MULTIMARKET CONTACT, ECONOMIES OF SCOPE, AND FIRM PERFORMANCE

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We integrate the efficiency and competitive effects of product-market scope choice into a comprehensive model of economic performance and empirically test the model in the context of the U.S. airline industry. Efficiency is influenced by a firm's scope economies, but the intensity of rivalry is determined by multimarket contact with rivals and their scope economies. The confluence of strong scope economies with multimarket contact results in superior economic performance. However, strong scope economies may not result in superior performance if rivals can obtain similar economies in nonoverlapping markets.

Few strategic decisions are as important for a firm as its choice of scope—the set of products and markets in which it will compete. Prior research has investigated how the presence of economies of scope, synergies, or relationships between product markets (Ansoff, 1965; Panzar & Willig, 1981; Porter, 1985) determines the efficiency associated with product-market choices. The literature suggests that efficiency is greater and performance higher when a firm's operations in multiple products or markets share common resources or value-chain activities (Brush, 1996; Panzar & Willig, 1981; Penrose, 1959; Porter, 1985). The choice of product-market scope also determines the set of competitive relationships with other firms. As firms expand into new markets, they may encounter new competitors as well as some competitors from their original markets that have undertaken similar expansions (Porter, 1985). Hence, firms often attempt to exploit scope economies in the context of other competitors' pursuing similar product-market extensions, a situation that may lead to multimarket competition. Generally, economies of scope and multimarket competition are likely to occur concurrently. Surprisingly, prior research has examined these constructs independently, ignoring their possible interdependence and interaction in determining economic performance.

The contribution of this research is the theoretical and empirical integration of the efficiency and competitive effects of product-market scope on economic performance. Even if economies of scope make firms more efficient, those economies may not result in superior performance if rivals are able to draw on similar economies and are motivated to compete intensely. Hence, we investigated the competitive effect of rivals' scope economies and their multimarket contact with a focal firm. The integrative approach also allowed us to explore the interaction between multimarket contact and scope economies, as managers may more readily recognize their interdependence with multimarket rivals when scope economies are present. The efficiency and competitive dimensions were integrated into an internally consistent model of economic performance. To clarify the causal structure of the model, we empirically specified two mediating dependent constructs, efficiency and intensity of rivalry, reflecting the efficiency and competitive dimensions, as well as the ultimate dependent construct representing economic performance, profitability. Hypotheses were tested in the context of the U.S. airline industry.

BACKGROUND

Since this article integrates theories from different research streams and disciplines, it is useful to define some key concepts as they are used here. Our research deals with firms that are present in multiple markets. In agreement with economic the-
ory, we use the term market to represent the aggregate demand for a product or service in a given geographical area, with market boundaries determined by low cross-elasticity of demand. In practice, markets can be outlined as different products or services within an industry, as geographical demand for a given product or service, or even as different industries. The presence of a multimarket firm—that is, a firm with a multimarket scope—in a specific market will be termed a market-unit.

Economies of Scope

The concept of economies of scope describes the cost savings that result from the activities of a firm in multiple markets (Panzar & Willig, 1981). Economies of scope are gained when the costs to a single firm of producing a given level of output for each of several markets are lower than the summed costs of separate firms each producing at the given output level for a single market (Bailey & Friedlaender, 1982). Economies of scope are commonly stated as a condition of cost subadditivity in a joint cost function for multiple markets $C(y_1, y_2)$, with:

$C(y_1, y_2) < C(y_1, 0) + C(0, y_2)$,

where $C(y_1, y_2)$ is the joint cost of producing $y_1$ units of output for market 1 and $y_2$ units for market 2.

Economies of scope generally arise from the sharing or joint utilization of inputs of production (resources, in our terminology), when the shared inputs are quasi-public—that is, they are developed or acquired for use in one market and are available freely or at reduced additional cost to other market-units (Bailey & Friedlaender, 1982; Panzar & Willig, 1981). Therefore, resource-sharing opportunities across markets are an antecedent of economies of scope. If transaction costs prevent the existence of an efficient market in the shared resources, economies of scope may lead to the emergence of multimarket firms (Penrose, 1959; Teece, 1980).

Although economies of scope have often been evaluated at the firm level of analysis, a recent trend is to analyze them at a more disaggregate (market-unit) level (Brush, 1996; Davis & Thomas, 1993). This trend provides a finer-grained representation of scope economies, since all market-units within a firm are not likely to benefit equally from resource-sharing opportunities with other market-units. For instance, if a firm has two market-units that share the same resources and a third that does not share resources with the others, the market-unit level of analysis would accurately describe the intrafirm differences in scope economies among these market-units. At the market-unit level, the condition of economies of scope can be written as

$[C(y_1, y_2) - C(0, y_2)]/y_1 < C(y_1, 0)/y_1$.

That is, the incremental average unit cost of producing output 1 when the firm is also producing output 2 is lower than the average unit cost of producing output 1 on its own. More generally, economies of scope imply lower average costs for a focal market-unit if the firm also has other market-units with resource-sharing opportunities with the focal market-unit.

Multimarket Contact

Multimarket contact occurs when firms encounter the same rivals in multiple markets. When firms compete with each other in several markets—a phenomenon also known as multimarket (or multipoint) competition (Karnani & Wernerfelt, 1985; Porter, 1980, 1985)—their competitive behavior may differ from that of single-point rivals. Multimarket competition may result in the reduction of the competitive intensity among rivals, an outcome known as mutual forbearance (Edwards, 1955). A firm that meets a rival in multiple markets can respond to an attack not only in the attacked market, but also in other markets in which both firms compete. The competitive moves of multipoint competitors may therefore be linked across markets; this condition is known as extended interde-

\[1\] Arguably, the definition of a market is partly dependent on the level of aggregation, since many industries actually entail multiple products, and national markets can often be divided into more meaningful regional or local markets. Economics researchers have developed econometric tests for the determination of market boundaries in terms of cross-elasticity of demand (Scheffman & Spiller, 1996).

\[2\] Bailey and Friedlaender (1982) suggested some common specific conditions for economies of scope, including (1) resources jointly produce multiple by-products, (2) fixed indivisible resources can be used for multiple markets, (3) economies of networking exist, (4) a resource can be reused by more than one product, and (5) markets share intangible resources.

\[3\] In addition to economies of scope (cost subadditivity), multimarket firms may also benefit from revenue superadditivity. Revenue superadditivity occurs when the volume of sales by the firm in one market increases the demand for the firm’s products in another market. Revenue superadditivity may exist in the demands of complementary products (such as razors and blades) or in markets with cross-market demand externalities.
pends (Areeda & Turner, 1979). As firms recognize their rivals' ability to retaliate in multiple markets, they develop expectations about cross-market retaliation (Feinberg, 1984) that will reduce their motivation to act aggressively (Chen, 1996). Since the retaliatory power is reciprocal, the forbearance is mutual. In addition to mutual deterrence, multimarket contact may also increase a firm's familiarity with the strategies of its rivals, which may also facilitate the tacit coordination and mutual understanding necessary to successfully reduce rivalry (Baum & Korn, 1996; Scott, 1993). Empirical research on mutual forbearance has shown inconclusive results in the past, although recent studies using longitudinal research designs have generally provided consistent support for the mutual forbearance hypothesis (see Jayachandran, Gimeno, and Varadarajan [1999] for a review). However, the lack of consideration of scope economies in empirical multimarket contact research casts doubt over some empirical findings since, as Montgomery pointed out, "Whether this [the performance effect of multimarket contact] was due to natural scope economies, anti-competitive behavior, or both was not clear" (1994: 169). In the theory and analysis presented below, we seek to clarify this important question.

THEORY AND HYPOTHESES

In the theory presented here, we first hypothesize an association between economies of scope and multimarket contact and then explore the performance effects of these two constructs. Although the ultimate dependent variable of interest is economic performance (profitability), we begin by explicitly examining the effects of these constructs on two mediating variables, efficiency and intensity of rivalry. Efficiency and intensity of rivalry are two important predictors of profitability (McWilliams & Smart, 1993; Schmalensee, 1987), and they are the theoretically expected mechanisms by which scope economies and multimarket contact influence profitability.

In order to tease out the effects of scope economies and multimarket contact, we defined the level of analysis at the market-unit rather than the aggregate firm level. This is a very important decision, since firm-level aggregation of effects may mask significant intrafirm differences among market-units. Different market-units within a firm may benefit differently from scope economies, depending on their ability to share resources with the firm's other market-units (Brush, 1996; Davis & Thomas, 1993). Competitive effects are also likely to differ across market-units, since firms are likely to encounter different combinations of competitors in each market. In this article, the term focal market-unit refers to the market-unit being analyzed in a given observation, and the term focal-market rivals identifies the rivals that a focal firm faces in a focal market. Figure 1 represents the main relationships studied here.

Association between Economies of Scope and Multimarket Contact

Theory and evidence suggest that firms' expansion paths are partly determined by the incentive to find additional uses for existing resources that are not fully used in existing markets (Montgomery & Hariharan, 1991; Penrose, 1959; Teece, 1980). Such activities can lead to scope economies from the sharing of resources across markets. These market expansion opportunities may not be totally specific to each firm. Firms in the same focal market may have developed similar resources for serving that market and may therefore consider similar market expansion options. To the extent that market expansion options based on resource-sharing opportunities are sufficiently visible, competitors are likely to independently perceive the gains from the same market expansions, so multimarket contact results. As Porter argued in the context of corporate diversification, "While multipoint competitors and interrelationships do not necessarily occur together, they often do because both tangible and intangible interrelationships lead firms to follow parallel diversification paths" (1985: 354). Therefore, although multimarket contact can also occur in the absence of economies of scope, the likelihood of meeting focal-market rivals in other markets that offer strong resource-sharing opportunities with the focal market should be greater than it will be in those with weak resource-sharing opportunities.

