COMPETITION WITHIN AND BETWEEN NETWORKS: THE CONTINGENT EFFECT OF COMPETITIVE EMBEDDEDNESS ON ALLIANCE FORMATION

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I examine how firms use alliances to respond to the alliance networks of their rivals, by either allying with their rivals’ partners or by building countervailing alliances. Evidence from the global airline industry (1994–98) suggests that these strategic responses depend on alliance cospecialization. Cospecialized alliances by rivals may involve exclusivity, precluding alliances with the rivals’ partners and thus encouraging countervailing alliances. Nonspecialized alliances are less exclusive and are used when rivals share the same partners.

Over the last decade, the network metaphor has become influential in research into strategic alliances and interorganizational relationships (Gulati, 1998), along with more established perspectives, such as the transaction cost and capability views (Hennart, 1988; Richardson, 1972). Alliance networks may provide members such benefits as access to capabilities and information from direct and indirect partners, referrals to other potential partners and opportunities, brokerage opportunities with other relations, and an effective network governance context for individual alliances (Burt, 1992; Coleman, 1990; Dyer & Singh, 1998; Jones, Hesterly, & Borgatti, 1997). Yet, if—as is suggested in the literature—firms obtain competitive advantages from their alliances and network membership, it follows that rivals may be negatively affected by such alliances (Silverman & Baum, 2002). As a result, they would be motivated to respond in ways that match and neutralize their opponents’ advantages.

This article examines how competitive dynamics shape alliance formation, partner selection, and network evolution. Prior research on this question has examined the likelihood of formation and dissolution of alliances among rivals (Garcia-Pont & Nohria, 2002; Kogut, 1989; Park & Russo, 1996; Pfeffer & Nowak, 1976). Evidence shows that alliances between rivals are often hazardous, since competitive goals encourage opportunistic behavior and appropriation of capabilities (Hamel, 1991; Kogut, 1989; Park & Russo, 1996; Park & Ungson, 2001). However, beyond direct rivalry between potential partners, competitive relations with third parties may also influence dyadic alliance formation. For example, a firm may develop alliances with its rivals’ partners in an attempt to match the network benefits of its rivals. Alternatively, it may seek out countervailing alliances with similar partners as a way of duplicating the rivals’ benefits.

This study contributes a theoretical model and empirical examination of how competitive relations with third parties influence alliance formation and partner selection. In particular, factors such as whether a firm’s rivals are already allied with a potential partner, or whether a potential partner faces competitive pressures from the same rivals or rival alliances, influence alliance and partnership choices. The notion that actors are embedded in networks of relations with third parties has been at the core of network-oriented social science for decades (Burt, 1992; Coleman, 1990; Granovetter, 1973; Heider, 1946; Simmel & Wolff, 1950), and this idea has been widely applied in alliance research. The present work departs from earlier research, however, by combining the two networks of competitive and cooperative relations to describe indirect, third-party competitive influences on alliance formation and partner selection.

To observe these indirect competitive effects, consider the following situations: After witnessing several important transatlantic alliances, such as those made by KLM with Northwest, by American Airlines with British Airways, and by Lufthansa with United Airlines, in 1999 Air France announced that it had selected Delta rather than Con-
tinental to be its major alliance partner for transatlantic travel. Although Air France had a “code-sharing” agreement (an agreement to jointly operate routes) with Continental in a few markets, Air France’s choice appeared to be influenced by Continental’s alliance plans with KLM, Air France’s rival. Four days later, Delta’s European partners Swissair and Sabena announced that they would switch to an association with Delta’s rival, American Airlines. These decisions appeared to be motivated by a desire to both avoid sharing alliance partners with rivals, and to counterbalance rivals’ alliances. In contrast, CSA Czech Airlines simultaneously maintained alliances with Air France, Lufthansa, KLM, Iberia, and Austrian Airlines throughout most of the 1990s. Similarly, British Midland maintained code-sharing agreements with both American and United for seven years, until 2000. In these cases, rivals managed to share the same partner for years without apparent structural conflict. These contrasting situations are not unique to the airline industry. In some industries, such as automobiles and mainframes, firms tend to polarize into competing alliance constellations, in which direct rivals select different partners (Axelrod, Mitchell, Thomas, Bennett, & Bruderer, 1995; Gomes-Casseres, 1996; Nohria & Garcia-Pont, 1991). In other industries, such as biotechnology or investment banking, however, direct rivals may share the same partners (Baum, Shipilov, & Rowley, 2003; Silverman & Baum, 2002; Stuart, 1998).

This study explores how dyadic alliance formation between potential partners is influenced by the competitive embeddedness of the dyad, represented by the competitive relations of the potential partners with third parties. In particular, I focus on how a firm’s selection of partners is influenced by its rivals’ choice of partners. Because strategic alliances provide access to the resources and information of direct partners and their networks, they provide a competitive advantage to participating firms . . . and a competitive disadvantage to their rivals. Generally, firms can respond to their rivals’ alliances in at least two ways: (1) by linking into their rivals’ networks, thus trying to obtain the same network benefits from the same partners (leading to intranetwork competition) and (2) by developing countervailing alliances that provide similar benefits from different (but substitute) partners (leading to internetwork competition).

