desired inputs, negotiating supply contracts, monitoring and enforcing these contracts, and the risk associated with unforeseen changes in supply conditions.

Scope economies derive primarily from the ability of the firm to exploit common inputs in the manufacture of a range of products. The same production line can be used for several products, marketing efforts can promote the whole range of goods a firm produces, and the fruits of research and development may extend to a number of diverse products. Advertising and promotional activities also frequently exhibit scope economies across a variety of activities. This line of argument implies that for scope economies to be an important element in conglomerate mergers it is necessary that the firms that merge are related in some respect. Either they sell in similar markets or they have similar production technologies. The data on conglomerates do not appear to be consistent with this hypothesis. A detailed study by Nathanson and Cassano (1982) concludes that there are at least as many conglomerate firms that produce goods with little in common, whether this be technology or the markets at which they are targeted, as there are firms that have relatively low product and market diversity.

[8] For an excellent discussion of transaction costs, see Besanko, Dranove, and Shanley (2009).

Transactions costs are particularly significant when specialized or knowledge-intensive assets are traded. Consider a specialized asset, such as a sophisticated machine that is specifically designed to produce two goods, A and B. Let us also suppose that the markets for A and B are highly concentrated with a small number of producers, and that the owner of the machine has spare capacity if the machine is used only to produce A. This might arise, for example, if demand for A is limited relative to the productive capacity of the machine. If such spare capacity exists, the owner of the machine may wish to use it to produce B goods as well. A conglomerate merger or the machine owner merging together A and B production is one way that this can happen. However, as Teece (1982) and others have argued, conglomeration is not strictly necessary. The machine owner, a producer of A, can instead simply lease the spare capacity to B producers.

There is a potential problem with the leasing arrangement, however. Because the number of B producers is small, each will have some monopoly power in bargaining over the terms of the lease. As a result, the machine owner may find that the costs and risks associated with the negotiations between the interested parties are large as each side tries to get the best possible deal. Conglomeration may be a means of avoiding such costs. By using the machine to produce both A and B within the same firm, the machine owner avoids all the bargaining hassles. There is no longer any conflict over how to divide the gains from using the machine because those gains all go to the same owner.

Transaction cost problems are particularly important when the asset involved is knowledge or information intensive. The knowledge of such matters as organizational routines or specialized customer needs is generally embodied in specific individuals or teams employed by the company. It is difficult to envision contracts to "lease" such personnel.

In short, the effort to minimize the transactions costs associated with contracting between firms may explain conglomerate mergers to some extent. Nevertheless this motivation seems unlikely to be the major factor behind such mergers. The reason is that here again, we are talking about some asset that is common to all the lines of production operated by the conglomerate, and such commonality in productive assets does not seem to be a feature of conglomerate firms.

### 16.5.2 Managerial Motives

The skepticism surrounding the explanations based on scope economies, transaction cost savings, and other arguments why conglomerate mergers improve production efficiency has led some to postulate a different, less benign motivation. The alternative motiveis that it is in the interest of management even if it is not in the interest of shareholders. Because management calls the shots, it is the managerial interest that prevails.

In any reasonably large public company, ownership, which essentially resides with the shareholders, may be separated from control, which essentially resides with the management team. This separation would not matter too much if management performance could be perfectly observed and monitored by shareholders. Yet perfect monitoring is rare, and absent such monitoring, management can pursue its own agenda at least to some extent. This would not matter so long as the best interests of management are served by maximizing shareholder wealth. It is precisely the attempt to secure this harmony of interest that lies behind the use of performance-related clauses and payment in stock options in many executive compensation schemes. Still, the match between the interests of shareholders and management is rarely perfect, leaving management with at least some ability to pursue goals other than maximization of shareholders' returns.

Suppose that management compensation is based upon company growth.[9] Growth is far from easy to generate internally. It requires that market share be won from competitors who can hardly be expected to sit passively by when they lose customers. Nor is it easy to buy growth through horizontal mergers because this is the kind of acquisition that is watched by the antitrust authorities. In these circumstances, we should not be surprised to find management supporting a conglomerate merger, even if this is not necessarily in the best long-term interests of shareholders. Such a merger offers management the desired growth while avoiding antitrust problems. In this light, it is, perhaps, significant that the greatest wave of conglomerate mergers in the United States coincided with a period in which the antitrust authorities were particularly fierce in their examination of mergers between related companies.

Management may also pursue conglomeration as a means to minimize risk. When a firm is involved in many distinct markets it avoids putting all its eggs in one basket. Such diversification may be important to management.[10] Shareholders often use compensation schemes that closely tie management's pay to the firm's profit performance.[11] Yet while these practices work to align management's interests more closely to those of the stockholders, they also increase the risk that management faces. As profits go up and down, management's compensation rises and falls irrespective of whether the profit results were management's fault or not. To protect against such fluctuations, management may seek to diversify the sources of the firm's income by pursuing conglomeration. This smooths the firm's income stream because with many product lines operating, positive and negative shocks tend to cancel each other out. The derived income stream of the firm's executives is also smoother. Even shareholders might prefer this approach if, in the absence of such diversification, the firm would have to pay its executives higher salaries to compensate them for the greater risk. This may be particularly true for managers who are heavily invested in the firms so that not only their labor income but also their capital income is subject to the same risk.