Hypothesis 1. Multimarket contact between a firm and its focal-market rivals is more likely to occur in markets that present strong resource-sharing opportunities with the focal market than in those that present weak resource-sharing opportunities.

Effects on Market-Unit Efficiency

The following hypothesis addresses the impact that resource-sharing opportunities with other market-units have on the efficiency of a focal market-unit. Efficiency, defined as the ability of a firm to produce a given level of output with fewer inputs and resources (or greater output with a given level
of resources), is an important predictor of competitive advantage within a market or industry (Demsetz, 1973; Peteraf, 1993; Schmalensee, 1987). Higher efficiency has been cited as one of the most salient potential benefits of sharing resources across the value chains of different market-units (Bailey & Friedlaender, 1982; Brush, 1996; Porter, 1985). The joint utilization of resources improves efficiency by increasing the rate of output that a firm obtains from existing resources. This is especially so if the underlying shared resources represent fixed costs or if the costs of the resources increase at a less than proportional rate relative to their utilization.

Operationally defined at the market-unit level of analysis, the concept of economies of scope suggests that the efficiency achieved by a focal market-unit is greater when it is able to share resources with other market-units of its firm. Therefore, we expected a positive efficiency spillover across market-units within a firm when the market-units have strong resource-sharing opportunities.

**Hypothesis 2.** The efficiency of a focal market-unit is higher if the focal firm is present in other markets that have strong resource-sharing opportunities with the focal market.

**Effect on Market-Unit Intensity of Rivalry**

We now shift focus from efficiency to intensity of rivalry as the dependent construct. The intensity of rivalry experienced by a focal market-unit is determined by the competitive interaction with focal-market rivals (Porter, 1980), and it is therefore influenced by the competitive behavior of those rivals. The product-market scope choices of focal-market rivals may influence the intensity of rivalry experienced by the focal market-unit if these choices lead to multimarket contact between the focal market-unit and its focal-market rivals. The mutual forbearance hypothesis suggests that the threat of cross-market retaliation among competitors that have substantial multimarket contact reduces the intensity of their rivalry. Past research has yielded evidence that multimarket contact is
associated with constraint of rivalry, as reflected by higher prices (Evans & Kessides, 1994; Gimeno, 1999; Gimeno & Woo, 1996a), lower frequency and speed of competitive moves (Young, Smith, & Grimm, 1997), higher conjectural variations (Parker & Röller, 1997), and lower likelihood of market entry (Baum & Korn, 1996) and exit (Barnett, 1993; Baum & Korn, 1996; Boeker, Goodstein, Stephan, & Murmann, 1997). Given the substantial amount of prior testing of this relationship that has occurred, the next hypothesis, replicating prior findings, was included for theoretical completeness of the model rather than for its original contribution.

Hypothesis 3a. The intensity of rivalry experienced by a focal market-unit is negatively associated with the extent of multimarket contact with its focal-market rivals.

Existing research on multimarket contact is limited by the established practice of aggregating all contacts into a summary measure. By doing so, researchers have not acknowledged that different types of contacts may have different collusive effects. In the next hypothesis, we differentiate between contacts in markets that have strong resource-sharing opportunities with a focal market and those that do not, in the expectation that these contacts may have different effects on the intensity of rivalry.

A necessary condition for mutual forbearance is that firms recognize their extended interdependence. Such recognition requires firms to actively consider the possibility of cross-market retaliation. Discussing multipoint competition across diversified firms, Porter suggested that “strategy towards a multipoint competitor is affected by whether or not the competitor perceives the connections among industries” (1985: 359; emphasis in original) and that “relatedness increases the likelihood that a competitor will perceive the linkages among businesses” (1985: 360). If managers are attempting to exploit economies of scope among market-units, decisions concerning these market-units will probably be more coordinated in the organization’s decision-making process. This coordinated decision making facilitates the perception of extended interdependence with multipoint competitors present in those markets. Even if the market-units are managed by different organizational units, the presence of strong resource-sharing opportunities among market-units may lead to the formation of coordinating roles and mechanisms (Hill, Hitt, & Hoskisson, 1992), which would permit the recognition of interdependence with multipoint rivals. On the other hand, failure to perceive extended interdependence or lack of effective coordination would likely reduce the ability to synchronize response to rivals across units and thus undercut the incentives for forbearance (Collins & Montgomery, 1997: 166). It is therefore reasonable to expect that unless the opportunities for resource sharing among units are strong and can be easily recognized, the coordination necessary to induce forbearance will largely be absent.

The gains from tacit collusion among multipoint competitors are also more limited in markets that do not benefit from economies of scope with other markets. This is because, in the absence of economies of scope, multimarket competitors do not have an efficiency advantage over single-point incumbents or potential entrants. Thus, an attempt by multimarket incumbents to collude (for instance, by raising their prices over their costs) may be self-defeating, since single-point incumbents and potential entrants would act to bring the market back to competitive equilibrium. In contrast, when multimarket competitors can draw on the benefits of economies of scope, they have a cost advantage over single-point incumbents or potential entrants. They can raise prices to a level that, although above the costs of the multimarket incumbents, does not generate output expansion by single-point incumbents and potential entrants. Thus, the opportunity to tacitly reduce rivalry may be greater when multimarket competitors meet in multiple markets characterized by strong resource-sharing opportunities.

These rationales therefore suggest that the effects of multimarket contacts are not homogeneous: multiple contacts in markets with strong resource-sharing opportunities with the focal market are more likely to reduce the intensity of rivalry experienced by the focal market-unit.

Hypothesis 3b. The reduction of rivalry from multimarket contacts is greater for contacts in markets that present strong resource-sharing opportunities with the focal market.

Intensity of rivalry may also be influenced by the focal-market rivals’ presence in markets in which the focal firm is not present—that is, when multimarket contact does not occur. Without the competitive restraint arising from multimarket contact, focal-market rivals are likely to exhibit competitive behavior in accordance with their competitive capability (Chen, 1996). We hypothesize that the intensity of rivalry will increase if the nonoverlapping product-market scope of rivals provides them with strong resource-sharing opportunities for their units in the focal market. In this case, the focal-market rivals enjoy a source of advantage and a potential for greater efficiency not available to the
focal market-unit. The source of this advantage also lies outside the range of retaliation by the focal market-unit. In that situation, focal-market rivals are likely to deploy their advantage to obtain a larger share of the focal market, thus increasing the intensity of rivalry experienced by the focal market-unit. As a result, the intensity of rivalry for the focal market-unit will be higher if focal-market rivals enjoy efficiencies gained from resource-sharing opportunities with other markets in which the focal market-unit is not present.

Hypothesis 4. The intensity of rivalry experienced by a focal market-unit is higher if focal-market rivals are located in markets that present strong resource-sharing opportunities and in which the focal firm is not present.

Effects on Market-Unit Profitability

We now examine the impact of multimarket contact and economies of scope on the variable of ultimate interest, profitability. Since profitability, or economic performance, is a combined result of efficiency and intensity of rivalry (Schmalensee, 1987), the hypotheses below extend the foci of the two prior sets of hypotheses to their ultimate implications. By simultaneously including economies of scope and multimarket contact in our model of profitability, we avoid the possible omitted variable bias implied in Montgomery’s (1994) quote.

Explanations of profitability differences in strategic management and industrial economics have emphasized two generic determinants of profitability (McWilliams & Smart, 1993; Schmalensee, 1987). Profitability may be due to “quasi-rents” associated with firm-specific resources and capabilities that make firms more efficient (Cool, Dierickx, & Jemison, 1989; Demsetz, 1973; Peteraf, 1993). Profitability may also be due to market power attained when external conditions, such as industry structure, determine a low level of competition from rivals, potential entrants, buyers, and suppliers (Porter, 1980; Scherer & Ross, 1990). Efficiency and market power explanations of profitability have often been presented as conflicting views, but they are clearly not mutually exclusive and are treated here as complementary influences.

The profitability of a market-unit is likely to be a function of its cost efficiency, since market-units with lower costs will also obtain larger margins, everything else being constant. Accordingly, factors that increase market-unit efficiency should also increase market-unit profitability. Hence, repeating and extending the arguments used for Hypothesis 2, we predicted that strong resource-sharing opportunities would increase market-unit profitability.

Hypothesis 5. The profitability of a focal market-unit is higher if the focal firm is present in other markets that have strong resource-sharing opportunities with the focal market.

The profitability of a market-unit is also likely to be a function of its competitive environment and, particularly, of the intensity of rivalry generated by focal-market rivals. If rivalry is intense, focal market-units will lose sales to those rivals undertaking competitive actions. Focal market-units may reduce the loss in revenues by stepping up their own competitive activity (by, for example, reducing their price or increasing promotional and differentiation efforts), but by doing so they may sacrifice margins. In either case, profitability is hurt by intense rivalry, and factors that reduce the intensity of the rivalry experienced by a market-unit should also increase the market-unit’s profitability. Repeating and extending the arguments used for Hypotheses 3a, 3b, and 4, we theorize that market-unit profitability will be positively associated with multimarket contact, particularly when contacts occur in markets with strong resource-sharing opportunities, and that it will be negatively associated with facing focal-market rivals that have strong resource-sharing opportunities in nonoverlapping markets.

Hypothesis 6a. The profitability of a focal market-unit is positively associated with the extent of multimarket contact with its focal-market rivals.