When do firms favor allying with their rivals’ partners, and when do they favor forming countervailing alliances? I argue that there is no universal tendency for either intra- or internetwork competition to predominate in alliance networks. Instead, drawing on transaction cost and social exchange theories, I claim that the relative predominance of one logic of network competition over the other depends on the level of alliance cospecialization in a network. Alliance cospecialization demands greater relational exclusivity. As a result, it reduces intranetwork competition (alliances with rivals’ partners) and increases internetwork competition (countervailing alliances against the rivals and their partners). Thus, according to the theory, alliance cospecialization is a critical contingency that determines the direction of alliance formation and the competitive evolution of an alliance network. I tested hypotheses in the context of the alliances in the global airline industry from 1994 to 1998.

**THE COMPETITIVE EMBEDDEDNESS OF ALLIANCE FORMATION**

Since theory integrates competitive considerations in alliance network evolution, I first define the two basic constituent relations: competitive relations and alliance relations. It is nowadays common to view alliances as elements of an alliance network, and therefore to theorize about network influences beyond those of direct relations, such as indirect ties (partner’s partners), centrality, status, autonomy, and so forth. This network perspective has not yet been adopted for competitive relations, thus hindering the development of theory about indirect competitive relations (such as rivals’ rivals, or rivals’ partners). By adopting a network perspective on competitive relations, it is possible to theoretically and empirically integrate the analysis of competitive and cooperative relations.

**Competitive Relations and Niche Overlap**

I define competitive relations in terms of niche overlap; that is, competitive relations exist when firms seek out the same limited resources or target the same markets or customers (McPherson, 1983). High niche overlap indicates that two firms are substitutes for one another in markets and, therefore, that their outcomes are competitively interdependent. Advantages obtained by firms with high niche overlap (that is, competitive advantages) are important for firm-level profitability: Without collusive coordination, a firm’s profit decreases when its competitors are more effective, and it increases when its competitors are less effective (Salop & Scheffman, 1983). A firm may therefore attempt to exclude its competitors from sources of advantage, such as access to its partners (Krattenmaker & Salop, 1986).

Because firms differ in their strategic positions within an industry, they also vary in their degrees
of niche overlap with other incumbents. Traditionally, strategy researchers have used the concept of strategic groups to cluster firms into discrete groups with high strategic similarity and niche overlap (Caves & Porter, 1977; Cool & Schendel, 1987; Hatten & Hatten, 1987). However, the idea that firms fit into discrete strategic groups has been seriously challenged (Barney & Hoskisson, 1990; Reger & Huff, 1993). In recent years, competitive strategy research has turned toward dyadic representations of relative competitive positions that recognize firm-specific niches (Chen, 1996; Stuart, 1998). In this study, I assumed that firms occupy firm-specific niches and, therefore, that niche overlap is a dyadic relationship between firms. Taken together, these dyadic competitive relations form a competitive network in which firms are embedded. The structure of that competitive network may influence behavior beyond the effect of dyadic niche overlap. For example, firms that are indirectly connected (that is, firms that share common rivals) may be interdependent, even if they don’t have dyadic niche overlap.

Defining competitive relations in terms of niche overlap makes it necessary to draw a conceptual distinction between niche overlap and the related concept of complementarity, which has been operationally defined in prior alliance research in terms of lack of niche overlap. Complementarity, an important antecedent of dyadic alliance formation (Chung, Singh, & Lee, 2000; Gulati, 1995), exists when it is possible for two firms to combine their scopes, resources, or capabilities to jointly pursue new strategic opportunities that they could not pursue independently in an effective way (Dyer & Singh, 1998; Richardson, 1972). Researchers have assessed complementarity by questioning whether firms occupy different niches or possess different capabilities (Chung et al., 2000; Gulati, 1995; Nohria & Garcia-Pont, 1991). Implicitly, they have assumed that niche overlap and complementarity are diametrically opposite concepts, whereby the absence of niche overlap necessarily entails the presence of complementarity. Such an assumption is problematic, since it ignores the likely case of dissimilar firms that are not complementary. Not all combinations of dissimilar scopes or capabilities lead to value creation; different capabilities held by dissimilar firms may be mutually incompatible. Low niche overlap may be a necessary condition for complementarity, but it is not a sufficient condition: firms may be dissimilar without being complementary. This conceptual distinction is important for untangling, theoretically and empirically, the effects of complementarity from those of competitive relations.