Some evidence in support of diversification as a means of diversifying managerial risk is found in studies by Ahimud and Lev (1981) and by May (1995). The first of these studies finds that when no shareholder owns 10 percent or more of the stock and management control is high, firms tend to be more diversified. May (1995) finds that a comparison of CEOs in terms of the proportion of their wealth invested in the firm reveals that as this proportion rises, CEOs tend to favor conglomeration.

There are also less attractive or more self-serving managerial goals that may be pursued through conglomeration. These include entrenchment and rent-seeking. It may be more difficult to replace managers who run more complicated firms. Obvious candidates to replace the existing CEO and other executives may be hard to find when the firm is a complex conglomerate. Similarly, the more complex the organization, the more difficult it is for shareholders to monitor management and to guard against managers skimming off profits to their own benefit. These problems are sufficiently real that shares in a conglomerate are often considered low-priced and subject to a conglomerate discount [Aggarwal and Samwick (2003)].

[9] This analysis is treated in detail in Mueller (1982).

[10] For a detailed discussion of these ideas, see Ahimud and Lev (1981).

[11] For example, Boeing Corp. linked its annual award of stock options to its 1,500 top executives to the performance of the company's share price over the next five years. See F. M. Biddle, "Boeing Links Managers' Stock Options to Five-Year Performance of Shares," *The Wall Street Journal*, February 26, 1998, p. B12.

## 16.6 A BRIEF DIGRESSION ON MERGERS AND THE THEORY OF THE FIRM

A merger involves the acquisition of one company by another. As a result of that purchase, the acquiring firm gets the physical capital—buildings, equipment, and land—and perhaps certain intangible assets, such as reputation or brand name, that formerly belonged to the acquired company. The ultimate question raised by any merger is, what does the change in ownership permit the merged firm to do that could not be done before?

In the case of a horizontal merger, the possibility of enhanced market power is clearly part of the motivation. Yet we often see horizontal mergers in which such an increase in market power may not occur. The merger paradox discussed in the last chapter suggests that increases in market power as the result of a merger could be rare. In the case of a vertical merger, the market power motivation is even more suspect. If the upstream and downstream firms each had 5 percent of their respective markets before the merger, little seems changed by moving the ownership of those market shares from two different firms to two different divisions of the same firm.

With upstream-downstream firms, there is the issue of double marginalization. We have suggested a vertical merger as a response to that problem. It is not the only response, however. Various contracts between two vertically related firms could be written to overcome the problem of double marginalization, and these contracts do not require integrating the two firms into one. We will examine such contracts in depth in the next chapter. Here we simply want to raise the question as to why firms merge rather than make use of such contracts. Alternatively, why don't more firms merge? What in fact limits the size of a firm? What stops firms from merging into bigger and bigger firms?

This question is really about what determines the boundaries of a firm. What is the difference between organizing the production of a commodity through many independent companies, on the one hand, and organizing that production through many divisions of the same company, on the other? Viewing the matter in this light makes transparent that what determines the boundaries of the firm is an important question for industrial organization theory.

Many alternative theories of the firm have been developed since the late 1970s. There is sufficient work in this area now for it to make up a course, or a field in itself. Our aim here is not to cover this material in depth. Instead, we wish simply to offer a brief discussion of the limits on firm size. Now seems a particularly appropriate point to raise this topic because a merger, by definition, is a transaction that increases a firm's size.

Neoclassical theory does not tell us much as to what such a transaction gains for the parties. Nor does it tell us why firms operate internal divisions rather than "spinning them off" into individual companies. However, neoclassical theory is not alone in this regard. Other approaches to the theory of the firm also fall short of a complete answer. Take, for instance, the agency view of the firm. Under this view, a firm is an organization designed to generate the proper incentives when the various parties engaged in the production process have different and private information. For example, a supplier of glass may contract with an automobile producer to provide windshields of a particular quantity and quality according to a particular schedule. Obviously, the actual quality of such windshields is beyond the complete control of the glass supplier but the supplier does know whether it exerted its full effort to supplying the specified quality. The automaker, though, is not so well informed. It cannot be sure whether a batch of low-quality glass is due to bad luck or, instead, bad faith on the part of its supplier. Agency theory has generated extremely

useful insights into the types of contracts that might be used to surmount such informational problems and provide the proper incentives for both parties to live up to their contractual obligations. Yet it does not tell us whether such contracts must be between two separate firms, as in the automaker and the glass supplier of our story, or whether the contract could simply be the incentive scheme offered to the windshield division of a giant car manufacturer.

Similar problems arise with the transactions cost approach to the firm. Under that approach, the firm is viewed as an organization designed to minimize the costs of negotiating, interpreting, enforcing, and renegotiating contracts. However, the precise mechanism by which this cost reduction is achieved is not typically spelled out. There is no reason, *a priori*, to assume that haggling is less of a problem between two divisions within one firm than between two separate firms.

The issue of corporate mergers reveals a weakness in economic theory regarding the limits or boundaries of a firm's activities. Why is it that we observe General Motors supplying autobodies internally rather than purchasing them from an independent supplier? What advantages are gained and then lost when these divisions are instead independent firms?

One answer is provided in the work of Hart (1995) and centers on the issue of ownership. A merger changes the ownership of assets and ownership gives control. The carmaker that owns its own windshield supply unit is in a position to resolve, by itself, any dispute between its assembly line and the glass unit. This does not necessarily minimize the cost of haggling. However, common ownership may permit investments that increase efficiency that would be less likely to occur otherwise.