Hypothesis 6b. The increase in profitability from multimarket contacts is greater for contacts in markets that present strong resource-sharing opportunities with the focal market.

Hypothesis 7. The profitability of a focal market-unit is lower if focal-market rivals are located in markets that present strong resource-sharing opportunities with the focal market but in which the focal firm is not present.

METHODS

Sample

Although the constructs of economies of scope and multimarket contact can be applied to multiple contexts of multimarket scope (multiproduct industries, corporate diversification, and domestic or international geographical diversification), here we tested the hypotheses in the context of the multiple markets within the U.S. airline industry. Data on the scheduled air transportation of passengers were
used. The industry is composed of multiple city-pair markets (customers demanding air transportation between two specific cities), with most airlines present in several of these markets simultaneously. The city-pair market offers a convenient definition of a market, since there is very little or no cross-elasticity of demand across city-pair markets. The presence of an airline in a city-pair market is referred to here as an airline route. The airline industry is the single or dominant business for most firms in the industry, which reduces any bias from the omitted effect of multimarket contact outside the industry.

This industry is ideal for the study of economies of scope and multimarket competition for various theoretical and empirical reasons. In terms of economies of scope, airlines engage in substantial sharing of resources across airline routes when multiple routes share airport facilities (for instance, ticketing and baggage-handling facilities, maintenance and hangar facilities, and proprietary airport investments) or common segments of service within a hub-and-spoke network. Airlines also experience substantial multimarket contact (Baum & Korn, 1996; Chen, 1996; Evans & Kessides, 1994; Gimeno & Woo, 1996a; Smith & Wilson, 1995). The few players in the industry engage in repeated competitive interaction in multiple markets, which means that firms mutually learn about the expected responses of their rivals. Anecdotal evidence of cross-market retaliations (Nomani, 1990; O’Brian, 1994) reflects the extended interdependence among airlines.

A panel data sample describing the domestic scheduled passenger activities of U.S. airlines for the fourth quarters of 1984 through 1988 was obtained from three U.S. Department of Transportation quarterly databases: the origin and destination (O & D) survey (a 10 percent sample of all the tickets sold in the United States), the service segment database, and the form 41 reports. The sample period represents a critical window in the evolution of the U.S. airline industry and incorporates phases of fierce rivalry as well as times of de-escalation (Gimeno & Woo, 1996a). We focused on both nonstop and one-stop services for city-pairs, since these services are often considered as substitutes for each other in the airline competition literature. We only considered city-pair markets in which both end-cities were at least small hubs, according to the Federal Aviation Administration (FAA) classification (that is, enplanements in each airport were at least 0.05 percent of the total yearly U.S. enplanements). We also eliminated markets between cities less than 100 miles apart (to avoid the effect of substitution by ground transportation) and those with average daily traffic of fewer than ten passengers. Since research focused on competitive contexts, we also eliminated observations of monopoly markets. The application of these restrictions yielded 3,008 valid city-pair markets.

The unit of analysis (the focal market-unit) was defined as the airline route. The sample included 14,122 airline routes. For each, an observation was created for each time period in which the airline route was active. The subscribers i, m, and t respectively identified the airline, city-pair market, and time period of an observation. An airline was considered to be an incumbent in a market if it met at least one of these two conditions: (1) it had at least a 5 percent share of the market or (2) it carried at least ten passengers a day. A potential entrant was defined as a nonincumbent with operations at both end-cities of the city-pair market. Airline-route passenger figures did not include those passengers flying with tickets that combined multiple airlines in a single trip (interline tickets). However, interline tickets were counted as part of the total market passenger figures used for calculating market shares and market structure variables. We also eliminated from the sample airlines for which the revenues obtained in the sampled markets differed by more than 30 percent from their published aggregated revenues (these airlines were included for calculations of market shares and of market structure and multimarket contact variables). These discrepancies could be the result of undersampling in the O & D survey or of the airlines’ substantial presence in other markets not included in the sample (such as small nonhub cities). Our final data set included 28 airlines and 44,493 observations.

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4 This definition eliminated cases in which passengers flew an airline route through connections unintended by a firm but kept in the sample small competitors that targeted niches of demand in high-density markets.

5 Research in the airline industry has well-developed protocols for the identification of potential entrants to markets, thanks to the accumulated research on contestability (Berry, 1989; Brueckner, Dyer, & Spiller, 1992). Our definition agrees with that used by Brueckner and colleagues. Berry supported this definition by finding that the odds of entry for a potential entrant already established at both points was more than 18 times larger than that for a firm only established in one city and that it was 77 times larger than that for a firm not established in either city.

6 Grouped by their FAA classifications, the 28 sampled airlines were (1) majors: American, Continental, Delta, Eastern, Northwest, PanAm, Piedmont, Republic, TWA, United, USAir, and Western; (2) nationals: Air California, Aloha, America West, Braniff, Jet America,
Dependent Variables

Efficiency. Efficiency was measured as cost per revenue-passenger-mile, which was the cost of flying a paying passenger in a given airline route divided by the distance between the endpoint cities, stated in cents per mile. Most of the costs in the airline industry (with the exception of food costs, which are about 3 percent of total costs) are incurred in making capacity (seats) available, and they are incurred regardless of whether a seat is filled or empty (Bailey, Graham, & Kaplan, 1985: 49). The efficiency of an airline route can therefore be increased in two ways: by reducing the cost of offering available seats and by achieving high utilization of those seats. Airlines do not report actual costs per revenue-passenger-mile for each airline route, but they can be constructed as a function of the load factor (the percentage of filled seats) and the cost per available-seat-mile. The cost per revenue-passenger-mile for each airline route equals the product of the cost per available-seat-mile and the ratio of available-seat-miles to revenue-passenger-miles, which is the inverse of the load factor. The formula is

\[
\text{Cost per revenue-passenger-mile}_{int} = \frac{\text{cost per available-seat-mile}_{int}}{\text{revenue-passenger-mile}_{int}} \times \frac{1}{\text{load factor}_{int}}.
\]

The airline-route load factor is calculated from the load factors of the segments used by passengers traveling the route. We estimated airline-route cost per available-seat-mile from firm-level and route-level data following the procedure developed by Brander and Zhang (1990).7

Intensity of rivalry. Although rivalry entails a pattern of competitive actions and reactions (Chen, 1996), its outcome is commonly reflected in decreased prices for the services provided by a firm. This is particularly true for the airline industry, in which price competition is the main dimension of competition. Thus, we used a measure of price known in the industry as yield to capture lack of rivalry. Yield was defined as revenue per revenue-passenger-mile, or the average price paid by customers in an airline route divided by the distance between the endpoint cities, stated in cents per mile. Higher yields reflect less intense rivalry.

Profitability. Profitability represents the ability of a firm to obtain revenues above costs. Unfortunately, airlines only report profitability at the airline level. To obtain a measure at the airline-route level, we used the variables yield_{int} (price per revenue-passenger-mile) and cost per revenue-passenger-mile_{int} to construct the Lerner index. The latter, a popular measure of economic performance used in industrial economics, is defined as the price-cost margin divided by the price. We calculated the Lerner index for each airline route as:

\[
\text{Lerner index}_{int} = \frac{\text{yield}_{int} - \text{cost per revenue-passenger-mile}_{int}}{\text{yield}_{int}} \times 100.
\]

The Lerner index is equivalent to the popular return on sales (ROS) performance ratio, which is defined as operating margins divided by sales. We assessed the validity of the Lerner index by comparing firm-level ROS to a firm-level aggregation of the Lerner index across airline routes. The sales-weighted average of the Lerner index of a firm’s airline routes demonstrated a Pearson correlation of .90 with firm-level ROS, suggesting substantial convergent validity.

Independent Variables

For each observation of a focal firm in a focal market, the independent variables pertained to the

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7 Brander and Zhang (1990) extrapolated unit costs for an airline route from firm-level data. The costs per available-seat-mile are primarily determined by both firm-level factors (such as labor costs or overall efficiency) and operational factors. Operational costs per available-seat-mile tend to decrease with market distance, since more efficient planes can be deployed over longer distances. The firm-level cost per available-seat-mile thus reflects firm-level efficiencies as well as the “average flight length” of the firm. Following Brander and Zhang (1990), we calculated airline-route cost per available-seat-mile as a distance-adjusted function of firm-level cost per available-seat-mile, as follows: \[ \text{cost per available-seat-mile}_{int} = \text{cost per available-seat-mile}_{it} \times (\text{average flight length}_{it}/\text{distance}_{it})^{1/2}. \]
other (nonfocal) markets served by the focal firm and its focal-market rivals. The variables described two dimensions of these nonfocal markets: the strength of resource-sharing opportunities with the focal market, and the presence of the focal firm, the focal-market rivals, or both, in these markets. The Venn diagram in Figure 2 reflects the intuition behind our definition of the independent variables. Three sets of nonfocal markets and their respective complementary sets can be defined from the universe of markets. First, markets can be classified by whether the focal firm is present as an incumbent (set $I$) or is absent (complementary set $I^*$). Second, markets can be classified by whether a given focal-market rival is present (set $J$) or absent (complementary set $J^*$). Finally, markets can be classified into those that offer strong opportunities to share resources with the focal market (set $SR[m]$) and those that offer weak opportunities (complementary set $SR^*[m]$). The independent variables were calculated on the basis of the number of markets in the intersections between these sets. Mathematical details of the definition of these variables are presented in Appendix A.