Alliance Relations

Horizontal alliances represent voluntary interfirm agreements involving the exchange, sharing, or codevelopment of products, technologies, or services among firms engaged at the same stage in the value chain. In contrast to market contracts, alliances involve incomplete contracts that do not fully specify the conditions of exchange. Accordingly, alliances allow more flexible and adaptive interfirm exchanges, but their success depends on effective governance of an ongoing relationship among parties with possibly divergent interests. Given that alliance partners have an ex post “inalienable de facto right to pursue their own interests at the expense of others” (Buckley & Casson, 1988: 34), the design of self-enforcing governance mechanisms is critical (Dyer & Singh, 1998).

Alliances differ on the intensity or strength of interorganizational dependence and, more particularly, on their levels of relation-specific investment (cospecialization) and sensitive knowledge sharing (Contractor & Lorange, 1988; Doz & Hamel, 1998). To reflect these differences in alliance relations, I distinguish between cospecialized and nonspecialized alliances. Cospecialized alliances, which involve investments in partner-specific assets and activities and sharing of sensitive or proprietary knowledge, can create value by exploiting efficiencies of mutual specialization. However, they also put firms at risk of “hold-up” and “leakage” (Klein, Crawford, & Alchian, 1978; Williamson, 1983) and are difficult and costly to reverse. Given the relational risk cospecialized alliances entail, the governance of these alliances tends to involve contractual safeguards, frequent and joint decision making, equity control, mutual adaptation, and interorganizational commitment and trust (Dyer & Singh, 1998; Jones et al., 1997; Uzzi, 1997). Alliance cospecialization may occur among both horizontal and vertical alliances, and among both “scale” and “link” alliances (defined respectively as alliances in which partners contribute similar resources and those in which they contribute different resources). Thus, alliance cospecialization is an indicator of the intensity and irreversibility of partner dependence, rather than a description of the nature of alliance activities.

In contrast, nonspecialized alliances—those with less cospecialization or proprietary knowledge sharing—entail less mutual dependence and lower risk of leakage. They are easier for a partner to reverse without incurring high exit costs. Because of the lower dependence and greater reversibility, firms may use actual or potential competition among its partners in a nonspecialized alliance to
maintain effective relations, and firms can easily terminate ineffective relations (Uzzi, 1997). The lower exit costs of nonspecialized alliance also make them safe instruments for exploring uncertain opportunities and unproven partners (Ring & Van de Ven, 1994; Rowley, Behrens, & Krackhardt, 2000).

Competitive Influences on Alliance Formation

Interest in the effect of competition on alliance formation is well established. An important theme within this literature is whether firms can indeed “collaborate with competitors and win” (Hamel, Doz, & Prahalad, 1989). However, empirical evidence on the effectiveness of alliances between direct competitors has generally been negative. Bleeke and Ernst (1992) found a rate of alliance success of 62 percent when firms had minimal geographic overlap, versus 25 percent when firms had moderate or high overlap. Kogut (1989) found that market share instability (a proxy for rivalry) increased alliance dissolution, while Park and Russo (1996) found that alliances among direct competitors (firms from the same four-digit SIC code) were more likely to fail. Two general reasons seem to underpin these cooperation difficulties. First, the alliances of direct competitors may lack goal alignment, given the strong incentives to behave opportunistically and gain a benefit in market competition (Park & Ungson, 2001). For direct rivals, benefits gained from an alliance that they share equally will not result in competitive asymmetry between them. Rivals will, therefore, have strong incentives to draw private benefits beyond the common benefits of the alliance (Khanna, Gulati, & Nohria, 1998). Second, direct competitors may face a risk of uncontrolled information disclosure that would allow competitors to appropriate capabilities and disband alliances (Bresser, 1988; Hamel, 1991).

Aside from the effects of direct competition between potential partners, the indirect competitive effects of third parties may influence alliance formation. These indirect competitive effects are important because alliances are potential sources of competitive advantage for rivals. Thus, a firm may be negatively affected by its rivals’ alliances and networks (Silverman & Baum, 2002). Although a firm may have multiple potential partners offering diverse opportunities for value creation, competitive threats focus attention on particular opportunities that rivals are exploiting (Greve, 1998). Thus, alliances by rivals could lead a firm to realize that rivals are exploiting some particular potential value creation opportunities and are thus undermining the firm’s competitive standing.

A firm may respond in at least two ways. First, it may seek entry into its rivals’ networks, thus creating alliances with its rivals’ partners. This response would create intranetwork competition, since the firm and its rivals would become substitute partners within the network. Intranetwork competition undermines the rivals’ unique advantage and power to appropriate rents from the relationships, and such competition will therefore reduce the firm’s competitive disadvantage. Alternatively, the firm may seek to match the rivals’ advantage by creating countervailing alliances with other partners who also face the same competitive threat. This response creates internetwork competition, since the networks themselves will compete with each other for customers. In this case, the firm and its rivals maintain their bargaining power to appropriate rents within their respective networks, but the rents generated by the networks will decrease. Figure 1 illustrates three types of competitive embeddedness. In the figure, firms $i$ and $j$ are rivals, and firm $j$ has an alliance with firm 1. Firms $i$ and 1 have a “rival’s partner” indirect connection. Formation of an alliance in this context would lead to intranetwork competition. Firms $i$ and 2 have a “rival alliance” indirect connection, since both face a common threat from partners of a rival alliance. Firms $i$ and 3 have a “common rival” indirect connection, since both firms face the same common threat from rival $j$. Countervailing alliances by firm $i$ with firms 2 or 3 would lead to internetwork competition, since they polarize rather than connect the alliance network. The following sections examine predictions for these types of competitive embeddedness in detail.

