BEYOND MUTUAL FORBEARANCE:

MULTIMARKET COMPETITION FROM A NETWORK PERSPECTIVE

Abstract

This paper extends prior research on dyadic interfirm competition by analyzing the structure of the entire network of multimarket competition. Drawing on a social network perspective, we investigate the effects of structural embeddedness on tacit cooperation through price coalition between competing firms in the US airline industry. We identify two dimensions of structural embeddedness: **structural equivalence** and **third party embeddedness**. Structural equivalence refers to the extent to which two firms have multimarket competitive relationships with the same set of other firms. Third party embeddedness refers to the extent to which two firms' contacts are interconnected in the multimarket competitive network. The results of our analysis of the airline industry show that structural equivalence reduces the likelihood of tacit cooperation whereas third party embeddedness increases the likelihood of tacit cooperation between airlines that are competing in the same routes.

(keywords: multimarket competition; social networks)

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The fundamental challenge for firms engaging each other simultaneously in multiple markets is to formulate an appropriate competitive strategy in each market. Given the opportunities to attack and retaliate in different markets, firms must take into account the potential competitive implications for other markets when deciding whether to take a competitive action (or a make a conciliatory move) toward a specific competitor in a given market. The question is: "How does the competitive situation across all relevant markets affect a firm' s decision to cooperate or compete with a specific competitor in those markets where both firms are dominant players?"

Although previous studies have examined how multimarket contact between two firms affects the intensity of their competition, most studies tend to focus on individual competitive dyads (by examining direct market contact between two firms in a pair) without considering the fact that each competitive dyad is embedded in a more complex network of competitive relationships (See, for example, Gimeno, 1999 for a review of previous studies on multimarket competition). The focus on competitive dyads in the existing literature is limited in capturing the dynamics of multimarket competition due to the ignorance of the situations where two firms may complete indirectly through third party ties, or in which two firms may have common rivals across multiple markets. Because competitive interactions are interdependent and may involve third parties that exist beyond the dyadic unit, it is critical that the entire network of competitive relationships be examined. In this way we may begin to understand the pattern of overall competition across all different markets.

In this paper, we propose that the overall pattern of competitive situations across multiple markets can be described as a network structure in which firms are connected to each other through competitive interactions. Drawing on a social network perspective, we extend the traditional theory of multimarket competition by including the structural attributes of multimarket competitive network (or multimarket contact network) in our analysis.

Using data collected from the US airline industry, we investigate the social structure of interfirm competition. The prevalence of interfirm competitive interactions among airlines provides us with rich materials for the study of the multimarket competitive network in the industry and the impacts of the network. By examining the social structure of competition in the industry, this research captures the complexity and richness of interfirm collaborative and competitive actions, and contributes to a network theory of multimarket competition.

THEORY AND HYPOTHESES

Multimarket Competition and Mutual Forbearance

Research on multimarket contact (or multimarket competition-competition among firms encountering each other in more than one market) was first expanded from the industrial organization economics literature, which examines the effects of multimarket contacts on the structural intensity of competition (Bernheim and Whinston, 1990; Edwards, 1955). There has been growing interest in this topic among organizational and strategy researchers, who have found multimarket contact to be a determinant of market entry and exit (Baum and Korn, 1996; Haveman and Nonnemaker, 2000), and who have explored the specific conditions under which competitors may be constrained due to their multimarket contacts (Gimeno, 1999). An important contribution of this research stream is the formal recognition that both macro market conditions (such as a firm’s overall profile across all the markets in which it operates, or the extent of its multimarket contacts with a given rival) and micro market conditions (the firm's position and competitive approach in a local market where a specific competitive (or cooperative) move occurs) are critical to the study of interactive competitive behaviour (Chen, 1996).

Because of their engagement in various markets, multimarket rivals have a wide choice of arenas in which to launch competitive actions or responses. A competitive response, for example, may not necessarily occur in the same market in which the initial attack is launched (McGrath, Chen, and MacMillan, 1998). Firms competing in multiple markets will be aware of their mutual dependence (Gimeno, 1999) and will use their awareness of potential retaliation in various markets when formulating their strategies (Amit, Domowitz, and Fershtman, 1988). This recognition will in turn affect their market behaviors.

Central to inquiry into multimarket competition is the mutual forbearance hypothesis, first introduced by Edward (1955), which suggests that firms meeting another in multiple markets are less likely to engage in vigorous competitive activities because of underlying reciprocal norms. The rationale behind the mutual forbearance hypothesis is the emergence of tacit cooperation between competitors. In making this prediction, the literature has developed two opposing lines of thought. One such argument – for tacit cooperation – is rooted in Simmel's work on reciprocal subordination (Simmel, 1950). Recognizing the divergent "territorial interests" that firms have in different markets, a competitor may choose to cooperate in market of less territorial interest, in exchange for similar treatment in its dominant market (Gimeno, 1999). Norms of potential reciprocity emerge as a result of the recognition of market interdependence and mutual learning from prior repeated interactions. Another vein of argument is built on the idea of mutual deterrence, or reciprocal retaliation (Edwards, 1955; Feinberg, 1985). That is, tacit cooperation also emerges due to the concern that multimarket contacts provide firms with opportunities to respond to an attack by a rival beyond the challenged market. The threats of retaliation in other markets – in which the rival has more to lose – may reduce the level of rivalry in the focal market.