**Focal firm’s resource-sharing opportunities.**

The set $SR[m]$ of markets that offer strong resource-sharing opportunities with a focal market was defined as those markets that share an end-city (origin or destination) with the focal market. Airline routes that share an origin or destination have the highest opportunity for scope economies, since they can share important ground resources such as gates, maintenance and baggage-handling facilities, and airport facilities, as well as common flight segments within a hub-and-spoke network. These sharing opportunities are not available to airline routes that do not share an origin or a destination. To evaluate the effects of resource-sharing opportunities, we divided the set of markets served by a focal firm (except the focal market) into two subsets: those with strong resource-sharing opportunities with the focal market (subset $I \cap SR[m]$) and those with weak resource-sharing opportunities (subset $I \cap SR^*[m]$). The numbers of markets in
these two subsets correspond to the variables markets served (strong resource sharing) and markets served (weak resource sharing), respectively. The difference in the effects of these two variables reflects the impact of strong (versus weak) resource-sharing opportunities.

**Multimarket contact.** Following prior research, we used a count measure of multimarket contact (Baum & Korn, 1996; Evans & Kessides, 1994; Gimeno & Woo, 1996a). For a focal airline route, we first counted the number of markets in which the airline met a specific rival outside the focal market (that is, the number of markets in subset $I \cap J$). Since a focal market-unit can meet multiple focal-market rivals, the variable multimarket contact was computed as the average number of multimarket contacts with all focal-market rivals. For instance, if a firm were competing with two rivals in a focal market and met the first in 100 other markets and the second in 300 markets, the measure of multimarket contact would be 200 ($[100 + 300]/2$).\(^8\)

**Interaction effects.** The common multiplicative specification of interaction effects was not valid here, since the independent variables for each focal market-unit represented aggregates of the conditions in multiple nonfocal markets. It was possible that a market-unit with large values for markets served (strong resource sharing) and multimarket contact might nevertheless have few multimarket contacts in markets with strong resource-sharing opportunities with the focal market. Instead, we measured the interaction by splitting the previous aggregate independent variable into submeasures according to whether the moderating condition was present or absent in each nonfocal market. Multimarket contact was split into two submeasures: (1) multimarket contact (strong resource sharing), which measured the extent of multimarket contact in markets with strong resource-sharing opportunities with the focal market, and (2) multimarket contact (weak resource sharing), which captured multimarket contact in the remaining markets. The first measure reflected the number of markets in subset $I \cap J \cap SR[m]$, and the second equaled the number of markets in subset $I \cap J \cap SR^*[m]$.

**Rivals’ resource-sharing opportunities.** To evaluate the effects of resource-sharing opportunities available to rivals from markets not served by a focal firm, we divided the number of markets served by focal-market rivals but not by the focal firm into two subsets: those that had strong resource-sharing opportunities with the focal market (subset $I^* \cap J \cap SR[m]$) and those with weak resource-sharing opportunities (subset $I^* \cap J \cap SR^*[m]$). The variable rivals’ noncontact markets served (strong resource sharing) captured the number of markets in the first subset, and the variable rivals’ noncontact markets served (weak resource sharing) captured the number in the second. The effect of rivals’ resource-sharing opportunities was evaluated from the difference in the effects of these two measures.

**Methodology and Control Variables**

Since we used panel data composed of multiple observations from each airline, market, and period, there was potential for nonindependence of errors. To accommodate the panel data structure, we used the fixed-effects intercept model, also known as the least squares dummy variable (LSDV) model (Hsiao, 1986). Including fixed-effects intercepts for each airline, city-pair market, and time period accounted for unobserved heterogeneity along those dimensions. We also used dummy variables to account for the effects of mergers in the surviving entities.

Three equations were estimated, each corresponding to one of the three dependent variables—cost per revenue-passenger-mile, yield, and the Lerner index. For each equation, we added a set of variables to control for effects found to be significant in prior research (Baum & Korn, 1996; Borenstein, 1989; Evans & Kessides, 1994; Marin, 1995). Control variables in the cost per revenue-passenger-mile equation included economies of scale in the route (the number of passengers transported), the cost of inputs, the percentage of direct flights, and the airline’s share of enplanements in the end-cities. Control variables in the yield equation included the average marginal cost among incumbents, demand characteristics, and other sources of market power.\(^9\) Demand characteristics were reflected by market size, demand growth, the percentage of direct flights, the percentage of first-class...

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\(^8\) Since multimarket contact captures the markets of overlap between firms, the same contacts are included in the analysis of each firm’s market-units. Although those contacts are the same, they are used to predict dependent variables for different market-units. This measurement follows prior practice in research on contact.

\(^9\) The need for those control variables can be established, for instance, from a Cournot oligopoly model (Tirole, 1988) with heterogeneous costs, linear demand, and conjectural variations (representing market power). The equilibrium price in that model is a function of the average marginal cost among incumbents, the intercept of the demand function, the number of incumbents, and conjectural variations.
tickets, and the percentage of round-trip tickets. Other sources of market power included the number of incumbents, the number of potential entrants, the variance of the market shares of incumbents, prior competitive experience among incumbents, the airline’s airport share, and the airline route’s share of the city-pair market. The control variables in the profitability equation included the control variables from the previous two equations. Appendix B explains the measurement of these control variables.

Table 1 presents the descriptive statistics and Pearson correlation matrix for all variables. We observed some substantial correlations among some independent variables. This was not entirely surprising, since all the independent variables were calculated from the number of nonfocal markets in the six subsets in Figure 2. Although this situation may raise concerns about multicollinearity, the theoretical and empirical validity of the study was not compromised. Theoretically, the variables were distinctly defined and often pertained to nonoverlapping sets of nonfocal markets. Even if the variables were correlated, it would be inappropriate to assume that they were redundant. Empirically, multicollinearity was reduced by the panel data analysis method used.\(^{10}\) Variance inflation factors for independent variables were never above 6, below the rule of thumb of 10 often considered to reflect excessive multicollinearity (Neter, Wasserman, & Kutner, 1985). Even with moderate multicollinearity, LSDV estimates are the best linear unbiased estimators (Greene, 1990). Since multicollinearity increases the estimated variance of coefficients, our assessments of the significance of individual coefficients are conservative.

RESULTS

Hypothesis 1 suggests that multimarket contact is more likely to occur in markets with strong resource-sharing opportunities with a focal market. We tested this prediction by comparing, for each airline route, the proportions of multimarket contact with focal-market rivals in markets with strong or weak resource-sharing opportunities with the focal market. The proportion of multimarket contact in markets with strong resource-sharing opportunities was the ratio of multimarket contact (strong resource sharing) to markets served (strong resource sharing), and the proportion of multimarket contact in markets with weak resource-sharing opportunities was the ratio of multimarket contact (weak resource sharing) to markets served (weak resource sharing). Both proportions ranged from 0 to 1. For the sampled airline routes, the proportion of multimarket contact in markets with strong resource-sharing opportunities averaged 0.5 (s.d. = 0.16). On average, a focal airline in a focal market encounters its focal-market rivals in about half of the nonfocal markets with strong resource-sharing opportunities that it serves. The proportion of contacts in markets with weak resource-sharing opportunities averaged 0.38 (s.d. = 0.14). A paired t-test comparison of these proportions yielded a difference in means of 0.13, significant at \(p < .001\). Thus, Hypothesis 1 was supported. The likelihood of an airline’s encountering a focal-market rival was about 35 percent higher in markets that had strong resource-sharing opportunities with the focal market. Hence, multimarket contact and resource-sharing opportunities were associated.

Hypothesis 2 explores the effect of resource-sharing opportunities with other markets on route efficiency (see model 2 in Table 2). We observed that the effect of markets served (strong resource sharing) on costs per revenue-passenger-mile was negative and significant \((p < .001)\), but the coefficient was not significant for markets served (weak resource sharing). The difference between these coefficients \((b_1 - b_2)\), which reflects the differential efficiency gained from a presence in markets with strong resource-sharing opportunities with the focal market, is significant \((p < .001)\). These findings led us to conclude that airlines were able to obtain economies of scope from resource-sharing opportunities across markets, in agreement with Hypothesis 2.

Hypothesis 3a restates the widely tested relationship between multimarket contact and reduction in rivalry. Results from the test of this hypothesis (model 2 in Table 3) show that multimarket contact had a significant and positive effect on yield and, hence, a negative relationship to rivalry \((p < .001)\). Thus, our analysis supports Hypothesis 3a and is in line with prior findings.