Alliances with Rivals’ Partners: Inclusiveness versus Exclusivity of Rivals’ Networks

When are firms likely to favor or avoid alliances with their rivals’ partners? Transaction cost economics and social exchange theory offer predictions about the emergence of exclusivity in exchange relations. For clarity, I will label the potential partners as firms $i$ and 1 and assume that firm $i$ competes with a rival $j$ that is currently allied with firm 1 (as described in Figure 1).

The formation of an alliance between a firm $i$ and its rival’s partner 1 would undermine the advantage and bargaining power of rival $j$ and improve the power of partner 1. On the one hand, rival $j$ would strive to keep its alliance exclusive in order to maintain its differential advantage relative to its rival (Krattenmaker & Salop, 1986; Salop & Scheff-
man, 1983). Assuming that the partner has capabilities or market access that make it an attractive partner for firm $i$, the formation of that alliance would erode rival $j$’s competitive advantage. Moreover, by increasing the bargaining power of partner 1, rival $j$ would be able to capture less value from the relationship (Emerson, 1962; Pfeffer & Salancik, 1978). Singh and Mitchell (1996) found supporting evidence that hospital software firms’ failure hazard increased after the firms’ partners entered alliances with the firms’ rivals.

On the other hand, an alliance between firms $i$ and 1 would benefit partner 1 by allowing it to exploit its resources with other partners and by improving its bargaining position relative to both firms $i$ and $j$. In the absence of special inducements from rival $j$ to keep partner 1 exclusive, partner 1 would likely favor the development of an alliance with firm $i$. To keep partner 1 exclusive, rival $j$ would have to provide its partner 1 with an “exclusivity premium” sufficient to compensate it for the opportunity costs of both missed opportunities with other partners and reduced bargaining power (Krattenmaker & Salop, 1986). Yet the provision of this exclusivity premium would reduce the net benefit that rival $j$ could obtain from exclusivity. It is possible that initial asymmetries in bargaining power, arising from resources or market position, may allow some firms to obtain exclusivity from their partners without sufficient compensation for missed opportunities. If partners have equally valuable capabilities, market positions, or network contacts, however, generally it will be difficult for firms to prevent partners from also allying with rivals. Because of the cost of exclusivity, it is unlikely that there will be a general predisposition toward exclusivity in alliance networks.

Exclusivity may be more likely when it facilitates incentive alignment and efficient governance of relations. Transaction cost and social exchange theories suggest that exclusivity may be demanded and obtained as a safeguard governance mechanism in alliance relations with high cospecialization (Anderson & Weitz, 1992; Cook & Emerson, 1978; Fein & Anderson, 1997; Klein, 1980; Williamson, 1983). To be accepted voluntarily by partners, exclusivity should improve the efficient allocation of resources, not simply shift bargaining power across partners. Transaction cost economists have argued that exclusivity may be an economically efficient mechanism to make relational contracts more self-enforcing against the lure of opportunism. Exclusivity increases the cost of ending a relationship by increasing the cost of switching to alternatives outside the relationship. It therefore serves as a credible commitment, or “hostage,” that can be used to safeguard transactions with high degrees of cospecialized asset investments (Klein, 1980; Williamson, 1983) and those whose parties may have an incentive to free ride on other parties’ investments (Heide, Dutta, & Bergen, 1998). Exclusivity can act as a pledge of relational commitment that sustains cooperation (Anderson & Weitz, 1992; Cook & Emerson, 1978; Jones et al., 1997). Evidence in the marketing channels literature shows that the degree of exclusivity granted to a supplier or distributor is related to the transaction-specific investments.

**FIGURE 1**

Illustration of Competitive Embeddedness Types

* Closer distance implies greater niche overlap.
made by the supplier or distributor (Fein & Anderson, 1997).

In the context of alliance formation, this view implies that cospecialized alliances will be more likely to develop voluntary norms of competitive exclusion as a governance mechanism, both as a hostage against possible costly defections and as a barrier against rivals’ potential free riding on the relational investment, proprietary knowledge, or capabilities (Jones et al., 1997). Nonspecialized alliances will not require such a high level of relational commitment, and therefore exclusion would not be expected.

I examine two testable implications of the previous logic. First, the level of cospecialization in the preexisting alliances between rivals and their partners should negatively influence the likelihood of firms making new alliances with their rivals’ partners. Thus, a firm would be more likely to be excluded from its rivals’ cospecialized partners than from its rivals’ nonspecialized partners.