Several researchers have empirically investigated the mutual forbearance hypothesis (Alexander, 1985; Barnett, 1993; Baum and Korn, 1996, 1999; Boeker et al., 1997; Evans and Kessides, 1994; Gimeno, 1999; Gimeno and Woo, 1999; Feinberg, 1985; Scott, 1982). Although the mutual forbearance hypothesis suggests a negative relationship between multimarket contact and intensity of competition, empirical findings on this topic are notably equivocal. Table 1 summarizes some recent multimarket competition studies along the following dimensions: sample, independent and dependent variables, key findings, and support for the mutual forbearance hypothesis.

-insert Table 1 about here-

For the multimarket competition approach to be useful in studying interfirm competitive behavior, and for the possible resolution of the conflicting findings in the literature, two major concerns need to be explicitly addressed. First, as Baum and Korn (1996) and Chen (1996) have noted, research has so far tended to examine variables such as average price and firm performance, which represent the outcome of competition rather than competitive behavior itself. Efforts should be made toward the study of interfirm dynamics (either competitive or cooperative), along the lines of those used in the competitive dynamics literature, which examines firm actions, or actual behaviors that firms use against one another in the competitive context.

Second, it should also be noted that previous studies tend to focus on direct contact at the dyad level without considering the overall structure of competition, which includes indirect contact and potential third party effect. Using the competitive dyad as unit of analysis, Baum and Korn (1999) have examined how a firm's entry into and exit from each of its competitor's markets was affected by the level of multimarket contact with a given competitor, its interactions with other competitors beyond the focal dyads, and size asymmetry between the two rival firms. Although their study represents an important step toward the understanding of competitive dynamics between multimarket rivals, modeling entry and exit in competitor dyads continue to pose one significant methodological challenge. When a firm enters into a new market with multiple incumbents, it has simultaneously attacked several competitors' markets. Which competitive dyads are more important in determining the focal firm's strategic moves? Because the logic of deterrence depends on a competitor's beliefs and expectation about the likelihood of retaliation by the rival, it is important to determine whose market is under attack by the focal firm. In a market with multiple incumbents, the relative importance of each dyad in determining the focal firm's entry decision cannot be empirically observed or analyzed. This problem is known as "common actor effect" (Baum and Korn, 1999; Lincoln, 1984). As Baum and Korn have pointed out, "firms commonly engage several competitors—and participate in several competitor dyads—simultaneously…the effect of multimarket contact on competitive interactions within a given competitor dyad depends not only on the level of multimarket contact within that competitor dyad, but also on competitor dyad members' levels of multimarket contact with other competitors (Baum and Korn, 1999: 257)." To deal with the common actor problem, researchers have to examine not only competition between a specific dyad but also the broader context of the rivalry network in which the dyad is embedded.

In an attempt to address the two concerns mentioned above, we propose a model of interfirm competitive behavior using a network structural perspective that allows us to examine the impacts of the overall pattern of multimarket contact on the dynamics of corporative or competitive behaviors between firms.

Beyond Mutual Forbearance: Network Structure of Multimarket Competition

Since any competitive dyad is embedded in a larger network that involves many other firms competing with each other in the same industry, strategy researchers have recently begun to extend the network perspective to the study of competitive interactions (Gnyawali and Madhavan, 2001). The concept of structural embeddedness is critical to our understanding of the dynamics of firm competitive behaviors. Structural embeddedness refers to the extent to which a dyad's mutual contacts are connected to one another and explains how the overall structure of relations influences economic actions (Granovetter, 1985; 1992). This means that firms do not have relationships only with each other, but with the same third parties as well (Jones, Hesterly, Borgatti, 1997). In a competitive network, firms are linked indirectly by third parties. They do not simply respond to each firm's competitive action individually; they respond, rather, to the interaction of multiple influences from the entire set of firms in the industry. Thus, explanations of firm competitive behaviors require analysis of the patterns of multiple and interdependent relationships in the competitive network.

In this research we focus on two dimensions of structural embeddedness—**structural equivalence** and **third party embeddedness**—to study the patterns of competitive relationships surrounding the two actors in a focal dyad. Structural equivalence refers to the extent to which two actors have the same relational patterns (i.e., have relationships with the same set of other actors). Third party embeddedness refers to the extent to which two actors' contacts are interconnected. Both structural equivalence and third party embeddedness have been considered important attributes of social structure because of their effect on dyads such as alliances (e.g., Gulati, 1995; Gulati and Westphal, 1999). Figure 1 provides examples to illustrate the ideas of structural equivalence and third party embeddedness. In this figure, a line (or a tie) between two actors represents the existence of multimarket contacts (or a multimarket competitive relationship) between the two actors. In Figure 1(a), A and B are structurally equivalent: they have ties with the same set of other actors (both A and B have direct multimarket competition with X, Y, U, and V). In Figure 1 (b), A and B have a high level of third party embeddedness: each of A's contacts (X and Y) has a tie with each of B's contacts (U and V), and vice versa (A's and B's contacts are in a tightly connected clique in which every player has direct multimarket competition with every other player in the clique).

Note the differences between structural equivalence and third party embeddedness. In Figure 1(b), A and B have a high level of third party embeddedness, though they are not structurally equivalent (A and B have ties to different others: A has direct multimarket competition with X and Y, while B has direct multimarket competition with U and V). In the next section, we elaborate how structural equivalence and third party embeddedness may influence cooperative or competitive behaviors between two actors in a given focal dyad.