Hypothesis 3b states that the forbearance effect is stronger when multimarket contact takes place in markets with strong resource-sharing opportunities with a focal market. Model 3 presents the results for this hypothesis. In the analysis, we split multimarket contact into multimarket contact (strong resource sharing) and multimarket contact (weak resource sharing). The coefficient of the effect of multimarket contact (strong resource sharing) on

\(^{10}\) This is because the high zero-order correlations reflected cross-sectional differences in the number of markets served by different firms. These correlations were reduced once airline-specific fixed effects were “partialed out.”
| Variable | Unit | Mean | s.d. | 1   | 2  | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | 11  | 12  | 13  | 14  | 15  | 16  | 17  | 18  | 19  | 20  | 21  | 22  | 23  |
|----------|------|------|------|-----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1. Lerner index | Ratio × 100 | 11.61 | 32.41 |     |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 2. Yield | Cents per mile | 16.66 | 9.43 | .30 |     |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 3. Cost per revenue-passerenger-mile | Cents per mile | 13.82 | 8.83 | -.43 | .64 |     |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 4. Average marginal cost among incumbents | Cents per mile | 7.28 | 2.49 | -.07 | .81 | .78 |     |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 5. Market size | 1 = $1 million squared/miles squared | 11.32 | 20.56 | -.16 | .33 | .46 | .52 |     |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 6. Market growth | Growth rate × 100 | 8.04 | 4.13 | .08 | .02 | -.04 | -.04 | .04 |     |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 7. Percentage of round-trip tickets | Percentage (0, 1) | 0.83 | 0.18 | .03 | -.13 | -.18 | -.21 | -.22 | -.07 |     |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 8. Percentage of first-class tickets | Percentage (0, 1) | 0.01 | 0.03 | .17 | -.14 | -.01 | -.02 | -.03 | .10 | .01 |     |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 9. Direct flights | Percentage (0, 1) | 0.17 | 0.36 | -.15 | .29 | .38 | .41 | .43 | .06 | -.12 | -.01 |     |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 10. Airport share | Percentage (0, 1) | 0.15 | 0.10 | .30 | .36 | .09 | -.25 | -.01 | -.04 | .03 | .08 | .33 |     |    |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 11. Prior competitive experience | Years | 41.08 | 17.02 | .15 | .04 | -.07 | -.10 | -.22 | -.06 | .33 | .05 | -.22 | .05 |     |    |     |     |     |     |     |     |     |     |     |     |     |     |
| 12. Number of potential entrants | Count | 3.12 | 2.27 | -.12 | .08 | .16 | .21 | .36 | .11 | -.14 | .00 | .45 | -.03 | -.28 |     |    |     |     |     |     |     |     |     |     |     |     |     |     |
| 13. Number of incumbents | Count | 3.98 | 1.79 | -.23 | -.31 | -.17 | -.25 | -.02 | -.05 | -.02 | .09 | -.35 | -.31 | .12 |     |    |     |     |     |     |     |     |     |     |     |     |     |     |
| 14. Market share variance | Percentage squared | 0.04 | 0.12 | -.11 | .00 | .08 | .07 | .21 | -.08 | -.03 | .26 | .01 | -.18 | .21 | .26 |     |    |     |     |     |     |     |     |     |     |     |     |     |     |
| 15. Market share | Percentage (0, 1) | 0.26 | 0.21 | .23 | .22 | .03 | -.13 | -.06 | .00 | .11 | .03 | .29 | .61 | .12 | -.05 | -.43 | -.04 |     |    |     |     |     |     |     |     |     |     |     |     |
| 16. Number of passengers | 1 = 1,000 passengers | 6.29 | 20.34 | -.02 | .07 | .08 | .17 | .45 | .05 | -.11 | .00 | .49 | .15 | -.20 | .30 | .22 | .19 | .18 |     |    |     |     |     |     |     |     |     |
| 17. Cost of inputs | Cents per mile | 15.89 | 3.60 | -.10 | .77 | .78 | .94 | .53 | .01 | -.33 | .00 | .44 | .25 | -.20 | .24 | -.18 | .11 | .13 | .20 |     |    |     |     |     |     |     |     |
| 18. Markets served (strong resource sharing) 1 = 100 markets | 0.06 | 0.27 | .14 | .09 | -.02 | -.03 | .04 | -.08 | .25 | .18 | .14 | .38 | .13 | .14 | .06 | .10 | .17 | .13 | -.06 |     |    |     |     |     |     |     |
| 19. Markets served (weak resource sharing) 1 = 100 markets | 9.49 | 4.41 | .07 | .06 | .00 | -.09 | -.13 | -.14 | .31 | .17 | -.16 | .15 | .30 | -.18 | -.11 | -.04 | .06 | -.10 | -.14 | .72 |     |    |     |     |     |     |
| 20. Multimarket contact (strong resource sharing) 1 = 100 markets | 3.78 | 2.12 | .13 | -.01 | -.10 | -.16 | -.21 | -.17 | .32 | .11 | -.24 | .10 | .51 | -.26 | -.21 | -.09 | .11 | -.15 | -.23 | .52 | .74 |     |    |     |     |     |
| 21. Multimarket contact (weak resource sharing) 1 = 100 markets | 0.33 | 0.15 | .18 | .06 | -.08 | -.09 | -.10 | -.13 | .26 | .14 | -.07 | .23 | .40 | -.08 | -.16 | -.02 | .16 | -.03 | -.14 | .71 | .62 | .83 |     |    |     |     |
| 22. Multimarket contact (strong resource sharing) 1 = 100 markets | 3.45 | 2.00 | .12 | -.01 | -.10 | -.16 | -.22 | -.17 | .32 | .10 | -.25 | .09 | .51 | -.27 | -.21 | -.09 | .11 | -.16 | -.24 | .50 | .74 | .99 | .81 |     |    |     |
| 23. Rivals' noncontact markets served (strong resource sharing) 1 = 100 markets | 0.32 | 0.17 | -.13 | -.13 | -.01 | -.01 | .12 | .01 | -.15 | -.12 | .11 | -.35 | -.04 | .25 | .24 | .15 | -.32 | .03 | -.02 | -.51 | -.58 | -.39 | -.36 | -.39 |     |    |     |
| 24. Rivals' noncontact markets served (weak resource sharing) 1 = 100 markets | 5.73 | 2.64 | .03 | -.10 | -.11 | -.06 | -.08 | -.08 | -.01 | -.12 | -.08 | .12 | .22 | -.12 | -.01 | -.01 | -.06 | -.09 | -.10 | -.44 | .51 | -.12 | -.13 | -.12 | .68 |     |    |     |

*a N = 44,493.

*b For correlations greater than .01, p < .05. For correlations greater than .02, p < .001.
### TABLE 2

Results of LSDV Regression Analysis: Effects on Cost per Revenue-Passenger-Mile

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient Model 1</th>
<th>Coefficient Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of passengers</td>
<td>-0.04***</td>
<td>-0.04***</td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>Direct flights</td>
<td>4.09***</td>
<td>3.97***</td>
</tr>
<tr>
<td></td>
<td>(0.10)</td>
<td>(0.10)</td>
</tr>
<tr>
<td>Cost of inputs</td>
<td>1.59***</td>
<td>1.63***</td>
</tr>
<tr>
<td></td>
<td>(0.13)</td>
<td>(0.13)</td>
</tr>
<tr>
<td>Airport share</td>
<td>-12.99***</td>
<td>-9.04***</td>
</tr>
<tr>
<td></td>
<td>(0.28)</td>
<td>(0.34)</td>
</tr>
<tr>
<td>Markets served (strong resource sharing)</td>
<td>$b_1$</td>
<td>-3.95***</td>
</tr>
<tr>
<td></td>
<td>(0.20)</td>
<td></td>
</tr>
<tr>
<td>Markets served (weak resource sharing)</td>
<td>$b_2$</td>
<td>-0.04</td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
<td></td>
</tr>
<tr>
<td>$N$</td>
<td>44,493</td>
<td>44,493</td>
</tr>
<tr>
<td>Parameters estimated</td>
<td>3,050</td>
<td>3,052</td>
</tr>
<tr>
<td>$R^2$</td>
<td>.79</td>
<td>.79</td>
</tr>
<tr>
<td>$F$ for increment in $R^2$</td>
<td>51.42***</td>
<td>52.02***</td>
</tr>
<tr>
<td>Degrees of freedom</td>
<td>2,41,440</td>
<td></td>
</tr>
<tr>
<td>Linear combinations of coefficients:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$b_1 - b_2$</td>
<td>-3.91***</td>
<td></td>
</tr>
</tbody>
</table>

* Unstandardized regression coefficients are shown; standard errors are in parentheses. Fixed effects for markets, airlines, years, and mergers are not shown.

*** $p < .001$

The cost per revenue-passenger-mile yield is positive, large, and statistically significant ($p < .001$). In contrast, the coefficient of multimarket contact (weak resource sharing) is not statistically significant in model 3 (it is marginally significant in model 4). The difference between these coefficients is significant ($p < .001$). These results support Hypothesis 3b and indicate that contacts in markets with strong resource-sharing opportunities with the focal market seem to have a greater forbearance effect than contacts in other markets.

Hypothesis 4 states that when rivals locate in markets that provide strong resource-sharing opportunities and are not occupied by a focal firm, rivalry for the focal market-unit will increase. In model 4, we added two variables reflecting rivals’ positions in markets in which the focal firm was absent, categorized by the strength of resource-sharing opportunities with the focal market. The coefficient of rivals’ noncontact markets served (strong resource sharing) was negative, of large magnitude, and significant ($p < .001$), and the coefficient of rivals’ noncontact markets served (weak resource sharing) was also negative and significant ($p < .01$) but of substantially smaller magnitude. The difference between these coefficients was statistically significant ($p < .001$). A focal market-unit experienced more intense rivalry if focal-market rivals were present in markets that offered them scope economies that were not exploited by the focal firm. Hypothesis 4 is supported.

Hypotheses 5 and 6a relate to the effect of focal firm’s resource-sharing opportunities and multimarket contact on profitability. Models 2 and 3 in Table 4 sequentially address these effects. Both effects were statistically significant ($p < .001$) when introduced independently. Model 4 incorporates both variables jointly. The results support Hypotheses 5 and 6a both and show that both multimarket contact and resource-sharing opportunities have a statistically significant and positive effect on market-unit profitability. Although the coefficient associated with multimarket contact (model 4) was statistically significant ($p < .001$), it was less than half of the magnitude of the corresponding coefficient in model 3, an analysis in which resource-sharing opportunities were not controlled for. Thus, the effect of multimarket contact on performance can be overestimated (in this case, by a factor of over 100 percent) if the effects of resource-sharing opportunities are not controlled for. The coefficients in model 5 also suggest that a presence in markets with strong resource-sharing opportunities with the focal market has a more positive impact on profitability than a presence in markets with weak resource-sharing opportunities, since the coefficients of these variables were significantly different ($p < .001$). Thus, Hypotheses 5 and 6a are supported.

