

## EXAMPLE 2.1

### HUB-AND-SPOKE NETWORKS AND ECONOMIES OF SCOPE IN THE AIRLINE INDUSTRY

An important example of multiplant economies of scope arises in a number of industries in which goods and services are routed to and from several markets. In these industries, which include airlines, railroads, and telecommunications, distribution is organized around “hub-and-spoke” networks. In an airline hub-and-spoke network, an airline flies passengers from a set of “spoke” cities through a central “hub,” where passengers then change planes and fly from the hub to their outbound destinations. Thus, a passenger flying from, say, Omaha to Louisville on American Airlines would board an American flight from Omaha to Chicago, change planes, and then fly from Chicago to Louisville.

Recall that economies of scope occur when a multiproduct firm can produce given quantities of products at a lower total cost than the total cost of producing these quantities in separate firms. If the quantity of a firm’s products can be aggregated into a common measure of output, this definition is equivalent to saying that a firm producing many products will have a lower average cost than a firm producing just a few products. In the airline industry, it makes economic sense to think about individual origin-destination pairs (e.g., St. Louis to New Orleans, St. Louis to Houston, etc.) as distinct products. Viewed in this way, economies of scope would exist if an airline’s average cost is lower the more origin-destination pairs it serves.

To understand how hub-and-spoke networks give rise to economies of *scope*, it is first necessary to explain *economies of density*. Economies of density are essentially economies of scale along a given route, that is, reductions in average cost as traffic volume on the route increases. (In the airline industry, traffic volume is measured as revenue-passenger miles [RPM], which is the number of passengers on the route multiplied by the number of miles, and average cost is the cost per revenue passenger mile.) Economies of density occur because of spreading flight-specific fixed costs (e.g., costs of the flight and cabin crew, fuel, aircraft servicing) and because of the economies of aircraft size. In the airline industry, traffic-sensitive costs (e.g., food, ticket handling) are small in relation to flight-specific fixed costs. Thus, as its traffic volume increases, an airline can fill a larger fraction of its seats on a given type of aircraft (in airline industry lingo, it increases its *load factor*—the ratio of passengers to available seats), and because the airline’s total costs increase only slightly, its cost per RPM falls as it spreads the flight-specific fixed costs over more traffic volume. As traffic volume on the route gets even larger, it becomes worthwhile to substitute larger aircraft (e.g., 300-seat Boeing 767s) for smaller aircraft (e.g., 150-seat Boeing 737s). A key aspect of this substitution is that the 300-seat aircraft flown a given distance at a given load factor is less than twice as costly as the 150-seat aircraft flown the same distance at the same load factor. The reason for this is that doubling the number of seats and passengers on a plane does not require doubling the sizes of flight and cabin crews or the amount of fuel used, and that the 300-seat aircraft is less than twice as costly to build as the 150-seat aircraft, owing to the cube-square rule, which will be discussed below.

Economies of scope emerge from the interplay of economies of density and the properties of a hub-and-spoke network. To see how, consider an origin-destination pair—say, Indianapolis to Chicago—with a modest amount of daily traffic. An airline serving only this route would use small planes, and even then, would probably operate with a relatively low load factor. But now consider an airline serving a hub-and-spoke network, with the hub at Chicago. If this airline offered daily flights between Indianapolis and Chicago, it would not only draw passengers who want to travel from Indianapolis to Chicago, but it would also draw passengers traveling from Indianapolis to all other points accessible from Chicago in the network (e.g., Los Angeles or San Francisco). An airline that includes the Indianapolis-Chicago route as part of a larger hub-and-spoke network can operate larger aircraft at higher load factors than can an airline serving only Indianapolis-Chicago and as a result, can benefit from economies of density to achieve a lower cost per RPM along this route. (It can also justify offering more frequent service, making it more convenient for Indianapolis travelers.) Moreover, because there will now be passengers traveling between Chicago and other spoke cities in this network, the airline's load factors on these other spokes will increase somewhat, thereby lowering the costs per RPM on these routes as well. The overall effect is that an airline that serves Indianapolis-Chicago as part of a larger hub-and-spoke network will have a lower average cost overall than an airline that only serves Indianapolis-Chicago. This is precisely what is meant by economies of scope.