-insert Figure 1 about here-

Structural Equivalence

The idea of structural equivalence, developed by White and his colleagues (White, 1961; White, Boorman, and Breiger, 1976), is useful for identifying structural similarity among a set of social actors in terms of their relational patterns. Two actors are structurally equivalent to the extent that they have a similar pattern of relations in a system, and are equally tied to the same other actors. The social network literature has developed a number of algorithms to operationalize structural equivalence and has empirically tested how structural equivalence can account for the competitive behaviors among actors involved in the same social structure. Two actors occupying the same structurally equivalent position in a social structure are expected to be competitors, as they have the same relational patterns and draw from the same resources (Burt, 1987). In this research, two firms are structurally equivalent if they contact the same set of other firms across different markets. Although firms occupying the same positions may or may not have direct multimarket contacts with each other, they tend to interact with the same types of other competitors and therefore are similarly "socialized" by others (Burt, 1987). Therefore, structurally equivalent firms can be said to occupy the same market niche and may compete fiercely with each other because they have a similar status in the marketplace.

A useful analogy for the ways in which structurally equivalent firms compete may be found in the principle of competitive exclusion that was developed by Gause (1934) based on his experiments on the coexistence of closely related species of beetles in controlled environments. He found that mixing two related species of beetles in the lab caused one species to disappear. For our purposes, structurally equivalent firms can be considered "related species", as they have similar relational patterns and occupy the same position in the network of interfirm relationships. Following the principle of competitive exclusion, we argue that firms occupying the same structural position in multimarket competitive networks cannot coexist in equilibrium and are less likely to cooperate with each other. Accordingly,

Hypothesis 1. Structural equivalence between two firms in the multimarket competitive network will decrease the likelihood of tacit cooperation *between the two firms (but increase the likelihood of intense competition between the two firms).*

It should be noted that for the purposes of this study, we define tacit cooperation as a situation in which two firms decide not to compete head-on; each takes a somewhat conciliatory stance in hopes of mutual benefit.

Third Party Embeddedness

A high level of third party embeddedness implies that a focal dyad is embedded in a dense network of many interconnecting third party ties. Two firms with many interconnecting ties are less likely to compete fiercely but are more likely to establish a norm for tacit cooperation due to the availability of multiple channels for them to indirectly contact each other through the interconnecting ties. In such a dense competitive network, multiple "deterrence" mechanisms exist and intensive competitive actions are likely to be constrained.

Tacit cooperation between two firms with a high level of third party embeddedness is also likely to occur because trust or tacit understanding may emerge as a result of the overlapping third party ties between the two firms. Previous research has suggested that third party ties may encourage the development of trust in the network (e.g., Burt and Knez, 1995; Gulati and Westphal, 1999). In a competitive network, common third party ties between two firms mean that there are common rivals between the two firms. It makes sense for firms to collaborate with its rival's rivals. Facing the same competitive threats, firms with common rivals in a dense competitive network tend to develop tacit understandings between them as they can predict each other's behavior patterns based on their own experience and situations. These firms are thus likely to cooperate with each other. Therefore,

Hypothesis 2. Third party embeddedness between two firms in the multimarket competitive network will increase the likelihood of tacit cooperation between the two firms (but decrease the likelihood of intense competition between the two firms).

METHODS

Sample

To test our research model and hypotheses, we use data collected from the US airline industry. Since airline companies usually compete with each other in many different routes, the airline industry provides an ideal context to study multimarket competition (e.g., Baum and Korn, 1996; Chen, Smith and Grimm, 1992; Chen, 1996; Gimeno and Woo, 1996; Gimeno, 1999). The airline industry also contains rich data for understanding the dynamics of interfirm rivalry because of its significant mixture of cooperation and competition. In the past few decades, virtually every major US airline regularly entered cooperative ventures with other carriers to expand route networks and to gain marketing and operating synergies. At the same time, these airlines battled with each other through competitive moves such as price cuts and service improvements to secure their own market shares. Because of low switching costs and low product diversity among different airlines, competition in this industry is intense.

We obtained data from the Department of Transportation's Origin-Destination (OandD) Survey of Airline Passenger Traffic for the years 1983 through 1986. This time period is chosen for two reasons. First, during the transition to deregulation period of 1979-1982, firms were not yet able to adjust fully to the changed environment (Morrison and Winston, 1987). There were restrictions on pricing practices prior to 1983: by regulation, fares could only increase 5 percent above or decrease 50 percent (Evans and Kessides, 1993). Second, this period is characterized by the rapid entry of new airlines and by the expansion of existing airlines into new routes, followed by a consolidation in the industry through merger and acquisitions. The turbulence of this period produced large variation for our examination of competitive networks.

The unit of analysis is airline routes. We first selected the top 10,000 city-pair markets for each year, based on the number of annual passengers. The year-specific top 10,000 routes account for an average of 94.8 percent industry-level market share across the years we studied. We used the city-pair market data to construct a multimarket competitive network. We then examined how network structural attributes influence interfirm competitive behavior in terms of pricing. To observe pricing behavior, we identified markets with only two incumbents that had a combined market share of over 90 percent in a given year. Following Gimeno (1999), we define an airline carrier as an incumbent if it had at least 5 percent share of the market or carried at least 10 passengers a day. Because of frequent entry and exit during this period, the set of duopoly markets varies by years, with 38.6 percent (N=2,149) of routes appearing only once in our sample and 13.4 percent (N=746) remaining duopolies for four consecutive years. Our final sample contained 11,351 observations across four years, representing 5,567 distinct city-pair markets and 26 airlines for the four-year period.