**Hypothesis 1.** The likelihood of alliance formation between a firm and its rivals’ partners is lower when the rivals’ alliances are cospecialized rather than nonspecialized.

Second, the presence of preexisting alliances between a firm’s rivals and its potential partner should affect the type of alliances (cospecialized or nonspecialized) that might be formed. Because cospecialization involves a relational risk, the availability of safeguard governance mechanisms, including exclusivity, should affect a firm’s willingness to engage in cospecialized alliances. A firm will be less willing to start a cospecialized alliance with a partner that already maintains alliances with the firm’s rivals, because such a partner could use its bargaining power to appropriate the quasi-rents generated by the transaction-specific investments made by the other firm. Thus, a firm would be more likely to initiate a nonspecialized alliance rather than a cospecialized alliance when the partner is allied with the firm’s rivals.

**Hypothesis 2.** Alliances between rivals and potential partners increase the likelihood of formation of a nonspecialized alliance rather than a cospecialized alliance.

The theory I am formulating here does not lead to a prediction of a general tendency toward or against exclusivity in alliance networks. Instead, I argue that exclusivity is contingent on the level of alli-<ref>ance cospecialization in a network. Industries in which alliances involve greater cospecialization should display a greater tendency toward competitive exclusion than industries in which alliances involve little cospecialization. Even within an industry with heterogeneous alliance types, the presence of more highly cospecialized alliances should generate greater competitive exclusion than the presence of less cospecialized alliances.

**Countervailing Alliances**

The practice of competitive exclusion, while beneficial for supporting cospecialization within an alliance, generates a competitive risk. If rivals cannot link into a firm’s network and benefit from access to the same partners, they may instead form countervailing alliances that replicate the network benefits by enlisting similar (but not the same) partners. Such a response would lead to competition among rival alliance groups (Garcia-Pont & Nohria, 2002; Gomes-Casseres, 1996; Nohria & Garcia-Pont, 1991).

A countervailing alliance is one intended to match and neutralize the rivals’ alliance advantage by aligning firms facing a common competitive threat. The rival alliance would increase the saliency of some potential complementarities exploited by rivals. With a countervailing alliance, a firm could replicate the complementarities generated by the rival alliance by selecting a partner that is a close substitute (and thus a direct rival) of the rival’s partner (firm 2 in Figure 1). Also, countervailing alliances align the competitive incentives of firms toward the mutual goal of counteracting the effectiveness of the common rival alliance. Alliances among direct competitors generally suffer from incentive misalignments, because the quest for competitive advantage encourages the pursuit of asymmetric private benefits from the alliances, which leads to opportunistic behavior. Yet when two firms form a countervailing alliance against a common rival entity, their incentives become competitively aligned. Efficiencies gained by the partners are used to gain market position from the common rival, not from the other alliance partners. A countervailing alliance therefore is likely to group firms that rank the threat from the common rival entity higher than the threat from other alliance partners. The incentive alignment within the countervailing alliance would increase as the alliance partners’ niche overlaps with the common rival entity increase, but the partners’ incentive alignment would decrease as their own niche overlap increases.

Competitive dynamics research suggests that action visibility and competitor dependence (that is, level of niche overlap) increase the likelihood of competitive response and the likelihood of matching moves (Chen & MacMillan, 1992). A matching
move is a risk-averse response to a competitor’s threatening action, a response intended to achieve competitive parity (Knickerbocker, 1973). In the case of an alliance between a rival and a resource-rich partner, a firm may either seek a countervailing alliance with a rival of that partner, as described above, or ally with the attractive partner, as discussed in the previous section. If the relationship between the rival and its partner is not exclusive, a countervailing alliance may not be the most effective response, since the firm could instead ally directly with its rival’s partner. A countervailing response would require the identification of a potential partner that could effectively match the rival’s partner’s capabilities and network connections. In some situations, available partners are only second best relative to the rival’s own partners. Thus, firms may not systematically favor countervailing alliances when they have the choice of linking to their rivals’ networks. The choice between partnering with a rival’s partners or forming countervailing alliances will depend on the potential partner’s relative endowments, not on a systematic structural tendency. In contrast, when a rival’s partners are exclusive, a firm’s only option to neutralize its competitive disadvantage is to create a countervailing alliance.

Following the theoretical logic described above, the cospecialization of the alliances between rivals and their partners will influence their level of exclusivity. When rival alliances are cospecialized, and thus more exclusive, countervailing alliances will be more likely to be systematically selected. When rival alliances are nonspecialized, however, countervailing alliances may not be necessary, and therefore should be less likely to be systematically favored. In addition, the nature of the rival alliances may also influence the competitive reaction. Cospecialized rival alliances are likely to be more competitively effective than nonspecialized rival alliances, since the ability to cospecialize operations gives rivals the opportunity to generate efficiencies that cannot be obtained in nonspecialized alliances. Thus, countervailing alliance formation in response to rival cospecialized alliances would also be more likely.