Many of the same principles of economies of scale are exhibited by the new LEO (low earth orbit) technology. Several firms or consortia of firms, including the Iridium consortium led by Motorola and the McGaw/Microsoft Teledesic group, are in the midst of launching hundreds of satellites into orbit a few hundred miles above the earth. Combined with land-based switching technology, these satellite networks will permit digital communications anywhere on the globe. At this time, each consortium is negotiating with nations around the world to obtain signal transmission rights. As each consortium must incur several billions of dollars of fixed costs to establish their networks, the advantage will clearly accrue to the sellers who can sign up the most users, in the most nations.

## EXAMPLE 7.4

### PRICING IN THE AIRLINE INDUSTRY

For the first fifteen years after deregulation in 1978, the U.S. airline industry was plagued by frequent price wars and large financial losses. U.S. airlines have enjoyed soaring profits during the economic recovery of the mid- to late 1990s. These trends may be directly tied to industry cost structure and the nature of competition among carriers.

Airline costs fall into three broad categories:

Flight-sensitive costs, which vary with the number of flights the airline offers. These include the costs associated with crews, aircraft servicing, and fuel. Once the airline sets its schedule, these costs are fixed.

Traffic-sensitive costs, which vary with the number of passengers. These include the costs associated with items such as ticketing agents and food. Airlines plan their expenditures on these items in anticipation of the level of traffic, but in the short run, these costs are also fixed.

Fixed overhead costs, which include general and administrative expenses, advertising and marketing, and interest expenses.

Once an airline has set its schedule, flight-sensitive and overhead costs are fixed. Traffic-sensitive costs, which make up only a small percentage of total costs, are the only variable costs. This means that the airline is better off selling a seat at a low price—near marginal cost but well below average total cost—than not selling the seat at all. Thus, if airlines are operating well short of capacity, they have tremendous incentives to reduce prices. Because marginal costs are so far below average costs, airlines can lose staggering sums during price wars. The airlines may cover their marginal costs, but will fail to make any contributions toward fixed costs. On the other hand, if airlines are at or near capacity, as is often the case nowadays, they can raise prices substantially above average costs without losing customers to competitors.

Many other factors affect airline pricing. In some cases, such as when a carrier dominates a hub, an airline faces little competition on certain routes and may raise price accordingly. Even when two or three carriers compete on a route, they may be able to price at or near the monopoly level. Chapter 9 discusses how firms that compete over a long time or in many markets often avoid price competition. Finally, although airlines seem to sell homogeneous products, there are a number of sources of differentiation among them. Business travelers prefer carriers that offer frequent service, which gives them flexibility to schedule meetings. Many travelers accumulate frequent-flier miles, which encourages them to use the same carrier for all their flights.

While the industry currently enjoys a respite from price competition, that may change if there is a recession or if entrants attempt to take market share from the incumbents. The Value Jet plane disasters of the mid-1990s may have helped incumbent carriers, at least for a while. Some consumers remain leery of startup carriers.

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### EXAMPLE 8.1

## COMMITMENT AND IRREVERSIBILITY IN THE AIRLINE INDUSTRY

Ming-Jer Chen and Ian MacMillan surveyed senior airline executives and industry analysts (e.g., financial analysts and professors) to study irreversibility in competitive moves in the airline business.<sup>6</sup> Mergers and acquisition, investment in the creation of hubs, and feeder alliances with commuter airlines had the highest perceived irreversibility. Hubs required the creation of transaction-specific assets (e.g., maintenance facilities) that could not be redeployed if the hub was abandoned. Mergers and acquisitions required cooperation with the management of other airlines and third parties, such as investment bankers and regulatory authorities. Not only does the negotiation of the merger or acquisition entail significant nonrecoverable negotiation costs, it may also entail significant transaction-specific changes in operating procedures or systems. The reputation of a firm's management would also suffer greatly (e.g., the firm would be seen as capricious or frivolous) if, after negotiating the merger or acquisition, it backed out at the last minute or tried to undo it once it was consummated. Feeder alliances with commuter airlines were seen as hard to reverse because employees and unions would oppose reversing the move.