Suppose that there is specific machinery that can be used to produce, inexpensively, windshields of a quality and style unique to the automaker in question. An independent glass company might not invest in such equipment because it ties the glassmaker too closely to supplying the particular auto firm. If the glass supplier did make the investment, its bargaining position in disputes with the automaker would be weak because it has no other buyer for the one product that this machinery permits it to make. From the perspective of the glass supplier, it is less risky to use more general equipment that makes it easy to produce glass products for other firms as well. This is true even though the use of such generic processes requires the firm to incur an extra cost to mold the windshield to the specific dimensions specified by the carmaker.

A merger or acquisition of the glass company by the automaker offers a way out. By operating windshield production as a unit within its own firm, the automaker removes the potential conflict. Now, the specialized machinery can be bought and the windshields produced at lower cost because there is no longer any friction over how the gains from this investment will be shared. They all go to the one, common owner of the assets.

In other words, common ownership is desirable whenever there are complementarities—or synergies—between different assets. As a result, we should expect firms to combine whenever such complementarities are present—and to split apart if such complementarities vanish. Because technological changes are ever present, and because such innovations are constantly altering the extent of production complementarities, we should also expect a constant fluctuation in the size and organization of firms. This approach may help explain the recent wave of mergers in the telecommunications industry where rapid innovations have greatly altered the production technology.

## 16.7 EMPIRICAL APPLICATION: VERTICAL INTEGRATION IN THE READY-MIXED CONCRETE INDUSTRY

Ready-mixed concrete is one of the most widely used construction materials. It consists mainly of cement, water, and aggregates such as sand and gravel. Of these, cement is clearly crucial as the binding agent that hardens the aggregates into a solid mass. Almost invariably, cement makes up 12 percent of the concrete mixture by weight. Hence, cement and ready-mixed concrete match the assumptions of the Salinger (1988) and Ordover, Saloner, and Salop (1990) models in that cement is an upstream product used in fixed proportion per unit of the downstream product, ready-mixed concrete. This makes it an ideal industry in which to study the effects of vertical integration.[12]

Ali Hortaçsu and Chad Syverson (2007) point out that there is a further aspect of the concrete business that makes studying vertical integration in that industry interesting. This is the fact that the different phases of antitrust policy over the late twentieth century were very much evidenced in the ready-mixed concrete market. In the 1960s, cement makers were interested in integrating forward into ready-mixed concrete and the percentage of vertically integrated plants rose steadily throughout the decade. Fearing that these consolidations would lead to foreclosure and anticompetitive price squeezes, the Justice Department filed fifteen antitrust cases in this industry and each one led to divestiture. This vigorous policy also deterred further mergers with the result that during the 1970s, the fraction of cement firms that were vertically integrated fell noticeably. Then came the 1980s and rise of the "Chicago School" approach to antitrust policy, which viewed vertical integration much more favorably. There was a new wave of mergers that again sharply increased the extent of vertical integration in the concrete market. Finally, in the 1990s, the "post-Chicago" school began to make its influence felt and antitrust policy became less lenient. Vertical integration in concrete again declined. This pattern is shown in Table 16.1 below.

Of course, transport costs are far too high for there to be one, national market for ready-mixed concrete. Using Commerce Department data, Hortaçsu and Syverson (2007) identify 348 local markets over the years 1963 to 1997. They then use this data to determine whether the differences in ready-mixed concrete prices across markets are systematically related to the extent of vertical integration in those markets. A simple regression aimed at answering this question might have the form: $P_{it} = A + \beta VI_{it} + e_{it}$, where $P_{it}$ is the average concrete price (measured in logs) in market $i$ in year $t$; A is an intercept term; $\text{VI}_{it}$ is the market share of output accounted for by vertically integrated firms in market $i$ in year $t$; and $e_{it}$ is a random error term centered on zero. Such a simple model, though, leaves out

**Table 16.1** Vertical integration in cement/ready-mixed concrete market

| *Year* | *1963* | *1967* | *1972* | *1977* | *1982* | *1987* | *1992* | *1997* |
|---|---|---|---|---|---|---|---|---|
| Fraction of Cement Sales Accounted for by Vertically Integrated Firms | 25.2 | 51.2 | 48.4 | 41.0 | 49.5 | 51.3 | 75.1 | 55.4 |

[12] See Chipty (2001) for a study of vertical integration in cable television.

many other variables that are likely to be important in determining concrete prices in any given market-year, and therefore would lead to a biased estimate of the coefficient $\beta$.

To begin with, the average price over time might be different in each market. There might be something about the Chicago market, for example, that makes its price of cement always relatively high. This effect can be handled by letting the intercept term vary across each market. Then too, industrial organization theory suggests that market structure, as measured by the Herfindahl Index (HI), could also be important for the behavior of prices, as might be the level of demand coming from the local construction industry in that year. In fact, given our discussion of antitrust policy, we might also think that the precise year is important as well because firms might try to keep prices low in years when antitrust pressure is more intense than in years when it is lenient. We need to control for such time-specific factors and the many other forces that could affect concrete prices if we are to isolate the influence of changes in vertical integration alone. The easiest way to do this is to include measures of concentration and local demand and put in a dummy variable for each market and each year.