**Hypothesis 3.** The likelihood of alliance formation between two firms is greater when the alliances between the firms’ respective rivals are cospecialized rather than nonspecialized.

The level of cospecialization of rival alliances is also likely to influence the level of cospecialization used in countervailing alliances. Because cospecialized rival alliances are more likely to be exclusive, they reduce the pool of partners available to other firms. In most industries, the number of viable and effective substitutes for a rival’s partner is limited. In these situations, firms engaged in inter-network competition risk “strategic gridlock,” a situation in which eligible partners for a countervailing alliance have been locked out by prior movers (Gomes-Casseres, 1996: 158). The more numerous the cospecialized rival alliances that form around two potential partners, the greater the incentive to preemptively lock in the potential partner with a cospecialized alliance. Therefore, potential partners facing cospecialized rival alliances would be more likely to form a cospecialized countervailing alliance than a nonspecialized one.

**Hypothesis 4.** Cospecialized alliances between two firms’ respective rivals increase the firms’ likelihood of forming a cospecialized countervailing alliance rather than a nonspecialized alliance.

Countervailing alliances may be formed not only when partners face rival alliances, but also when they face a single firm whose capabilities or scope puts it in competition with both partners. The incentive alignment among firms facing common rivals is sometimes problematic, since firms facing the same rivals are likely to be rivals themselves. However, incentive alignment can be achieved in a countervailing alliance if potential partners face greater competitive threat from the common rival than they face from each other. For example, in the European mobile phone industry, several international “roaming” and data services alliances have been launched to compete against Vodafone, the leading multinational mobile operator in most European markets. The alliance partners have low geographical niche overlap with each other, but Vodafone is a major competitor to all of them in their respective markets.

According to transaction cost economics, alliance transactions are quasi-integration relations that permit levels of cospecialization between arm’s-length market transactions and hierarchical transactions (Hennart, 1993; Williamson, 1991). If this is so, common rivals pose a greater competitive threat than cospecialized rival alliances, since the hierarchical governance of common rivals should allow them to sustain a greater cospecialization and coordination of activities than alliances between independent firms. The competitive niche of common rivals may reflect potential complementarities in scope, resources, and capabilities that the common rival has integrated within its boundaries. Firms facing common rivals would be confronted by the particular complementarities their rivals had internalized and would likely strive to replicate or
respond to those complementarities by the common rivals rather than focusing on other potential complementarities not explored by their rivals. As a result, firms facing common rivals should be more likely to form alliances. More specifically, if integrated common rivals are more competitively effective than cospecialized rival alliances, the effect of common rivals on alliance formation should be greater than that of cospecialized rival alliances. That is, the likelihood of an alliance between two firms increases if the members of a cospecialized rival alliance facing these firms merges into a single common rival.

**Hypothesis 5. The likelihood of an alliance between two firms is greater when they face the same common rivals than when they face cospecialized alliances among their respective rivals.**

In summary, I propose that greater cospecialization of alliances by rivals should lead firms toward internetwork competition, as reflected by lower likelihood of their forming alliances with their rivals’ partners (Hypothesis 1) and higher odds of their forming countervailing alliances with the rivals of their rivals’ partners (Hypothesis 3). Moreover, the odds of countervailing alliance formation should be even higher when potential partners face a common integrated rival rather than a cospecialized rival alliance (Hypothesis 5). The type of alliances firms form should also be influenced by those of rivals. Alliances with rivals’ partners, if they happen at all, are more likely to be nonspecialized (Hypothesis 2). If rivals form cospecialized alliances, countervailing alliances are also more likely to be cospecialized (Hypothesis 4). Overall, the hypotheses provide a logically consistent set of predictions reflecting how cospecialization of alliances generates competitive dynamics that limit intranetwork competition and enhance internetwork competition.

**METHODS**

I tested the hypotheses for this study in the context of the international airline industry between 1994 and 1998. The prevalence of cooperative relationships and the heterogeneity in dyadic competitive relationships made this industry a natural context for the study. During the 1990s, strategic alliances among major global airlines dramatically increased in frequency and scope. By the early 1990s, alliances tended to involve route-specific agreements, but some alliances formed in the 1990s involved broad-based agreements covering multiple cooperative activities (GRA Incorporated, 1994; U.S. General Accounting Office [GAO], 1995). The geographic focus of airline services also creates heterogeneity in competitive relations: some pairs of firms compete over many markets, while many pairs do not overlap at all.