Promotions, decisions to abandon a route, and increases in commission rates for travel agents were considered the easiest moves to reverse. Price cuts, while seen as having a below-average degree of irreversibility, were not considered the easiest competitive move to reverse. Evidently, airline executives and industry analysts believe that once an airline cuts its prices, the inescapable cost of advertising the change is significant enough to make the airline maintain the new prices for some time. However, because price cuts are visible and clearly affect competing airlines' profitability, they are more provocative than other moves, such as temporary ad campaigns, that might be considered more reversible. Indeed, as we show in the next section, a firm's profit-maximizing response to a price cut by a competitor is generally to cut its own price. In addition, as we point out in Example 9.3, in Chapter 9, in the airline business, prices are instantaneously known through a computerized clearinghouse, so competitors learn them and can quickly match them.

Chen and MacMillan hypothesized that competitors are less likely to match an airline's competitive move when the original move is hard to reverse. Their logic is akin to the simple example we discussed earlier. The more credible a firm's commitment to play aggressive, the more likely it is that its competitors will respond by playing soft. This logic would suggest that a preemptive move by one airline to expand its route system by acquiring another airline is less likely to provoke a matching response than is a decision to engage in a short-term promotional or advertising campaign. Chen and MacMillan test this hypothesis through an exhaustive study of competitive moves and countermoves reported over a seven-year period (1979–1986) in a leading trade publication of the airline industry, *Aviation Daily*. In general, their findings support their hypothesis: harder-to-reverse moves are less frequently matched than easier-to-reverse moves. The study also supports the hypothesis that price cuts are especially provocative and thus likely to be matched frequently and quickly. MacMillan and Chen find that rival airlines responded to price cuts more frequently than other moves the authors saw as having a similar, or even higher, degree of irreversibility.

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### EXAMPLE 9.3

## FIRM ASYMMETRIES AND THE 1992 FARE WAR IN THE U.S. AIRLINE INDUSTRY<sup>26</sup>

When firms are different from each other—asymmetric—even the expectation that competitors will instantly match a price cut may not deter certain firms from cutting prices aggressively. Robert Gertner has argued that low-quality or low-market-share firms may make themselves better off by defecting from collusive prices even though they fully anticipate that their high-quality or high-market-share rivals will match their price cuts right away. To illustrate this argument, Gertner cites the example of Northwest Airlines.

In June 1992, Northwest Airlines triggered a fare war when it launched its promotion “Kids Fly Free.” The next day, American Airlines cut coach fares on every route on which it competed with Northwest, and within hours, all major U.S. airlines had matched American’s price cuts. The 1992 fare war was the most vicious price war to hit the U.S. airline industry since it was deregulated in 1978. It deepened the already record losses the airline industry was suffering in the wake of the recession that began with the Persian Gulf crisis in 1990.


It seems curious that Northwest would start a price war. After all, what did it have to gain? Airlines receive information about their competitors’ fares instantaneously through a clearinghouse computer system run by the Airline Tariff Publishing Company (ATP). Northwest could hardly expect to cut fares without eliciting a competitive response. Moreover, throughout the spring of 1992, American Airlines had made it clear that it intended to defend its Value Pricing initiative that it had announced in April 1992. Indeed, earlier that spring when TWA had attempted to undercut American’s fares, American quickly matched TWA’s prices, by late May 1992, TWA had rescinded its price cuts. Given American’s words and actions, Northwest should have known that American would match or undercut any major promotion that Northwest might announce.