Hortaçsu and Syverson (2007) make the foregoing adjustments and some others as well to estimate regressions explaining the variation in concrete prices across markets and time. Their central results are shown in Table 16.2 below.

In all the regressions, results for the time and market dummies are suppressed, as are those for the HI and construction demand, which are never significant. The first column shows the results when, apart from the control variables just mentioned, the only explanatory variable is the extent of vertical integration in the local market. This effect is both negative and statistically significant. It is also economically meaningful. For their entire sample, Hortaçsu and Syverson (2007) find that on average, vertically integrated firms account for 31.5 percent of the typical market. The estimated coefficient shown in the first column then implies that ready-mixed concrete prices would be 4 percent lower in such a market than they would be in a market with no vertically integrated firms. Thus, this result suggests that the efficiency results of vertical integration typically outweigh any anticompetitive effects so that consumers benefit.

The next two columns test additional variables that may be important for concrete prices. In column 2, a second independent variable is added for the fraction of firms that operate more than one plant. This includes all the vertically integrated firms plus all those that operate multiple plants horizontally. Including this variable is a means of testing whether

**Table 16.2** Results for regressions explaining ready-mixed concrete prices in the US

| *Independent Variable* | *Dependent Variable: Weighted Average Market Price (log)* | *Dependent Variable: Weighted Average Market Price (log)* | *Dependent Variable: Weighted Average Market Price (log)* |
|---|---|---|---|
| Market Share of Vertically | −0.090* | −0.086* | −0.043 |
| Integrated firms | (0.041) | (0.041) | (0.039) |
| Market Share of Multiple | ____ | −0.015 | 0.001 |
| Plant Firms | | (0.022) | (0.024) |
| Weighted Average Total | ____ | ____ | −0.293* |
| Factor Productivity | | | (0.054) |
| $R^2$ | 0.433 | 0.434 | 0.573 |

*Significant at five percent level.

the vertically integrated variable is really capturing efficiencies that come from coordinating different plants, e.g., better-timed production, lower transport costs, rather than from vertical integration *per se*. However this variable is insignificant and does not materially affect the results in column 1.

The third column is perhaps the most interesting. Here, Hortaçsu and Syverson (2007) include as an additional regressor a measure of average productivity in the local market. This is clearly an important variable. Including it reduces the magnitude of the effects of vertical integration and eliminates their statistical significance. What are the implications of this finding?

First, it makes intuitive sense that concrete prices will be lower in markets where firms are more productive. In this sense, the results in column 3 are not surprising. Second, we should recall that vertical integration has potentially two effects, a price-reducing effect due to greater efficiency and a price-increasing effect due to foreclosure-type forces. Including the productivity variable should control for any efficiency effects so that the vertical integration term now picks up only the price-increasing impact of vertical mergers. The findings in column 3 suggest that once this control for efficiency effects is included, the price-increasing effects appear very weak. Finally, Hortaçsu and Syverson (2007) produce other evidence to show that vertically integrated firms have higher productivity. If vertical integration in this industry has an impact on prices, it does so through the efficiency effect. Overall, these results imply that vertical integration has been welfare-enhancing and good for consumers, at least in the ready-mixed concrete business.

## Summary

We have considered two broad types of merger in this chapter: vertical and conglomerate. A vertical merger typically involves the merging of companies operating at different stages of production in the same product line. A conglomerate merger is a merger of two firms that have little or no common markets or products.

Vertical mergers raise complicated issues. On the one hand, such mergers can benefit firms and consumers by eliminating double marginalization. On the other hand, they may be a means to foreclose either upstream or downstream markets to rivals, and to facilitate price discrimination. There is no simple way of determining which of these forces is likely to be the stronger. Some argue that the negative impact of potential vertical foreclosure itself sets up a countervailing force that will induce remaining independent companies to integrate as well. If so, this can reduce inefficiencies still further. However, we have seen that the vertically integrated firm may have both the means and the motive to prevent such subsequent mergers. Resolution of these issues in any particular case must, as always, depend on careful evaluation of the realities of the specific situation.

It is worth noting, however, that even when foreclosure and a price squeeze for independent rivals does happen, it may nonetheless be the case that final consumers are made better off with the vertical merger. Policy makers should therefore not be too hasty in condemning a vertical merger simply because it disadvantages rival firms. The goal of antitrust policy is to preserve the benefits of competition, not the fortunes of competitors.

Conglomerate mergers probably raise the fewest problems from an antitrust perspective. However, for this very reason, the motivation for such mergers can be difficult to identify. They may reflect an attempt to minimize risk either for stockholders or managers. But there would seem to be other means to achieve these same ends.

The ambiguous effects of mergers that characterize our economic models are also found in empirical analysis. To date, there is little clear evidence that vertical mergers have led to significant increases in monopoly power. A recent study of the ready-mixed concrete industry suggests that such vertical integration tends to bring greater productive efficiency and lower consumer prices. The combination of ambiguity in the theory and, if anything, favorable

empirical evidence has led the legal authorities to take a much less aggressive and much less rigid stand against proposed vertical mergers. Today these are inevitably handled on a case-by-case approach. In the absence of definitive results—either from economic theory or economic data—this is the best approach to follow.