Few interorganizational networks are closed systems with natural boundaries; network boundary determination often requires an arbitrary decision (Wasserman & Faust, 1994). In addition to horizontal alliances with other, similar airlines, large global airlines also ally with small local “feeder” airlines, to increase hub traffic, and with providers of related services, such as airports, hotel chains, car renters, and so forth. This study focused on the structure of the competitive and cooperative relationships among the world’s major international scheduled passenger airlines. Accordingly, I did not include in the sample airlines that only carried cargo, only served domestic routes, or only flew charter (unscheduled) flights. Moreover, I focused only on horizontal alliances between firms in the study population, excluding domestic feeder alliances and cross-industry alliances.

Global airline alliances perform a variety of cooperative activities. Some coordinated activities include logistic or marketing cooperation, such as facility sharing, joint maintenance, and frequent flyer program agreements (GAO, 1995). With very few exceptions, however, the most important cooperative activity of global airline alliances is joint route operation, a practice known in the industry as “code sharing.” In code sharing, reservation systems list a flight segment with the codes of both an operator and a partner, so that both companies can market seats under their own flight numbers. This arrangement allows the partner: (1) to market direct flights that it does not fly and (2) to market as its own “online” connecting flights some onestop flight trajectories in which it only serves one segment. For instance, Northwest can market as its own connecting flight the Detroit-Amsterdam-Budapest trajectory, even though its partner KLM operates the Amsterdam-Budapest segment. Most customers strongly prefer “online” flights (traveling multiple segments with the same airline) to “interline” flights (combining segments on multiple airlines). Airlines with code-sharing agreements do not offer true online service, but they often implement supportive practices (coordinated check-in, shared executive lounges, coordinated frequent flier programs, or coordinated schedules) that allow them to offer service quality near that of online service. Alliances can coordinate revenues from shared flights in multiple ways, including block-seat purchases (where the partner buys a block of seats from the operating airline), revenue-sharing agreements, etc. Pricing in code-sharing trips, may be coordinated in order to avoid a double marginal-
in 1985, and it stimulated a wave of alliances in the industry. Indeed, code sharing has been described by airlines as “the glue that holds other cooperative activities together” (GRA Incorporated, 1994: ES-4). There are a few alliances that exclude code sharing, often because of antitrust restrictions. Code sharing increases economies of scale in specific routes (allowing two firms to jointly serve more passengers with fewer planes) and economies of scope through the network (extending the firms’ networks with segments served by their partners).

The extent of alliance activities (particularly code-sharing activities) varies widely among alliances. Most alliances involve code sharing and cooperation in one or a few routes (point-specific alliances). Yet some strategic or extensive alliances involve a broad range of cooperative activities, including many code-sharing routes that integrate the regional or global networks of the partners (e.g., KLM-Northwest, United-Lufthansa, etc.). These alliances involve substantial cospecialization of network structures and ongoing information exchange to facilitate joint coordination of activities. Since regulation in many countries limits foreign ownership of local airlines (and therefore cross-border mergers) and also prohibits foreign airlines from serving domestic markets (cabotage rights) or from flying passengers directly to other third countries (fifth freedom rights), extensive alliances allow firms to globalize their networks within the current regulatory environment.

The time period in the sample (1994–98) was a critical junction in the evolution of alliance networks in the global airline industry. Although international alliances began in the middle of the 1980s, airline alliances remained mostly point-specific until 1994 (about 78 percent of all alliances in 1994 were point-specific). During the 1994–98 period, many strategic or extensive alliances were initiated (increasing 115 percent, while point-specific alliances increased 20 percent). Major alliance groups (Oneworld, Star, SkyTeam) began to emerge toward the end of this period.

Data

Actors in the network of large international airlines were selected from the 1994–98 Airline Business 100 rankings, which list the 100 largest world airlines by revenues for the years 1993–97. Airline Business, which publishes these rankings annually, is the leading monthly magazine for strategy-related issues in the global airline industry. From the 114 airlines that appeared in the rankings for at least one year, I selected 99 firms after eliminating purely domestic airlines, all-cargo or all-charter airlines, and majority-owned subsidiaries of other airlines in the sample. Data on some airlines were not continuously available for all the years in question. Since the independent variables reflect relations with third parties in the industry, missing data for one firm would influence all observations. To ensure that longitudinal changes in the independent variables reflected true changes in relations rather than sampling differences, I selected a stable subset of 67 firms that reported consistent data on their cooperative and competitive relationships for all the years of the study. The results reported here, based on the subset of 67 airlines, are fully consistent with those for the full network of 99 firms.

Alliance network. Data on alliances among airlines were obtained from the alliance survey published by Airline Business for 1994–98. This is arguably the most comprehensive public source of information on international airline alliances. To ensure maximum coverage of the alliances, Airline Business collected data from multiple sources, including company self-reports and press releases collected by industry experts. The survey, published in June of each year, included alliances active up to the previous month. Therefore, the alliance survey actually was a census of alliances in the industry, except for feeder alliances, which it does not include.