But if Northwest expected that competitors would respond to its price cut, the theory we have just developed suggests that a price cut would not increase its profit: The fare cut would be matched instantly by American and Northwest’s

other competitors. Relative market shares would not change, and with smaller margin and no increase in share, Northwest would be worse off than it would have been at higher fares. Because reduced margins are especially costly during the summer, when air travel peaks, the timing of Northwest's price cutting seems odd.

But these arguments overlook an important point: When firms are asymmetric, they will have different views about how high the price in the industry ought to be. Gertner notes that in the early 1990s, Northwest had a poor route system, an inferior frequent-flier program, and a reputation for poor service. If Northwest's principal competitors, American and United, charged the monopoly price along particular routes, and Northwest matched, Northwest would probably get less business than American and United, which had better route structures and better frequent-flier programs. Indeed, in spring 1992, suffering from excess capacity, Northwest's planes might have flown nearly empty had it matched American and United at the monopoly price.

Under these conditions, Northwest's best hope was probably to move the industry down the market demand curve through deep price cuts. Even though competitors would match these price cuts, the cuts might fit Northwest for two reasons. First, the price cuts took place during the summer, so much of the additional traffic that they would generate would consist of discretionary vacation travelers. Within this group, Northwest's competitive disadvantages were minimized because differences among airlines in terms of frequent-flier programs or on-time performance matter less to discretionary travelers' choice of carriers. Second, a disproportionate share of the additional traffic that generates the price cut will end up flying the poorer-quality airline, such as Northwest, simply because at equal prices, seats on the higher-quality carriers will sell out more quickly and cause a "spill" of traffic that only the less desirable carrier can serve. These two points explain why Northwest might have benefited from a price war and why it made sense to launch it during the summer. If Northwest could fill its planes only by stimulating market demand, its incentive was to do so when demand was most price elastic. This occurs during the summer when there are more price-elastic leisure travelers.



### **EXAMPLE 10.3**

## **BARRIERS TO ENTRY IN THE AUSTRALIAN AIRLINE INDUSTRY**

In 1992, a second attempt was made to start Australia's third airline, under the name Compass II. Compass' first startup effort, described in Chapter 9, came two years earlier, when there was considerable public support for a cut price domestic carrier. To leverage this public goodwill, the decision was made to use the name Compass II. To counter negative sentiment created when many "vacationers" were left stranded with worthless tickets when the original Compass went bankrupt, Compass II would honor the tickets issued by the original Compass airlines for a \$20 fee. The new airline was forced to issue 100,000 of these \$20 tickets. At the same time, Qantas and Ansett (the two incumbent airlines) both

restarted an airfare price war with the new airline. These factors put major financial strains on an already under capitalized airline.

The biggest problem facing Compass II was the leasing of terminal space. Both Ansett and Qantas had been granted long leases on land at all Australia's major airports, and both airlines had invested considerable money in building terminal facilities. The government forced Qantas to lease terminal space to Compass II airlines. Compass II had to negotiate with Qantas for airport gates and boarding areas in their terminal. Not surprisingly, the boarding gates allocated to the new airline were all at least a half mile from the terminal entrance and the farthest gates from the terminal hub.

Compass II encountered many other obstacles. Qantas was responsible for baggage handling for Compass flights. The CEO of Compass II claimed that Qantas was committing "corporate sabotage" by delaying baggage handling for Compass flights, resulting in major delays for the new startup airline. Compass II lacked the terminal space to offer flight lounges for business travelers. This business service was critical, because several large companies offered to transfer large quantities of business travel to support airline competition, if Compass II could offer business class facilities. Another critical factor in attracting business travelers is flight frequency. Compass II could not compete with the incumbent airlines, both of whom were offering hourly flights between major Australian airports.