There are two reasons why we focus on pricing behaviors in duopoly markets or markets that have only two dominant players. First, although there has been an increase in the number of competitors at the route level since deregulation, most routes are still dominated by one or two carriers (Evans and Kessides, 1993). In our sample, the number of monopoly and duopoly markets cumulatively account for 50.2 percent of the top 10,000 city-pair routes for the four-year period.

The second reason is related to the problem of "common actor effect" mentioned above (Baum and Korn, 1999; Lincoln, 1984). Implicit in the theory of multimarket competition is the notion that market are tangible social structures consisting of firms that come to view and are perceived by each other in a different manner. Yet researchers have rarely taken into account the complexity of multiple identities in the same market, treating multimarket contact as an aggregate property of the markets or firms. The standard treatment is to calculate the average level of multimarket contact among rival firms. This treatment implicitly assumes an additive effect of multimarket contact with different rivals – each incremental unit of multimarket contact is assumed to be identical. Duopoly markets allow one to study competitive dynamics on a firm-to-firm basis, without being "contaminated" by other competitors beyond the focal dyad. It thus provides an ideal context for examining the "pure" effect of multimarket contact, avoiding the dangerous assumption that there is a linear relationship between the degree of competitive intensity and the average level of multimarket contact.

Dependent variable

The dependent variable for this research is the likelihood of tacit cooperation in pricing between two competing airlines in a duopoly market. To operationalize our dependent variable, we compared the fares charged by the two airlines in a duopoly market with the expected fare charged by other similarly-situated airline carriers. Borrowing the terminology from Gimeno (1999), we call the airline carrier with a large market share in the city-pair route a "leader" and the airline with a small share a "challenger". We first measured the benchmark fare by regressing the average fare of each route on a set of route-specific characteristics –

$$Yield = a + b \cdot \mathrm{X} + d \cdot \mathrm{P}$$

-- where yield is defined as passenger revenue per passenger-mile. We included in our sample only ticket prices for local, outbound, fared passengers. The expected yield is expressed as a function of route and service attributes (**X**), including market size, itinerary miles, percentage of round trip tickets, number of deplaned stops, and a set of period dummies (**P**).

We then compared leader and challengers' yields to the expected yield to obtain the deviation scores, which measure the extent to which the two incumbents have deviated from the "market norm". A taxonomy of interfirm competitive behavior, based on the outcomes of the two comparisons, is summarized in a two by two matrix in Table 2. As shown in the table, juxtaposing the two dimensions of comparisons yields four quadrants, each indicating a particular type of competitive scenario. Quadrant (I) illustrates the situation when both carriers charged higher than average price. This represents "tacit cooperation" between the two carriers through price coalition. In Quadrant (II) and (III), an airline is able to charge a higher price without creating an "umbrella" effect that allows the other airline to raise their prices as much (Borenstein, 1989); we called these "premium" markets. When both carriers charged lower than average price, they faced "intense competition" (Quadrant IV). These four types of competitive scenarios will be used as the dependent variables in a multinomial logit model, with the "intense competition" market as the base category.

-insert Table 2 about here-

The major advantage of this categorical dependent variable is that it allows us to observe and compare leader and challenger competitive behaviors (in term of pricing). In contrast, many previous studies have used the average price of the airline-route as the dependent variable (Evans and Kessides, 1994; Gimeno, 1999). The average price is limited in telling us whether the leader or the challenger charged a higher price than the other. By identifying different pricing scenarios, our categorical dependent variable is more informative than the average price measure in revealing the competitive dynamics between the leader and the challenger in a specific market.

Independent variables

There are two independent variables in this research: structural equivalence and third party embeddedness. These two variables are the structural attributes of multimarket competitive network. To measure these two variables, we first constructed a network of multimarket competition. We calculated a multimarket competition index for each pair of airline carriers following Chen' s (1996) formulation that defines an airline *i*' s multimarket contact with another airline *j* as follows:

$$Z_{ij} = \sum_{k=1}^{N}[(P_{ik} / P_i) \times (P_{jk} / P_k)]$$

where Z_{ij} = multimarket contact that the focal airline *i* has with another airline *j*

P_{ik} = number of passengers served by *i* in route *k*;

P_i = number of passengers served by *i* across all routes;

P_{jk} = number of passengers served by *j* in route *k*;

P_k = number of passengers served by all airlines in route k;

i = A route served by both i and j.

Z_{ij} is determined by two factors: the strategic importance of each of the markets the focal airline shares with the competitor, and that competitor's market share in these markets. The fraction (P_{ik} / P_i) represents the relative importance of market k to airline i; the second term (P_{jk} / P_k) is the market share of airline j in route k. Z_{ij} will be large to the extent that j was considered a major threat in the markets that are important to i. To take into account "competitive relativity" (Chen and Hambrick, 1995), the raw relationship Z_{ij} was "normalized" by the total contact volume of i ($Z_{ij} / \sum_j Z_{ij}$), so that the sum of the multimarket contact indices for all of a given firm's competitors is equal to 1. This transformation improves comparisons across firms, eliminating differences in magnitude of contacts.