## Problems

1. Norman International has a monopoly in the manufacture of *whatsits*. Each *whatsit* requires exactly one *richet* as an input and incurs other variable costs of \$5 per unit. *Richets* are made by PepRich Inc., which is also a monopoly. The variable costs of manufacturing *richets* are \$5 per unit. Assume that the inverse demand for *whatsits* is:

   $$p_w = 50 - q_w$$

   where $p_w$ is the price of *whatsits* in dollars per unit and $q_w$ is the quantity of *whatsits* offered for sale by Norman International.
   a. Write down the profit function for Norman International assuming that the two monopolists act as independent profit-maximizing companies, with Norman International setting a price $p_w$ for *whatsits* and PepRich setting a price $p_r$ for *richets*. Hence, derive the profit-maximizing price for *whatsits* as a function of the price of richets, and use this function to obtain the derived demand for *richets*.
   b. Use your answer in (a) to write down the profit function for PepRich. Hence, derive the profit-maximizing price of *richets*. Use this to derive the profit-maximizing price of *whatsits*. Calculate the sales of *whatsits* (and so of *richets*) and calculate the profits of the two firms.

2. Now assume that these two firms merge to form NPR International.
   a. Write down the profit function for NPR given that it sets a price $p_w$ for *whatsits*. Calculate the postmerger profit-maximizing price for *whatsits*, sales of *whatsits*, and the profits of NPR.
   b. Confirm that this merger has increased the joint profits of the two firms while reducing the price charged to consumers. By how much has consumer surplus been increased by the merger in the market for *whatsits*?
   c. Assume that the two firms expect to last forever and that the discount factor $R$ is 0.9. What is the largest sum that PepRich would be willing to pay the owners of Norman International to take over Norman International? What is the lowest sum that the owners of Norman International would be willing to accept? (Hint: Calculate the present value of the profit streams of the two firms before and after the merger, and notice that neither firm will want to be worse off with the takeover than without it.)

3. Now assume that PepRich gets the opportunity to sell to an overseas market for *whatsits*, controlled by a monopolist FC Hu Inc., which has the same operating costs in making *whatsits* as Norman International. PepRich knows that it will have to pay transport costs of \$2 per *richet* to supply the overseas market. Inverse demand for *whatsits* in this market is

   $$p_w = 40 - q_w/2$$

   a. Repeat your calculations for question 1(a).
   b. The authorities in the overseas market are contemplating taking an antidumping action, accusing PepRich of dumping *richets* into its market. They calculate that by doing so, they will induce PepRich to offer to take over FC Hu. Assume that PepRich has limited access to funds, so that it can take over only one of the two firms Norman International and FC Hu. Are the overseas authorities correct in their calculations? (Hint: Compare the maximum amounts that PepRich would be willing to pay for Norman International and FC Hu.)

4. Go back to the conditions of question 1, so that PepRich is supplying only Norman International. But now assume that the manufacture of each *whatsit* requires exactly one *richet* and one *zabit*. Zabits are made by ZabCor, another monopolist, whose variable costs are \$2.50 per *zabit*.
   a. Assume that the three firms act independently to maximize profit. Calculate the resulting prices of *richets*, *zabits*, and *whatsits* and the profits of the three firms.
   b. Assume an infinite life for all three firms and a discount factor $R = 0.9$. PepRich and ZabCor are each contemplating a takeover of Norman International. Which of these two companies would win the bidding for Norman International? What will be the effect of the winning takeover on consumer surplus in the market for *whatsits*?

5. As an alternative to buying Norman International, the owners of PepRich and ZabCor contemplate merging to form PRZ, which will control the manufacture of both *richets* and *zabits*.
   a. Calculate the impact of this merger on (1) the prices of *richets*, *zabit*s, and *whatsits*, (2) the profits of these firms, and (3) consumer surplus in the *whatsit* market.
   b. Which merger will be preferred
      i. by consumers of *whatsits*?
      ii. by the owners of PepRich and ZabCorp.?
      iii. by the owners of Norman International?

6. (More difficult) Ginvir and Sipep are Bertrand competitors selling differentiated products in the carbonated drinks market. The demands for the products of the two firms being given by the inverse demand functions:

   $p_G = 25 - 2q_G - q_S$ for Ginvir and

   $p_S = 25 - 2q_S - q_G$ for Sipep.

   Both companies need syrup to make their drinks; the syrup is supplied by two competing companies, NorSyr and BenRup. These companies incur costs of \$5 per unit in making the syrup. Both Ginvir and Sipep can use the syrup of either supplier.
   a. Confirm that competition between NorSyr and BenRup leads to the syrup being priced at \$5 per unit.
   b. What are the resulting equilibrium prices for Ginrip and Sipep and what are their profits?

7. Now suppose that Ginvir and NorSyr merge and that NorSyr no longer competes for Sipep's business.
   a. What price will Benrup now charge Sipep for the syrup?
   b. What are the resulting profits to the three post-merger companies?
   c. Do Benrup and Sipep have an incentive also to merge?

8. Return to the model of Cournot competition presented in Section 16.3. Show that when both pairs of upstream-downstream firms vertically integrate, total industry profit falls below what it was with no vertical integration.