Hypothesis 6b explores whether the effect of multimarket contact on profitability depends on the strength of resource-sharing opportunities with a focal market. As for the tests of Hypothesis 3b, we divided multimarket contact into two submeasures based on whether contacts occurred in markets with strong or weak resource-sharing opportunities with the focal market. The coefficient of multimarket contact (strong resource sharing) was positive, of large magnitude, and statistically significant ($p < .001$), but the coefficient of multimarket contact (weak resource sharing) was negative, of small magnitude.
### TABLE 3
Results of LSDV Regression Analysis: Effects on Yield

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient 1</th>
<th>Coefficient 2</th>
<th>Coefficient 3</th>
<th>Coefficient 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average marginal cost among</td>
<td>0.79***</td>
<td>0.80***</td>
<td>0.81***</td>
<td>0.82***</td>
</tr>
<tr>
<td>incumbents</td>
<td>(0.04)</td>
<td>(0.04)</td>
<td>(0.04)</td>
<td>(0.04)</td>
</tr>
<tr>
<td>Market size</td>
<td>0.30***</td>
<td>0.31***</td>
<td>0.31***</td>
<td>0.31***</td>
</tr>
<tr>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
</tr>
<tr>
<td>Market growth</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
</tr>
<tr>
<td>Percentage of round-trip tickets</td>
<td>-5.54***</td>
<td>-5.56***</td>
<td>-5.61***</td>
<td>-5.62***</td>
</tr>
<tr>
<td>(0.18)</td>
<td>(0.18)</td>
<td>(0.18)</td>
<td>(0.18)</td>
<td>(0.18)</td>
</tr>
<tr>
<td>Percentage of first-class tickets</td>
<td>21.94***</td>
<td>21.86***</td>
<td>21.75***</td>
<td>21.70***</td>
</tr>
<tr>
<td>(0.62)</td>
<td>(0.62)</td>
<td>(0.62)</td>
<td>(0.61)</td>
<td></td>
</tr>
<tr>
<td>Direct flights</td>
<td>0.12</td>
<td>0.19*</td>
<td>0.20*</td>
<td>0.27***</td>
</tr>
<tr>
<td>(0.08)</td>
<td>(0.08)</td>
<td>(0.08)</td>
<td>(0.08)</td>
<td></td>
</tr>
<tr>
<td>Airport share</td>
<td>7.25***</td>
<td>7.17***</td>
<td>6.87***</td>
<td>6.46***</td>
</tr>
<tr>
<td>(0.25)</td>
<td>(0.25)</td>
<td>(0.25)</td>
<td>(0.27)</td>
<td></td>
</tr>
<tr>
<td>Prior competitive experience</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td></td>
</tr>
<tr>
<td>Number of potential entrants</td>
<td>-0.38***</td>
<td>-0.36***</td>
<td>-0.35***</td>
<td>-0.37***</td>
</tr>
<tr>
<td>(0.02)</td>
<td>(0.02)</td>
<td>(0.02)</td>
<td>(0.02)</td>
<td></td>
</tr>
<tr>
<td>Number of incumbents</td>
<td>-0.54***</td>
<td>-0.50***</td>
<td>-0.46***</td>
<td>-0.51***</td>
</tr>
<tr>
<td>(0.03)</td>
<td>(0.03)</td>
<td>(0.03)</td>
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</tr>
<tr>
<td>Market share variance</td>
<td>-0.83***</td>
<td>-0.76**</td>
<td>-0.65**</td>
<td>-0.61*</td>
</tr>
<tr>
<td>(0.24)</td>
<td>(0.24)</td>
<td>(0.24)</td>
<td>(0.24)</td>
<td></td>
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<tr>
<td>Market share</td>
<td>0.57***</td>
<td>0.51***</td>
<td>0.47***</td>
<td>0.37***</td>
</tr>
<tr>
<td>(0.12)</td>
<td>(0.12)</td>
<td>(0.12)</td>
<td>(0.12)</td>
<td></td>
</tr>
<tr>
<td>Multimarket contact</td>
<td>0.16***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.02)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multimarket contact (strong</td>
<td></td>
<td>2.31***</td>
<td>1.75***</td>
<td></td>
</tr>
<tr>
<td>resource sharing)</td>
<td></td>
<td>(0.32)</td>
<td>(0.37)</td>
<td></td>
</tr>
<tr>
<td>Multimarket contact (weak</td>
<td></td>
<td>0.03</td>
<td>0.05*</td>
<td></td>
</tr>
<tr>
<td>resource sharing)</td>
<td></td>
<td>(0.03)</td>
<td>(0.03)</td>
<td></td>
</tr>
<tr>
<td>Rivals’ noncontact markets served</td>
<td></td>
<td></td>
<td></td>
<td>-0.97***</td>
</tr>
<tr>
<td>(strong resource sharing)</td>
<td></td>
<td></td>
<td></td>
<td>(0.25)</td>
</tr>
<tr>
<td>Rivals’ noncontact markets served</td>
<td></td>
<td></td>
<td></td>
<td>-0.04**</td>
</tr>
<tr>
<td>(weak resource sharing)</td>
<td></td>
<td></td>
<td></td>
<td>(0.01)</td>
</tr>
<tr>
<td>N</td>
<td>44,493</td>
<td>44,493</td>
<td>44,493</td>
<td>44,493</td>
</tr>
<tr>
<td>Parameters estimated</td>
<td>3,058</td>
<td>3,059</td>
<td>3,060</td>
<td>3,062</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>.89</td>
<td>.89</td>
<td>.89</td>
<td>.89</td>
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<tr>
<td>( F )</td>
<td>107.45***</td>
<td>107.65***</td>
<td>107.74***</td>
<td>107.82***</td>
</tr>
<tr>
<td>( F ) for increment in ( R^2 )</td>
<td>83.79***</td>
<td>44.10***</td>
<td>25.64***</td>
<td></td>
</tr>
<tr>
<td>Degrees of freedom</td>
<td>1, 41,433</td>
<td>1, 41,432</td>
<td>2, 41,430</td>
<td></td>
</tr>
</tbody>
</table>

Linear combinations of coefficients:

| \( b_1 - b_2 \) | 2.28*** |
| \( b_3 - b_4 \) | 1.69*** |

\( a \) Unstandardized regression coefficients are shown; standard errors are in parentheses. Fixed effects for markets, airlines, years, and mergers are not shown.

\( b \) Fs are for model 2 versus model 3, model 3 versus model 2, and model 4 versus model 3, respectively.

* \( p < .10 \)

** \( p < .01 \)

*** \( p < .001 \)
<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average marginal cost among incumbents</td>
<td>0.86**</td>
<td>1.35***</td>
<td>0.98***</td>
<td>1.38***</td>
<td>1.30***</td>
<td>1.43***</td>
</tr>
<tr>
<td>Market size</td>
<td>0.18**</td>
<td>0.20***</td>
<td>0.19***</td>
<td>0.20***</td>
<td>0.20***</td>
<td>0.18**</td>
</tr>
<tr>
<td>Market growth</td>
<td>0.06</td>
<td>0.09</td>
<td>0.09</td>
<td>0.09</td>
<td>0.09</td>
<td>0.12</td>
</tr>
<tr>
<td>Percentage of round-trip tickets</td>
<td>-15.13***</td>
<td>-16.66***</td>
<td>-15.31***</td>
<td>-16.70***</td>
<td>-16.84***</td>
<td>-16.82***</td>
</tr>
<tr>
<td>Percentage of first-class tickets</td>
<td>117.83***</td>
<td>112.65***</td>
<td>117.00***</td>
<td>112.51***</td>
<td>112.28***</td>
<td>112.36***</td>
</tr>
<tr>
<td>Direct flights</td>
<td>-18.50***</td>
<td>-17.19***</td>
<td>-17.82***</td>
<td>-16.92***</td>
<td>-17.00***</td>
<td>-16.47***</td>
</tr>
<tr>
<td>Airport share</td>
<td>81.91***</td>
<td>55.29***</td>
<td>81.11***</td>
<td>55.80***</td>
<td>58.36***</td>
<td>58.36***</td>
</tr>
<tr>
<td>Prior competitive experience</td>
<td>0.03**</td>
<td>0.04***</td>
<td>0.01</td>
<td>0.02*</td>
<td>0.02*</td>
<td>0.04***</td>
</tr>
<tr>
<td>Number of potential entrants</td>
<td>-1.53***</td>
<td>-1.30***</td>
<td>-1.36***</td>
<td>-1.32***</td>
<td>-1.21***</td>
<td>-1.35***</td>
</tr>
<tr>
<td>Number of incumbents</td>
<td>-3.07***</td>
<td>-2.70***</td>
<td>-2.68***</td>
<td>-2.54***</td>
<td>-2.14***</td>
<td>-2.54***</td>
</tr>
<tr>
<td>Market share variance</td>
<td>-2.41</td>
<td>-1.65</td>
<td>-1.69</td>
<td>-1.31</td>
<td>-0.46</td>
<td>0.06</td>
</tr>
<tr>
<td>Market share</td>
<td>10.23***</td>
<td>8.76***</td>
<td>9.59***</td>
<td>8.46***</td>
<td>8.54***</td>
<td>7.48***</td>
</tr>
<tr>
<td>Number of passengers</td>
<td>0.15***</td>
<td>0.14***</td>
<td>0.15***</td>
<td>0.14***</td>
<td>0.14***</td>
<td>0.14***</td>
</tr>
<tr>
<td>Cost of inputs</td>
<td>-6.87***</td>
<td>-7.88***</td>
<td>-7.01***</td>
<td>-7.87***</td>
<td>-7.87***</td>
<td>-8.04***</td>
</tr>
<tr>
<td>Markets served (strong resource sharing)</td>
<td>28.62***</td>
<td>27.70***</td>
<td>21.65***</td>
<td>14.66***</td>
<td>14.66***</td>
<td>14.66***</td>
</tr>
<tr>
<td>Markets served (weak resource sharing)</td>
<td>1.56***</td>
<td>1.35***</td>
<td>1.60***</td>
<td>1.60***</td>
<td>1.60***</td>
<td>1.60***</td>
</tr>
<tr>
<td>Multimarket contact</td>
<td>b&lt;sub&gt;3&lt;/sub&gt;</td>
<td>1.61***</td>
<td>0.77***</td>
<td>(0.13)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multimarket contact (strong resource sharing)</td>
<td>b&lt;sub&gt;4&lt;/sub&gt;</td>
<td>21.67***</td>
<td>21.50***</td>
<td>(2.79)</td>
<td>(2.80)</td>
<td></td>
</tr>
<tr>
<td>Multimarket contact (weak resource sharing)</td>
<td>b&lt;sub&gt;5&lt;/sub&gt;</td>
<td>-0.44*</td>
<td>-0.48*</td>
<td>(0.21)</td>
<td>(0.21)</td>
<td></td>
</tr>
<tr>
<td>Rivals' noncontact markets served (strong resource sharing)</td>
<td>b&lt;sub&gt;6&lt;/sub&gt;</td>
<td>-13.33***</td>
<td>(2.23)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rivals' noncontact markets served (weak resource sharing)</td>
<td>b&lt;sub&gt;7&lt;/sub&gt;</td>
<td>-0.08</td>
<td>(0.12)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N = 44,493
Parameters estimated = 3,060
R<sup>2</sup> = .55
F = 16.31***
F for increment in R<sup>2</sup>b = 463.42***
Degrees of freedom = 2, 41,430