Note that the measure of multimarket contact between a pair of firms is asymmetric, depending on which competitor is the focal firm under consideration. Because of different territorial interests and operational scope, each firm will define competitors differently and will also experience different degrees of competitive threat from each competitor (Chen, 1996). A national carrier with an extensive operation may be perceived as a major threat, while a smaller and geographically focused airline may have few contacts and escape notice in the eyes of major airlines.

Structural equivalence

Social network analysis is useful for depicting the underlying structures of webs of interconnected markets (Berkowitz, 1988). Network structural analysis is based on the premise that relational patterns, rather than individual dyad, define actors' constraints and opportunities in the network (Burt, 1982, 1992). In the multimarket contact matrix, a firm's relative position in the competitive network is defined by its relationship to and from other competitors in the rivalry network. Specifically, the pattern of competitive relationships for a particular firm *i* to all other competitors can be completely characterized by a row vector $\mathbf{Z}i.$ (*i*'s multimarket contact with each competitor relative to its total contact) and a column vector $\mathbf{Z}.i$ (*j*'s multimarket contact with *i* relative to *j*'s total contact, that is, how *i* is perceived in the eyes of its competitors). These two vectors jointly define a firm's position in the rivalry or competitive network.

Two firms are structurally equivalent to the extent that they have similar relations with every other competitor within the rivalry network. The degree of structural equivalence is measured by the Euclidean distance between the two firms:

$$d_{ij} = [\sum_q (z_{iq} - z_{jq})^2 + \sum_q (z_{qi} - z_{qj})^2]^{1/2}, q \neq i, j$$

where *q* denotes all other airlines in the industry. A structural equivalent index was created using the following transformation:

Structural equivalent index = 1 - d_{ij}

An index of zero indicates completely nonequivalent patterns, and increasing values of the index indicate increasingly equivalent patterns.

Third party embeddedness:

The measure of third party embeddedness is similar to Burt's formalization of "dyadic constraint" and "network redundancy" (Burt 1987; 1992). The measure captures the extent to which a focal dyad is embedded in a dense network (or a redundant network, using Burt's term) of many interconnecting third party ties. Formally, the measure is defined as:

$$c_{ij} = (\sum_{q} p_{iq} p_{qj})^2, \qquad q \neq i, j$$

where p_{ij} is i's multimarket contact with j divided by the sum of all of i's contacts. The value of c_{ij} will be large when the proportion of i's network that connects to j is substantial.

Control variables

Variables identified in prior research as being important determinants in explaining prices are included as control variables. These include: the total number of passengers transported in the city-pair route (market size), market concentration at the endpoint airports, and the number of potential entrants. We also included a set of asymmetric variables that may affect both cost and service quality, including differences in operating cost, endpoint airport market share, actual routing mileage traveled by passengers, average number of deplaned stops made by passengers (measured by the average number of coupons), route market share, and the percentage of round-trip tickets. Details of the control variables are given in Table 3. Since our data was comprised of multiple observations from each airline and period, we also added a set of year-specific dummy variables to control for unobserved heterogeneity.

-insert Table 3 about here-

RESULTS

Table 4 presents the descriptive statistics and correlations among the variables included in the multinomial logit models. Table 5 presents the results of the multinomial logit models. We first tested a model with control variables only and then tested a full model with our independent variables. Because our dependent variable has four categories, there are three equations in each model. Each of these three equations is a binary logistic regression comparing a particular type of market with a baseline market. The coefficients can be converted to relative risk ratios (RRR) and be interpreted as reflecting the effects of the covariates on the odds of being in a particular type of market compared to the baseline market. Since our baseline market is the most competitive one (L, L), a positive coefficient indicated that an increasing value of the covariates will help to reduce the competitive intensity.

-insert Tables 4 and 5 about here-

The first three equations show the effects of the control variables and the multimarket contact. The coefficients of logarithm of market size and itinerary miles are both significant and negative, suggesting that carriers are able to charge higher price in short haul, low demand markets. The effect of the number of potential entrants is positive, indicating that the leader and challenger tend to act cooperatively rather than competitively under the threat of potential entrants. Market concentration at the endpoints does not affect price ratio, but a large share at the endpoints may lead to greater market power and thus increase a leader's ability to raise prices. When a leader has higher operating costs, it tends to charge higher prices to reflect its cost (H, L) and is less likely to be in "low-high" market. Greater circularity of flight and number of deplaned stops made by passengers lowers an airline's service quality, thus lowering consumers' willingness to pay for the flight. Therefore, when a leader's service is less attractive to consumers, it should behave cooperatively (H, H) or charge a lower price to reflect its lower service quality (L, H). Although the effects of circularity of flight are consistent with this prediction, the positive effect of the difference in number of deplaned stops in equation (2) is inconsistent. Because the number of deplaned stop is highly correlated with itinerary miles (r = .402), the irregularity could result from the problem of multicollinearity. A higher percentage of round-trip tickets is expected to lower the cost of providing service, and thus has a positive effect on the odds of being in a "low-high" market. Alternatively, a leader with lower costs could choose to act cooperatively and allow challenger to raise its price to a similar level (H, H).

Previous studies on airline pricing have shown that prices are higher on concentrated routes (Bailey et al., 1985; Borenstein, 1989; Evans and Kessides, 1993, 1994; Barla, 2000). One would thus expect to observe the leader charging higher price than the challenger (H, L) as the difference in route market share increases. A somewhat surprising result is that the coefficient of difference in market share is significantly positive in equation (3). This seems to result primarily from higher operation costs for the challenger, associated with serving small market.