9. [Hart and Tirole (1990)]. Consider a monopolist upstream supplier $U1$ selling to two downstream producers $D1$ and $D2$ engaged in Cournot competition. Downstream demand is described by: $P = 100 - Q$ and marginal cost is zero at both the upstream and downstream level.
   a. Show that the monopoly level of output is 50 and that monopoly profit is \$2500.
   b. Imagine a contract by which $U1$ sells 25 units as a package to each of $D1$ and $D2$ at a price of \$1,250. Each firm can either accept the package or reject it. Show that if decisions are made simultaneously, and each firm has full information about the other's actions, the Nash Equilibrium is for each to accept this offer.

10. Imagine now that deals between $U1$ and $U2$ are done in secret. This can be thought

of as raising the possibility that one player goes first. If that player accepts 25 units at a package price of \$1,250, $U1$ can then offer a second package to the other retailer.

a. Show that in a sequential setting the first downstream firm will never accept $U1$'s offer.

b. Show that by vertically integrating with one of the downstream firms and foreclosing the other, $U1$ can earn the monopoly profit of \$2,500.

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# 17

# Vertical Price Restraints

You may never have heard of Seagate or Western Digital. Yet, chances are, you have used their products. Together, these two firms produced roughly 90 percent of the hard drives used in computers, including laptops and the computers that run the "cloud." This means that the customers to whom Seagate and Western Digital sell are firms such as Apple, Dell, and Hewlett-Packard. In turn, these firms assemble their desktop and laptop computers and sell them to retailers including Best Buy and Staples. Apple, of course, maintains its own retail outlets as well.

Vertical chains such as that connecting the hard drive maker to the computer retailer are common. ArcelorMittal and other steel companies sell their product to auto manufacturers (among others) who, in turn, assemble finished auto products and distribute these to dealers for final retail sales. Mattel Toys sells its *Barbie* doll, *Fisher-Price*, and *Hot Wheels* products through retailers such as Toys 'R' Us and Wal-Mart. Kellogg's sells its ready-to-eat cereals through supermarkets such as Kroger and Safeway. Relations at each step require contracts. Seagate and Western Digital sign contracts with Apple, Dell, and Hewlett-Packard and these firms in turn have contracts governing their relations with Best Buy, Staples, and other retailers. The steel firms sign contracts with the auto companies who in turn sign contacts with the car dealers and so on.

The contracts signed by the firms in these production and distribution chains inevitably impose restrictions on the signatory parties. Suppliers may be required to guarantee quality and to help with final sales promotion. Retailers may be required to display the product prominently and to offer various services. Because they take place in the context of the vertical supply chain, these restrictions are typically referred to as vertical restraints. While they may help the firms better coordinate their efforts they can also restrict competition on two levels. First, there is the possibility that vertical restraints may be used to suppress competition between different manufactured goods. That is, the fact that Apple, Dell, and Hewlett-Packard all sell through Best Buy may enable these firms to suppress competition between their different brands, i.e., it may suppress interbrand competition. Alternatively, the fact that different Best Buy establishments are each selling, say, Dell computers may allow for the coordination of Dell pricing thereby suppressing intrabrand competition.

Traditionally, concerns with the competitive effects of vertical restraints have distinguished between those constraints that focus on price and those that focus on non-price

decisions. We follow this dichotomy here. In this chapter, we examine vertical price restraints. We investigate the effects of vertical non-price restraints in the following chapter.

## 17.1 ANTITRUST POLICY TOWARD VERTICAL PRICE CONSTRAINTS: HISTORY AND THEORY

The principle type of retail price restriction is Resale Price Maintenance (RPM). Under such an agreement, the upstream firm such as the manufacturer imposes either an upper level that the retail price cannot exceed, or a floor price that the retail price cannot fall below. Because they are explicitly an agreement on price, all such contractual provisions were for many years considered to be a *per se* violation of the US antitrust laws beginning with the *Dr. Miles* case decided by the US Supreme Court in 1911.[1] This was true regardless of whether the contract specified a minimum or a maximum downstream price.

However, exceptions to this blanket approach crept in rather quickly. In the *Colgate* case of 1919, the Supreme Court ruled that if a producer unilaterally announced that it would terminate any firm that sold below a specified retail price, it could then proceed to do just that and to cut off downstream firms that violated that pricing policy because the unilateral quality of the decision meant that there really was no price agreement.[2] Then in the wake of the Great Depression, the US Congress passed the Miller-Tydings Act of 1937, which explicitly exempted RPM agreements from antitrust prosecution. This was later followed by the 1952 McGuire Act, which permitted the enforcement of an RPM agreement even on firms who had not signed on to the arrangement, provided at least one retailer and manufacturer had agreed to it.

The one loophole in the Miller-Tydings and McGuire legislation was that it required participation by state legislatures to make it effective. Some states, however, continued to prohibit RPM agreements so that in these states, RPM agreements did not become legal. Over time, this led to a discrepancy between prices in those states in which RPM was legal and those in which it was not. In 1975, in the wake of the substantial inflation induced by OPEC's four-fold increase in the price of crude oil, both the Miller-Tydings and the McGuire Acts were repealed. This reestablished the strong presumption of illegality applying to all RPM agreements. It did not remove the ability of manufacturers to cut off discount dealers established by the *Colgate* decision.