Compass II fell into bankruptcy less than 12 months after its incorporation, even faster than its predecessor. Incensed with the failure of its efforts to create a more competitive airline industry, the Australian government considered building a third "common use" terminal at all major Australian airports, for any airline wishing to lease terminal gates. The previous chairman of Compass announced an attempt to start a third discount airline, "Aussie Airlines." However, the two major airlines, Qantas and Ansett, both publicly committed to matching any airfares a future discount airline may offer. This commitment had the effect of scaring any investors from backing another startup airline. At the same time, the Australian government will not build any new "common use" terminal space until there are new airlines to lease these facilities, and potential investors see terminal space as a major requirement for any startup airline. It seems that the public's desire for a third carrier will not be satisfied anytime soon.

## EXAMPLE 12.6

### DELTA AIRLINES IS SOARING AGAIN

From 1990–1996, through recession and recovery, Delta Airlines consistently underperformed other airlines. Its profit margins were several percentage points below the industry average, and well below the most profitable carriers such as American and Southwest. In 1997, however, Delta had one of the highest profit margins in the industry. Why did Delta struggle and how did it turn itself around?

In the introduction to this chapter, we described the strategic positions of several carriers. Southwest has been highly profitable by holding costs well below industry norms and selecting routes so as to avoid competition. American Airlines is another profitable carrier. Its costs are relatively high, but it offers schedules that appeal to business travelers, with hubs in major business cities such as Chicago and Dallas. It is also the dominant American carrier flying to Central and South America. United Airlines has also done well recently. Aside from the Shuttle by United on the west coast, UAL has used a strategy similar to American's: It has relatively high costs, but it offers convenient schedules for business travelers, has strong hubs, and a dominant route structure to Asia.

Throughout most of the 1990s, Delta's costs were similar to those at American and United. But unlike those two carriers, Delta was not well-positioned to serve the lucrative business market. It has had a successful hub in Atlanta, but its other hubs are in Cincinnati and Salt Lake City, both of which lack substantial origin/destination traffic. Most significantly, Delta has lacked a "northern" hub to serve cities in the midwest and northeast. Hence, only a small percentage of business travelers have turned to Delta when selecting a carrier. Delta operates a shuttle service in the Boston–New York–Washington corridor, but this is a

fiercely competitive market in which a number of carriers have failed to prosper. Finally, Delta has offered numerous flights to Europe. But this is a crowded market with fierce price competition. Delta's fares on European flights can easily be half that of American's or United's fares on comparably long trips to Latin America or Asia.

It is apparent that Delta had failed to match the strategic positioning of its most successful rivals. In some ways, Delta was "struck in the middle;" that is, its shortcomings stemmed from an effort to pursue too many strategies at once, such as its effort to serve the business market both with shuttle and full-fare service.<sup>49</sup> Whatever the source of its difficulties, Delta clearly needed to rethink its strategic direction.

In 1995, Delta introduced the "Leadership 7.5" plan, focusing exclusively on reducing total operating expenses. This plan was somewhat successful, but Delta also benefitted from the rebounding economy. Two years later, Delta replaced this cost-cutting plan with a strategy that seems to epitomize "stuck in the middle." The "Balanced Plan" is designed to simultaneously reduce costs and increase revenue. Despite the reservations about firms becoming stuck in the middle discussed above, so far the plan is working. Delta has reduced its costs to the point where its operating costs per available seat mile are below that of American and United. At the same time, it is boosting revenue, largely by changing its route structure. By concentrating its routes in Southeast and Florida and expanding into certain profitable routes in South America, Delta is increasingly the first choice for both tourist and business travelers to these growing regions. (Interestingly, the Operational Review in Delta's Annual Report for fiscal year 1997 does not mention the shuttle.)

It is too soon to know if Delta's strategy of maximizing  $B-C$  is a permanent success. It does seem, however, that by judiciously choosing its target markets, Delta has found that it is possible to simultaneously reduce costs and increase benefits.