Linear combinations of coefficients:

b<sub>1</sub> - b<sub>2</sub> = 27.06***
26.35***
20.06***
13.06***
22.12***
21.97***
b<sub>5</sub> - b<sub>6</sub> = -13.25***

*Unstandardized regression coefficients are shown; standard errors are in parentheses. Fixed effects for markets, airlines, years, and mergers are not shown.

<sup>b</sup>F<sub>0</sub>s are for models 2 and 3 versus model 1, model 4 versus model 2, model 5 versus model 4, and model 6 versus model 5, respectively.

<sup>+</sup> p < .10
<sup>*</sup> p < .05
<sup>**</sup> p < .01
<sup>***</sup> p < .001
magnitude, and less significant \(p < .05\). The difference between these coefficients was highly statistically significant \(p < .001\). The finding suggests that multimarket contact has the greatest effect on profitability when it occurs in markets that have strong resource-sharing opportunities with a focal market. Thus, Hypothesis 6b is supported.

Hypothesis 7 suggests that the profitability of a focal market-unit will be lower when the focal firm is not present in markets occupied by focal-market rivals and these markets provide the latter with strong resource-sharing opportunities. As for Hypothesis 4, we segmented the markets in which the focal-market rivals were present but the focal firm was absent by the strength of resource-sharing opportunities. The coefficient of rivals’ noncontact markets served (strong resource sharing) was negative, of large magnitude, and significant \(p < .001\), although the coefficient of rivals’ noncontact markets served (weak resource sharing) was statistically insignificant. The difference between these coefficients was statistically significant \(p < .001\). The profitability of a market-unit decreases if focal-market rivals are present in markets that give those rivals some economies of scope that are not exploited by a focal firm. Hypothesis 7 is supported. Overall, the results for profitability (Hypotheses 5 to 7) are very consistent with the findings for efficiency (Hypothesis 2) and intensity of rivalry (Hypotheses 3 and 4).

DISCUSSION

This article is the first to systematically investigate the association between multimarket contact and the presence of resource-sharing opportunities (the antecedent of economies of scope) and their joint effects on efficiency, rivalry, and, ultimately, profitability. We found that multimarket contacts were more likely to occur in markets characterized by strong resource-sharing opportunities with a focal market. Market-units within a firm that share common resources are also likely to encounter common competitors. This possibility has been recognized in the literature (Porter, 1985), but we have provided the first explicit empirical evidence supporting it. This finding suggests that the effects of economies of scope and multipoint competition may be entangled and that they should be simultaneously considered in future studies as two interrelated dimensions.

The empirical model provides evidence linking scope economies and multimarket contact with profitability. We have also provided some evidence about the causal mechanisms linking the independent variables to profitability by examining their links to two important antecedents of profitability: efficiency and intensity of rivalry. The results with all three dependent variables were internally consistent and in full support of theoretical predictions. With respect to scope economies, we found that the efficiency of a market-unit was enhanced, and its profitability was accordingly increased, if the focal firm participated in markets that had strong resource-sharing opportunities with the focal market. Multimarket contact was found to reduce the intensity of the rivalry experienced by a market-unit and, accordingly, to increase its profitability. Moreover, the effects of multimarket contact on the intensity of rivalry and profitability were more pronounced if the contacts occurred in markets with strong resource-sharing opportunities with the focal market. This latter finding suggests a boundary condition to the forbearance effect of multimarket contact. It appears that multimarket contact has little effect in the absence of strong economies of scope. Finally, we found that intensity of rivalry was increased, and profitability accordingly decreased, if a focal firm was absent from markets where focal-market rivals obtained strong economies of scope. Without the competitive restraint enforced by multimarket contact, the superior efficiency of rivals can make them more capable and aggressive competitors, increasing the intensity of rivalry for the focal market-unit and reducing its profitability.

In addition to examining the significance of the profitability effects of economies of scope and multimarket contact, we also examined their magnitude. To that effect, consider a representative market-unit obtaining a Lerner index of 11.61, the average in the sample. We investigated the change in the Lerner index predicted by a change in the number of nonfocal markets in each of the six subsets determined by the intersection of the I, J, and SR[m] sets. An arbitrary number of 25 markets was chosen; this number was less than two standard deviations of the number of markets in each subset. Thus, a change of 25 markets within a subset was a realistic change in this sample. If a focal firm added 25 markets that had strong resource-sharing opportunities with the focal market and were not served by the focal-market rivals, the profitability of the focal market-unit would increase by 31.56 percent. However, if focal-market rivals added 25 markets with strong resource-sharing opportunities and not served by the focal firm, the latter’s profitability would decrease by 28.70 percent. Taken together, these findings suggest that when both a focal firm and its focal-market rivals obtain economies of scope from different nonoverlapping markets, the
profitability of the market-unit is roughly the same as if neither firm had obtained scope economies. In that case, the profitability effect of economies of scope is “competed away” by equally efficient and unrestrained rivals. In contrast, the profitability of a market-unit increases by 77.86 percent if the focal firm adds 25 markets with strong resource-sharing opportunities with the focal market and providing multimarket contact with the focal-market rivals. Hence, the results suggest that the best profitability scenario for a focal market-unit is obtained when presence in nonfocal markets simultaneously provides economies of scope and multimarket contact with rivals. The worst profitability scenario for a focal market-unit occurs when it lacks scope economies while competing against rivals with strong scope economies.

If a focal firm adds 25 markets with weak resource-sharing opportunities with the focal market and in which the focal-market rivals are not present, profitability is 3.45 percent higher. The increase is only 2.41 percent if these markets provide multimarket contact, suggesting that multimarket contact does not contribute to profitability in markets with weak resource-sharing opportunities. When the focal-market rivals add 25 markets with weak resource-sharing opportunities and not served by the focal firm, profitability of the focal market-unit decreases by only 0.17 percent. Overall, the profitability effects of presence in markets with weak resource-sharing opportunities are of much smaller magnitude than the effects of presence in markets with strong resource-sharing opportunities.

**Generalizability of Results**

This study benefited from the rich data available in the airline industry, which allowed the measurement of independent and dependent variables at very disaggregate levels. Moreover, the industry was possibly an ideal context for finding support for the theoretical predictions. In the airline industry, it appears that economies of scope are strong and well understood by managers. The forbearance effects associated with multimarket contact are also of important magnitude in the industry, possibly because of the high concentration in most city-pair markets. The combination of these dimensions leads to our conclusion that airlines are better off pursuing economies of scope in the same markets as competitors, since the forbearance effect associated with multimarket contact reduces the erosion of performance. The generalizability of these results needs to be evaluated in other settings (for instance, multiproduct industries or international and corporate diversification), since the relative strength of scope economies and multimarket contact may differ across settings. In other settings, scope economies may be of a less technical nature, and there may be differences in firms’ ability to implement those economies. Forbearance may also be less viable in other settings if markets are defined in a more aggregate way and include more competitors. In any case, the generalizability of our results to other settings is an empirical question that must be established by future research.

**Implications for Multipoint Competition**

The theory and results presented in this article have important implications for the literature on multipoint competition because they allow a more detailed understanding of the role of forbearance in competitive situations. Bernheim and Whinston’s (1990) very influential game-theoretical treatise on multipoint competition developed a model of mutual forbearance that, as a simplifying assumption, did not incorporate the effect of economies of scope among the markets in which contact occurred. We show that this assumption can lead to a serious misrepresentation of the actual conditions under which multimarket contact occurs and can also lead to overestimation of the effect of multimarket contact. Indeed, we found that the forbearance effect of multimarket contact is less likely to exist if the multiple markets are not linked by scope economies.