Three subsequent legal cases have greatly expanded the ability of manufacturers to impose retail price restrictions. In the *Sharp Electronics* case,[3] the Court broadened its *Colgate* exception by permitting the manufacturer to terminate a discount dealer even if this termination was the result of other dealers' complaints. Then, in the 1997 *State Oil vs. Khan* case, the Court moved to renounce explicitly any *per se* illegality for RPM agreements establishing a *maximum* price or a price ceiling. Most recently, in the *Leegin* case of 2007, the Court reversed the *Dr. Miles per se* ruling and held that all resale price agreements, maximum or minimum, should be subject to a rule of reason test. In short, despite the initial *Dr. Miles* 1911 ruling, exceptions and exemptions to that *per se* approach have always been part of the legal framework governing RPM agreements. With the *Khan* and *Leegin* cases,

[1] *Dr. Miles Co. v. John D. Park and Sons, Co*., 220 U.S. 373 (1911).

[2] *United States v. Colgate & Co*., 250 U.S. 300 (1919). This exception is often referred to as the *Colgate Doctrine*.

[3] *Business Electronics Corp. v. Sharp Electronics Corp*. 488 U.S. 717 (1988).

## Reality Checkpoint

## Yesterday's News

Resale price maintenance contracts have both a variety of motivations and a variable legal history. The 1968 case *Albrecht v. The Herald Co*. makes clear, however, that preventing the extra high retail price that results from double marginalization is a central motivation. In that case, the Herald Co., the publisher of the St. Louis *Globe Democrat*, was taken to court by Albrecht, one of the many independent carriers it hired to deliver the morning paper, each exclusively to a specific territory.

Herald printed its suggested retail price for the *Globe Democrat* on each paper. In 1961, Albrecht began charging his customers a price above that recommended by Herald. The company quickly objected, but Albrecht would not relent. Finally, Herald took decisive action. It offered to deliver the paper to Albrecht's customers at the lower recommended price by using another carrier to "invade" Albrecht's exclusive territory. Albrecht sued citing Herald's efforts as attempted price-fixing. When the case finally made it to the US Supreme Court in 1968, the court found in Albrecht's favor. It agreed that that the Herald's efforts to force a specific price on Albrecht amounted to price-fixing and was therefore *per se* illegal. There was no defense.

The *Albrecht* case did not sit well with many economists. Others also recognized the double-marginalization problem and the possibility that some vertical price arrangements might benefit consumers. Gradually, this learning spread to the courts but the major break came with the ruling in *State Oil v. Khan*.

Barkat Khan was a Midwestern gasoline dealer supplied by State Oil. The oil firm required that all dealers who set a markup of more than 3.25 cents per gallon would have to rebate the excess markup to the company, itself. Khan began to exceed this maximum and when State Oil complained, Khan filed suit, again, claiming price-fixing much like Albrecht. In its dramatic 1997 ruling, the court not only found in favor of State Oil but also made an explicit statement that vertical price agreements stipulating *maximum* prices would no longer be *per se* illegal. Instead, they would be permitted if it could be shown that there was a legitimate justification for their use and if they did not substantially lessen competition. The Albrecht case was yesterday's news.

Sources: *Albrecht v. The Herald Co*., 390 U.S. 150 (1968), and *State Oil v. Khan*, 522 U.S. 3 (1997). See also, L. Greenhouse, "High Court, in Antitrust Ruling, Says Price Ceilings Are Allowed," *The New York Times*, November 5, 1997, p. A1.

those exceptions have become the rule, so that RPM agreements are now evaluated using a rule of reason approach.

## 17.2 VERTICAL PRICE RESTRAINTS AS A RESPONSE TO DOUBLE-MARGINALIZATION

As noted, vertical price restraints can enable the vertically linked firms to better coordinate their decisions. This can benefit consumers as well as the firms. The most prevalent example of such a positive effect of an RPM is the double-marginalization problem discussed in the last chapter. Recall the basic argument. A monopoly manufacturer with constant marginal cost sells to a monopoly retailer whose only marginal cost is assumed, for simplicity, to be the upstream or wholesale price $P^U$. Given retail demand of $P^D = \mathrm{A} - \mathrm{B}Q$, the retailer

maximizes profit by setting a retail price of $P^D = (A + P^U)/2$. In order for the upstream manufacturer to earn a profit, however, the wholesale price must include a markup $m$ above cost, i.e., $P^U = c + m$. Accordingly, the retail price will be: $P^D = (A + c + m)/2$. Yet the retail price that maximizes upstream and downstream profit combined is: $P^{D*} = (A + c)/2$. Thus, unless the manufacturer foregoes all profit and sets $m$ equal to zero—unless it resolves the double markup problem by removing one of the markups—the downstream price will be higher than the price that maximizes the total profit of the two firms.

In Chapter 16, we demonstrated that this double-marginalization issue could be addressed by a vertical merger. However, an RPM agreement offers an alternative resolution. Under an RPM agreement, the manufacturer can stipulate a maximum retail price equal to the joint-profit-maximizing price of $P^{D*} = (A + c)/2$. If the manufacturer also sets the wholesale price at this level—if it sets $m = (A - c)/2$ —then the manufacturer can in principle appropriate the entire maximum profit. In reality, this may be difficult and the manufacturer may have to settle for a smaller markup while still keeping the price at $P^{D*} = (A + c)/2$. The crucial point to make is that $P^{D*}$ is not only the retail price that maximizes the total profit pie going to the manufacturer and retailer, and therefore one that any RPM should specify; it is also a lower retail price than would occur in the absence of an RPM. Hence, the RPM agreement benefits producers, dealers, *and* consumers.