The last two coefficients in equations (1) to (3) examine how multimarket contact, measured by $Z_{leader, challenger}$ and $Z_{challenger, leader,}$ affect competitive behaviors. The two coefficients are both positive and significant in equation (1), suggesting that tacit cooperation through price coalition is more likely to be sustained when leader and challenger have multimarket contacts. Because consumers prefer firms with larger capacity, the leader, with a large share of the traffic on a route, can exercise market power and charge a higher price without creating an "umbrella" effect that allows the challenger to charge a similar price (Borenstein, 1989). From equation (2), it can be seen that the coefficient of $Z_{leader, challenger}$ is negative and is statistically significant, indicating that, all else constant, the leader is less likely to use its dominant position and charge a higher price when it has multimarket contact with the challenger. Because the severity of the punishment that the challenger can inflict is not limited by its small size, the leader may choose not to exercise market power despite the fact that it has a larger market share in the focal market. This is consistent with the deterrence effect in mutual forbearance research. In contrast, the positive effect of $Z_{challenger, leader}$ in equation (2) suggests that the leader's temptation to deviate may increase when the leader also dominates the challenger's other markets beyond the focal route. This is similar to Gimeno's (1999) argument that nonreciprocal multimarket contact, where the leader plays the same role in both the focal and contact markets, is less effective in promoting price coordination among rival firms.

Equations (4) to (6) test the effects of structural equivalence on tacit cooperation through price coalition. As shown in all three equations, the coefficient of structural equivalent index is significantly negative, indicating that both leader and challenger are more likely to behave competitively when they have similar relationships with other rivals. This result suggests that when the two airline carriers are structurally equivalent, tacit cooperation in pricing is more difficult to sustain as compared to when they are nonequivalent in their competitive profiles.

Equations (4) to (6) also test the effect of third party embeddedness on tacit cooperation. In accordance with our hypothesis, we find that the effects are positive in all three equations. In other words, as the degree of third party embeddedness increases, the two airline carriers are more likely to act cooperatively rather than independently. In other words, when a leader is connected to all of its challenger's other contacts, the intensity of competition between the two tends to be reduced.

DISCUSSION

The purpose of this research is to investigate how the network structure of multimarket contact affects a firm's decision to cooperate or compete with a specific competitor in those markets where both firms are dominant players. Drawing on a social network perspective, we identify two structural attributes of multimarket competitive network: structural equivalence and third party embeddedness and investigate the impact of these attributes on the likelihood of tacit cooperation between competing firms in duopoly markets in the airline industry. The results show that both structural equivalence and third party embeddedness significantly affect the likelihood of tacit cooperation between competitors. The results demonstrate the importance of social structure and confirm the value of applying network concepts and methods to examine multimarket competition. The results also contribute to our understanding of the dynamics of interfirm relationships in the airline industry.

Our research advances the multimarket competition literature in several ways. First, by identifying different scenarios for interfirm competitive behavior, we improve the measure of "tacit cooperation", a critical idea in the multimarket competition literature (Chen, 1996; Baum and Korn, 1996, 1999; Gimeno, 1999, 2002). Many previous studies relied on average price or firm performance as a measure of tacit cooperation, with the assumption that a high average price (or average firm performance) indicates a high level of cooperation. The assumption is not valid as a high average score may result from a non-cooperative situation where only one firm has a very high price (or firm performance) but not the other. Taking into account different pricing scenarios between a firm and its rival, our research offers a new way to more accurately capture the idea of tacit cooperation.

Second, our research offers new insights into the multimarket competition literature by moving beyond a dyadic view of competition to a network perspective of competition. Our research represents one of the first attempts to consider the entire network structure in the investigation of multimarket competition. Using social network concepts and analysis, our research shows that the social structure surrounding multimarket rivals significantly affect their competitive behaviors after controlling for dyadic level measures of multimarket contact. The results show that social structure matters. The significant role of social structure shown in this research may provide a source of motivation for future researchers to examine not only competitive dyads but also third parties and explore more structural attributes of multimarket competitive network.

Finally, our research extends the mutual forbearance hypothesis, which underlies multimarket competition research (Baum and Korn, 1996, 1999; Gimeno, 1999, 2002). By taking into account the effects of third parties when testing the mutual forbearance hypothesis, our results provide some implications for future research on multimarket competition. As firms expand their networks and increase multimarket contacts, there may be additional gains through lessened competition. Given the ongoing entry and exit of competitors and, more important, the diversity of these new competitors, who often bring new capabilities to the marketplace, the extent to which, and the conditions under which the idea of mutual forbearance may be applied is an important area for future research.

The results of this research also contribute to the social network literature by showing how a network of competitive relationships influences the behavior of individual firms embedded in the network. Although many scholars have examined networks of cooperative relationships, few scholars have investigated networks of competitive relationships and the outcomes of such networks. The interpretations and implications for cooperative networks can be very different from those for competitive networks. Future research may contrast and compare cooperative and competitive networks and include both types of networks at the same time to predict firm behaviors and outcomes.

Several limitations pertain to this research. Although we tried to conduct a longitudinal investigation, the time frame of this research is short due to the availability of data. In addition, we tested our theory and hypotheses in a specific industry, the U.S. airline industry, which may potentially restrict the external generalizability of our findings. Future studies can replicate our multimarket competitive network model to study other industries.