The interaction between multimarket contact and scope economies has important theoretical implications. Mutual forbearance appears to be a mechanism by which multipoint competitors retain the value created by their scope economies, by avoiding its loss through price competition. Their ability to do so presumes cost advantages from synergistic cross-unit activities that are not available to single-point incumbents and potential entrants. Thus, when competitors meet in multiple markets with strong scope economies, they may maintain prices above their own efficient costs (given their own scope economies) but below the limit price that would encourage entry or challenges by less efficient firms. Without multimarket contact, these same efficient competitors would reduce their prices toward their cost levels, eroding their efficiency quasi-rents. Ironically, the interaction also suggests that mutual forbearance behavior would be quite unlikely among diversified firms of the conglomerate form, the context in which the mutual forbearance hypothesis was originally developed. Multipoint competition theory may be
most relevant under conditions of strong resource sharing among market-units, such as those existing in the airline, packaged foods, and telecommunications industries and under conditions of related diversification or geographic expansion.

Finally, in agreement with Montgomery (1994), who was quoted in this article’s introduction, we caution against the possible omitted variable bias in studies of mutual forbearance that do not control for the effects of economies of scope. Since multimarket contact is more likely to occur in markets with strong scope economies, the variable may pick up the effect of those omitted economies unless they are explicitly controlled for. Our analysis showed that lack of control for resource-sharing opportunities may lead to overestimation of the effect of multimarket contact on performance by over 100 percent.

Implications for Economies of Scope Research

This study also has important implications for research on the performance effect of scope economies. In prior research examining this effect (for instance, in the corporate and international diversification literature), the role of rivals’ product-market scope has not been considered. According to our model, this is problematic. In our model, scope economies make market-units more efficient and, accordingly, more profitable. However, profitability not only depends on the efficiency of a focal market-unit, but also on the efficiency of its rivals and on the aggressive or collusive interaction with those rivals. A market-unit with strong scope economies but competing with rivals that also have strong scope economies (from nonoverlapping markets) and aggressive competitive behavior (due to lack of forbearance) obtains the same profitability as a market-unit without scope economies competing with rivals that also lack scope economies. This result suggests that market-units with scope economies will perform better than those without them under two alternative conditions: (1) when they compete with rivals lacking scope economies or (2) when they compete with rivals that have similar scope economies but are less aggressive because of multimarket contact. These important considerations need to be taken into consideration in future research on the performance effect of scope economies.

Extensions

Our focus on the interaction between multimarket contact and scope economies has left some relevant dimensions unattended. Firms with overlapping multimarket scope may also encounter each other as buyers or suppliers or as partners in cooperative activities. For example, Disney and Time Warner, which compete in multiple markets (amusement parks, specialty stores, TV broadcasting, video), also encounter each other as partners in several cooperative ventures and as buyers or suppliers to each other (Landro, Reilly, & Turner, 1993). This situation makes competitive outbreaks between these companies particularly complex, since firms may react on any of the dimensions of interaction. We did not consider other possible vertical or cooperative links among the firms in this study, but this is an important direction for extending current research (Gimeno & Woo, 1996b).

We also encourage extension of this research to the contexts of international or corporate diversification in which different organizational units (country subsidiaries, divisions) are responsible for operations in different markets. This line of research would explicitly highlight the role of organizational structure and coordinating mechanisms on the effects of resource-sharing opportunities and multimarket contact. We argued that lack of administrative coordination may limit the ability of firms to obtain the forbearance effect of multimarket contact and assumed that strong resource-sharing opportunities between markets were likely to be associated with the presence of coordinated decision making across markets. Explicit observation of administrative coordinating mechanisms across markets would make a substantial contribution by allowing tests of their moderating influence on the efficiency effects of resource-sharing opportunities and the forbearance effects of multimarket contact. The role of organizational structure must be integrated more fully into the study of multipoint competition, since firms differ in their orientations toward internal competition or cooperation (Collis & Montgomery, 1997; Hill, Hitt, & Hoskisson, 1992). Studies of multipoint competition in the global context could benefit from a direct examination of the coordinating mechanisms used among national subsidiaries.

Conclusion

This article has highlighted the interdependence between economies of scope and multipoint competition. Market-units within a firm that share common resources are also likely to encounter common competitors. Multipoint competition is likely to become even more prevalent as firms expand to take advantage of resource-sharing opportunities, as the boundaries between markets become blurred, and as firms become global competitors. Given the sig-
significant interaction between multimarket contact and scope economies, future research on scope economies and multimarket contact should address them jointly. In particular, the competitive context of multimarket firms and the product-market scope of rivals should be explicitly considered in the well-established research on the performance effects of scope economies. Further cross-fertilization between research on scope economies and multipoint competition is needed.

REFERENCES


**APPENDIX A**

**Mathematical Definition of Independent Variables**

We first define two matrixes of dummy variables, A and SR. A is a three-dimensional matrix whose element $A_{imt}$ equals 1 if firm i is present in market m at time t and equals 0 otherwise. SR is a two-dimensional square matrix whose element $SR_{mn}$ equals 1 if market n has resource-sharing opportunities with market m and 0 otherwise. Given those two matrixes, the independent variables reflecting resource-sharing opportunities for the focal market-unit im at time t are operationally defined as follows:

- **Markets served (strong resource sharing)**
  \[ \text{Markets served (strong resource sharing)}_{imt} = \sum_{n \neq m} A_{imt} \times SR_{im}. \]

- **Markets served (weak resource sharing)**
  \[ \text{Markets served (weak resource sharing)}_{imt} = \sum_{n \neq m} A_{imt} \times (1 - SR_{im}). \]

The next independent variables are measured relative to focal market rivals. We first calculate the variables with respect to a given focal-market rival j (in brackets) and then obtain the average of the measures for all focal-market rivals. Thus:

- **Multimarket contact**
  \[ \text{Multimarket contact}_{imt} = \sum_{j \neq i} A_{jimt} \times \left[ \sum_{n \neq m} A_{imt} \times A_{jnt} \right] / \sum_{j \neq i} A_{jimt}. \]

- **Multimarket contact (strong resource sharing)**
  \[ \text{Multimarket contact (strong resource sharing)}_{imt} = \sum_{j \neq i} A_{jimt} \times \left[ \sum_{n \neq m} A_{imt} \times A_{jnt} \times SR_{im} \right] / \sum_{j \neq i} A_{jimt}. \]

- **Multimarket contact (weak resource sharing)**
  \[ \text{Multimarket contact (weak resource sharing)}_{imt} = \sum_{j \neq i} A_{jimt} \times \left[ \sum_{n \neq m} A_{imt} \times A_{jnt} \times (1 - SR_{im}) \right] / \sum_{j \neq i} A_{jimt}. \]

- **Rivals’ noncontact markets served (strong resource sharing)**
  \[ \text{Rivals’ noncontact markets served (strong resource sharing)}_{imt} = \sum_{j \neq i} A_{jimt} \times \left[ \sum_{n \neq m} (1 - A_{im}) \times A_{jnt} \times SR_{im} \right] / \sum_{j \neq i} A_{jimt}. \]
Rivals’ noncontact markets served
(weak resource sharing) _imt_

\[
= \sum_{j \neq i} A_{imt} \times \left[ \frac{\sum_{n} (1 - A_{nm}) \times A_{jm} \times (1 - SR_{mn})}{\sum_{j \neq i} A_{imt}} \right] / \sum_{j \neq i} A_{imt},
\]

APPENDIX B

Definition of Control Variables

Average marginal cost among incumbents _imt_:
The average cost per available-seat-mile _imt_ among incumbents in the market. Cost per available-seat-mile was used (instead of cost per revenue-passenger-mile) because it better reflects the marginal (as opposed to average) costs, which are the determinants of pricing strategies.

Market size _imt_:
Market gravity, or the product of the total constant-dollar personal income in the end-cities’ Metropolitan Statistical Areas divided by the square of the distance between the cities (data were from the Regional Economic Information System).

Market growth _imt_:
The growth in market gravity from a prior to a current year (representing growth in population or per capita income in the end-cities).

Percentage of round-trip tickets _imt_:
The percentage of an airline route’s passengers buying round-trip tickets.

Percentage of first-class tickets _imt_:
The percentage of an airline route’s passengers flying first class.

Direct flights _imt_:
The percentage of an airline route’s passengers flying nonstop.

Airport share _imt_:
The average of a firm’s share of total enplanements at both end-cities of a city-pair market.

Prior competitive experience _imt_:
The minimum age of an incumbent in a market. The age of the youngest rival limits prior competitive experience among incumbents.

Number of potential entrants _imt_:
The number of firms with presence at both end-cities of a city-pair market that are not incumbent in the market.

Number of incumbents _imt_:
The number of firms that are incumbent in the market (that either have an over 5 percent market share or carry at least 900 passengers per quarter).

Market share _imt_:
The percentage of total passengers transported in the market carried by the focal airline route.

Market share variance _imt_:
The variance of market shares among incumbents.

Number of passengers _imt_:
The number of passengers carried by the focal airline route.

Cost of inputs _imt_:
An index of changes in the cost of labor and fuel costs, measured as the Standard Industry Fare Level (an index calculated by the FAA to estimate “fair” prices in each market and adjusted by changes in costs of inputs) per mile of distance.

Merger controls _imt_:
Dummy variables to account for the changes to ongoing companies from major mergers and acquisitions. For the entity that survived a merger, a dummy variable was set to 1 for periods after the merger and to 0 for periods before the merger.

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