Note though that there is an alternative solution to the manufacturer's problem. This is to use a two-part pricing contract similar to those discussed in Chapter 6. Specifically, the manufacturer could sell to the retailer at a wholesale price $r$ equal to marginal cost $c$. This would induce the retailer to set the monopoly profit-maximizing price of $P^D = (A + c)/2$ and earn the maximum profit $(A - c)^2/4B$, which the manufacturer can then capture with an up-front fee. We return to this point later in the chapter.

**17.1 Practice Problem**

Tiger-el is an upstream manufacturer of electric trains that sells wholesale to The Great Toy Store, the only such store in the area. Demand for the trains at the retail store level in inverse form is $P = 1000 - 2Q$, where $Q$ is the total number of trains sold. The Great Toy Store incurs no service cost in selling the trains. Its only cost is the wholesale price it pays for each train. Tiger-el incurs a production cost of $40 per train.

a. What wholesale price should Tiger-el charge for its trains? What price will these trains sell for at retail? How many trains will be sold?
b. What profit will the toy store and the retailer earn under the pricing choices found in part (a)?
c. What would be the retail price and the quantity sold if Tiger-el sold the trains to the toy store at cost but received a 66.67 percent sales royalty on every train sold? What would each firm's profit now be?

## 17.3 RPM AGREEMENTS AND RETAIL PRICE DISCRIMINATION

As we saw early in this book a retailer that is able to determine "who is who" on its demand curve and separate consumers into different groups will find it profitable to charge the different groups different prices, with the highest prices charged to those customers with least elastic demand. Coupons, quantity discounts, variations in quality in which the price difference does not match the cost difference, and market segmentation are all mechanisms

by which a retailer may price discriminate. However, while such price discrimination can enhance retail profits, it can make life difficult for the upstream manufacturer.

To see how retail price discrimination can raise problems for the manufacturer, consider the following simple example. A retailer serves two separate markets. In each market, retail demand is characterized by $P = 100 - Q$ and, again, the only retail cost is the wholesale price per unit $r$ set by the manufacturer. In one market, the retailer is a monopolist. In the other, the retailer faces Bertrand competition from a rival who also buys at $r$ per unit from the manufacturer. The retailer can add a markup to the wholesale price $r$ in the first market, but in the second, Bertrand competition forces the retail price to be equal to $r$. We assume that the manufacturer's unit cost is $c = \$20$.

Although one retailer sells in two markets, we assume that the manufacturer cannot sign a separate contract with that retailer for the goods sold in each market. We also assume that where there is more than one retailer, the manufacturer must offer each the same terms. In other words, while a retailer may be able to discriminate, the manufacturer cannot. To avoid the double-marginalization problem, we will allow this one contract to specify both a wholesale price $r$ and an up-front franchise fee $T$. The manufacturer's problem is to choose $T$ and $r$ to maximize its total profit. A little algebra quickly reveals that the profit-maximizing monopoly price in each market is \$60. If this price can be made to stick, each market will generate \$1,600 in profit.

Without an RPM agreement, the manufacturer's choice of $r$ and $T$ imposes a clear tradeoff. The conventional strategy of setting $r$ equal to marginal cost $c = \$20$ and using the fixed fee $T$ to claim the profits this strategy generates works well in the monopolized market. There, the retailer facing $r = c = \$20$, will set price $P^D = \$60$ and the maximum monopoly profit of \$1,600 will be achieved. However, competition in the remaining market will mean that the wholesale price will also be the retail price in that market, $P^D = r$, because both retailers buy upstream at price $r$. As a result, there will be no profit to be claimed in this market by any fixed payment $T$. The only two-part tariff that can work for both markets is one with $T = 0$, which is really just a single-part tariff. Recognizing this, the manufacturer will find it profitable simply to set $r = \$60$ (and $T = 0$). In this case, the competitive market price is also \$60 and the manufacturer earns \$1,600 in that market. Unfortunately, with $r = \$60$, the retailer will set a price of $P^{D-} = \$80$ in its monopolized market so that only 20 units are sold. The manufacturer will then earn only $(\$60 - \$20) \times 20 = \$800$ in profit from this market—half of the expected \$1,600.

In the Appendix to this chapter, we show that, without an RPM agreement, the best that the manufacturer can do in this case is to set a wholesale price of \$52, which results in a combined profit from both markets of \$2,304. The retail prices in the monopolized and competitive market are then, respectively, \$76 and \$52. Relative to the profit maximizing retail price of \$60 in each market, the price is too high in the monopolized market and too low in the competitive market.

The appeal of an RPM agreement in this setting should be clear. The manufacturer can continue to forego the fixed fee (set $T = 0$) but now set a wholesale price of $r = \$60$ while imposing an RPM agreement that the retail price can never exceed this amount. This will lead to the desired retail price of \$60 in each market and of course, the maximum manufacturer total profit of \$3,200.

While the two-market story told above is somewhat contrived, it nonetheless serves as a useful illustration of a general principle. Whatever the source of a retailer's ability to discriminate in prices, such discrimination makes it difficult for the upstream manufacturer to establish a wholesale contract that maximizes the total, manufacturing, and retail profit