In conclusion, this research bridges social network research and multimarket research and shows that structural attributes of multimarket competitive network such as structural equivalence and third party embeddedness significantly affect interfirm competitive behavior. The results of this research demonstrate the importance of social structure for analyzing interfirm rivalry and suggest new directions for studying multimarket competition. The managerial implication for this research is clear: when making a decision regarding whether to cooperate or compete with a particular rival, a firm needs to consider not only its market overlap with this particular rival but also the structure of competitive relationships with all the third parties involved.

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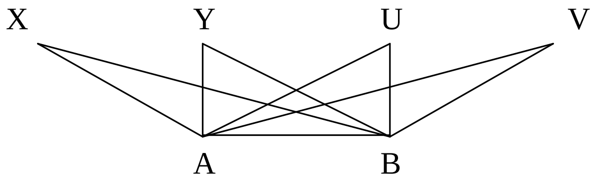
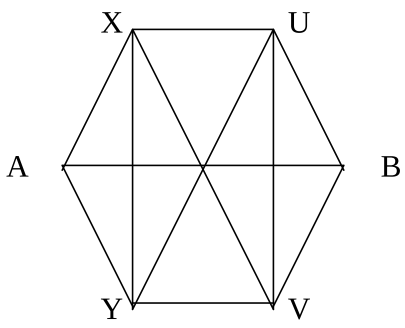
Figure 1. Different Pattems of Competitive Relationships



(a) Structural Equivalence



(b) Third Party Embeddedness

Table 1. Recent Research of Multimarket Competition

Authors	Sample	Key Independent Variables	Dependent Variables	Key Findings	Support for Mutual Forbearance
Gimeno (2002)	U.S. airlines	Spurious MMC, purposeful MMC	price-cost margin per passenger mile	MMC positively related to performance regardless of whether MMC is deliberate or emergent	positive
Busse (2000)	U.S. cellular telephone	MMC, demand similarity across markets, distance	Identical pricing across markets, average price	Identical pricing across markets is mechanism by which tacit collusion occurs leading higher prices	positive
Haveman and Nonnemaker (2000)	California savings and loans	Total MMC	Market entry and market growth (new branches)	MMC has inverted U relationship with growth in current market and entry to new markets. Market dominance decreases growth and entry.	some support, effects are not linear
Young, Smith, and Simon (2000)	U.S. computer software	MMC, resource dissimilarity	Competitive moves, speed,	Relates MMC to actual competitive moves. MMC lowers competitive moves and quickens responses	positive
Gimeno (1999)	U.S. airlines	Total MMC, reciprocal MMC, non-reciprocal MMC	yield and market share	Reciprocal MMC reduces competitive intensity	positive
Baum and Korn (1999)	California commuter airlines	Dyadic MMC, relative size, average amount of MMC	entry and exit rates	Inverted U shape relation between MMC and competitive behavior	positive for high levels of MMC
Gimeno and Woo (1999)	U.S. airlines	MMC, economies of scope	cost efficiency, yield, price-cost margins	MMC and resource sharing likely to occur concurrently. Mutual forbearance strongest with combinations of MMC *and* resource sharing.	positive
Boeker, Goodstein, Stephan, and Murmann (1997)	California hospitals	MMC in hospital services, outsourcing	market exit	MMC reduces exit rate particularly for services provided in-house	positive
Baum and Korn (1996)	California commuter airlines	MMC and market domain overlap	entry and exit rates	MMC reduces rivalry (entry/exit) rates decline. Market domain overlap increases rivalry (entry/exit).	positive
Gimeno and Woo (1996)	U.S. airlines	MMC and strategic similarity	yield (revenue per passenger mile)	MMC reduces rivalry and strategic similarity increases rivalry	positive
Smith and Wilson (1995)	Large U.S. airlines	entry, sales volume, barriers to entry, synergies	counterattack, defense	"Do nothing" response is most common	mixed
Evans and Kessides (1994)	U.S. airlines, 1000 largest routes	MMC, route market share, airport market share	route fares	MMC, route market share, and airport markets share all associated with higher fares	positive
Barnett (1993)	Phone industry	MMC	exit rates	MMC lowered exit rates	positive
Hughes and Oughton	UK manufacturing	MMC, diversification	industry level price-cost margin and rate of return	MMC has positive effect on industry profitability and diversification a negative effect	positive
Cotterill and Haller (1992)	Supermarket chains	mkt. structure, concentration, # of chains, mkt. growth	entry	Entry less likely when high levels of incumbent chains	positive
Martinez (1990)	Large bank holding companies	# of intrastate branches/subsidiaries, interstate subsidiaries and deposits	size ranking stability	Expanded geographic coverage (presumed MMC) associated with greater size ranking	positive
Mester (1987)	California savings and loans	MMC, concentration ratio, market growth	profitability, market share stability, interest paid on deposits	High MMC and high concentration leads to higher rivalry	negative
Rhoades and Heggestad (1985)	Banking	MMC, concentration ratio	profitability, share stability, interest on deposits	No consistent relationship	none
Alexander (1985)	Banking	MMC	deposit interest, service charges	MMC leads to higher rivalry	negative

Table 2. A Taxonomy of Interfirm Competitive Behavior

		Challenger's Yield	
		H (Above average)	*L (Below average)*
Leader's Yield	*H (Above average)*	(I) (H, H) Tacit Cooperation	(II) (H, L) Leader Premium
	L (Below average)	(III) (L, H) Challenger Premium	(IV) (L, L) Intense Competition

Table 3. Description of Control Variables Used in the Analysis

Variables	Description
Market size	Total "outbound", "local" passengers from origin airport to destination airport, excluding zero fare passengers
Endpoint concentration	Weighted average of the Herfindahl index at both endpoint airports
Potential entrants	Number of airlines with presence at the endpoint airports that do not serve the city-pair
Endpoint share	Weighted average of an airline's market share at the both endpoint airports
Itinerary miles	The actual routing mileage traveled by passengers
Operating cost	Annual operating expenses divided by revenue passenger miles
Number of deplaned stops	Average number coupons used by a passenger, it represents the number of times that passengers deplaned.
Route market share	A firm's share of the total passengers on the city-pair market
Round tickets	Percentage of round trip tickets in the city-pair route
△Endpoint market share	Weighted average of leader's market share minus challenger's market share at the endpoint airports
△Itinerary Miles	log(leader's itinerary miles) - log(challenger's itinerary miles)
△Operating costs	Leader's operating cost per RPM - challenger's operating cost per RPM
△Number of stops	Leader's average number of coupons used by a passenger - challenger's average number of coupons
△Route market share	Leader's share of total passengers in the city-pair - challenger's market share
△Round trip tickets	Leader's % of round tickets - challenger's % of round tickets
$Z_{\text{leader, challenger}}$	Leader's multimarket contact with the challenger relative to its total contacts
$Z_{\text{challenger. Leader}}$	Challenger's multimarket contact with the leader relative to challenger's total contacts

Table 4. Descriptive Statistics and Correlation Matrix

		Mean	S.D.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1)	*ln*(Market Size)	6.23	1.24													
(2)	Ln(iterate miles)	6.75	.71	-.371												
(3)	Potential Entrants	2.51	2.39	.634	-.329											
(4)	Endpoint Concentration	.21	.08	.028	-.209	-.080										
(5)	△Endpoint Market Share	.06	.15	.119	-.085	.055	.248									
(6)	△Operating Costs	.01	.21	-.041	-.052	.030	-.009	-.145								
(7)	△Itinerary Miles	-.05	.15	.040	.081	.023	.004	-.042	-.033							
(8)	△Number of Deplaned Stops	-.09	.31	-.137	.072	-.085	-.040	-.127	.029	.402						
(9)	△Route Market Share	.47	.26	-.039	-.081	-.028	.046	.212	.040	-.271	-.231					
(10)	△% of Round Tickets	.09	.16	-.108	-.051	-.052	.013	.046	.047	-.093	-.043	.398				
(11)	$Z_{leader, challenger}$	.17	.12	.080	-.022	.024	.092	-.144	.102	.105	.083	-.110	-.056			
(12)	$Z_{challenger, leader}$	.18	.12	.116	-.009	.024	.101	.178	-.125	.192	.151	-.122	-.071	.595		
(13)	Structural Equivalence	.19	.26	.056	-.137	.098	-.107	-.031	.075	.003	.013	-.035	-.036	.273	.273	
(14)	Third Party Embeddedness	.06	.03	-.080	.140	-.042	.034	-.180	.114	.041	.032	-.062	.011	.555	.200	.108

Table 5. Results of Multinomial Logit Regression Analysis (N=11,491 routes)

	Type of Markets --(Low, Low) as contrast group					
	(1)	(2)	(3)	(4)	(5)	(6)
Number of routes	HIGH, HIGH	HIGH, LOW	LOW, HIGH	HIGH, HIGH	HIGH, LOW	LOW, HIGH
Intercept	7.939**	5.574**	3.937**	8.396**	5.955**	4.547**
Fixed effect of calendar year (1983)						
1986	-.806**	-.619**	-.381**	-.681**	-.510**	-.216
1985	-.375**	-.294**	-.261*	-.279**	-.202*	-.137
1984	-.215**	-.269**	-.134	-.187**	-.238**	-.104
Route characteristics						
ln(Market Size)	-.443**	-.442**	-.543**	-.448**	-.450**	-.559**
ln(iterate miles)	-.935**	-.736**	-.492**	-1.062**	-.838**	-.646**
Potential Entrants	.077**	.056**	.115**	.074**	.053**	.115**
Endpoint Concentration	.221	-.530	-.513	-.313	-.980*	-1.147+
Difference between leader and challenger						
$\triangle$Endpoint Market Share	.550**	1.232**	-.775*	.637**	1.312**	-.637+
$\triangle$Operating Costs	.133	1.003**	-.828**	.126	.979**	-.833**
$\triangle$Itinerary Miles	1.784**	-3.946**	7.384**	1.824**	-3.976**	7.480**
$\triangle$Number of Deplaned Stops	.840**	.383**	.235	.822**	.362**	.192
$\triangle$Route Market Share	-.065	.464**	.716**	.035	.521**	.817**
$\triangle$% of Round Tickets	.883**	-.065	1.169**	.794**	-.138	1.066**
Multimarket Contact						
$Z_{leader, challenger}$	3.458**	-2.163**	3.646**	2.228**	-3.635**	2.278**
$Z_{challenger, leader}$	1.551**	3.633**	-2.101**	2.228**	4.365**	-1.346*
Network Measures						
Structural Equivalence				-.649**	-.509**	-.887**
Third Party Embeddedness				11.159**	10.187**	13.460**
Number of routes	3887	1364	669	3887	1364	669

-2 Loglikelihood, (d.f., p-value)	22471.96, (45, p<.000)	22216.74, (51, p<.000)