I interpreted the term “alliance” broadly, including cooperative relationships ranging from point-specific code-sharing and narrow marketing agreements to extensive equity-based strategic alliances involving joint operations and revenue pooling across many markets. A symmetric network matrix L was created for each year, with each element indicating whether an alliance existed between a pair of firms. Therefore, the elements of matrix L were defined as:

\[
I_{ij} = \begin{cases} 
1 & \text{if firms } i \text{ and } j \text{ are linked by an alliance during year } t. \\
0 & \text{otherwise.}
\end{cases}
\]

Matrix L can be divided to capture differences between cospecialized and nonspecialized alliances. Cospecialized alliances \((s_{ij} = 1)\) were defined as extended alliances including a broad set of code-sharing routes (typically, alliances to provide connections to a region or a continent) together with a broad range of cooperative activities (frequent flyer programs, joint use of ground facilities,
and so forth). The implementation of these alliances requires mutual adaptation of activities in network operations (cospecialization), sharing of sensitive information, and joint coordination. In contrast, nonspecialized alliances \((ns_{ij} = 1)\) were defined as those including a few code-sharing routes that did not comprise a regional or global feeding network (typically, they involve one or two routes between the partners’ home countries that may not have sufficient density to allow multiple airlines to serve the markets effectively). These point-specific alliances entail little mutual adaptation and are easy to reverse. They typically involve the agreement to buy a block of seats on certain of a partner’s flights but rarely entail attempts to cospecialize operations or provide service levels consistent with those of the partner. I defined the cospecialized and nonspecialized categories as mutually exclusive. Two raters knowledgeable about airline alliances rated all the alliances using the short descriptions of alliance activities provided by *Airline Business*.\(^2\) The raters reached an initial interrater agreement of .82 and attained consensus after discussion with the author.

**Competitive network.** Competitive relationships reflect the extent of niche overlap between airlines. Niche overlap describes the dependence of a firm on resources and markets in which another firm is present (Chen, 1996). The competitive structure in an industry may then be represented as a network (an adjacency matrix) formed by these pairwise competitive relations. Although niches can be characterized in terms of markets, capabilities, and technologies, research suggests that overlap in output markets (geographic markets, product segments, and customer niches) tends to exert a stronger influence in competitor identification and competitive response (Chen, 1996; Clark & Montgomery, 1999; Porac, Thomas, Wilson, Paton, & Kanfer, 1995). In the airline industry, which is characterized by multiple discrete geographical markets and relatively homogeneous services, niche overlap reflects the degree of market commonality or multimarket contact between airlines (Chen, 1996). Since firms have different scope breadth and different levels of presence in specific markets, competitive relations may be asymmetric. Moreover, competitive relations may be “intransitive” (that is, two firms facing high niche overlap from a common rival may not experience high niche overlap with each other).

I calculated dyadic niche overlap between airlines by assessing their overlap over 12,847 international city-pair markets connecting the world’s 200 largest cities by air traffic volume. The measure of niche overlap of airline \(i\) with airline \(j\) at time \(t\) \((NS_{ij})\) is the ratio between the size-adjusted sum of the markets of overlap between airlines \(i\) and \(j\) and the size-adjusted sum of the markets served by airline \(i\). The asymmetry of the measure captures the egocentric saliency of competitive relationships for each firm, since the same level of overlap affects large and small firms differently (Chen, 1996; Hannan & Freeman, 1989). The Appendix presents details of the calculation of these niche overlap measures. Dyadic niche overlap between airlines ranged from 0 to 1, with a mean of 0.03 and a standard deviation of 0.07. Fifty-seven percent of airline dyads had zero market overlap.

**Dependent Variable**

Alliance formation, the dependent variable, represents events in which an alliance did not exist one year \((I_{ij} = 0)\) but existed the following year \((I_{ij,t+1} = 1)\). For the analysis of alliance nature, additional indicators represented whether the alliances formed were cospecialized \((s_{ij,t+1} = 1,\ or\ 0\ otherwise)\) or nonspecialized \((ns_{ij,t+1} = 1,\ or\ 0\ otherwise)\). Since the dependent variables were symmetric for each pair of firms, the unit of analysis was defined as the nondirectional dyad (that is, either dyad \(ij\) or dyad \(ji\) was in the sample, not both). There were 144 new alliances formed between 1994 and 1998, 112 nonspecialized and 32 cospecialized.

**Independent Variables**

The first set of independent variables measured whether a potential partner already had alliance relations with the rivals of the other potential partner, and the nature of those relations. If firms seek to connect to their rivals’ networks, these variables will have a positive effect on alliance formation. On the other hand, if firms seek to exclude rivals from their networks, or firms shun positions of redundancy inside networks, these variables will have a negative effect on alliance formation. My working theory suggested that the direction of the effect would depend on whether the exchange relationships involved cospecialization. Since I examined unordered pairs, I had to consider two possible situations: when firm \(i\) was a partner of firm \(j’s\n
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\(^2\) *Airline Business* provides a one- or two-sentence description of the activities each alliance entails. Although those descriptions were adequate for classifying alliances with sufficient reliability, they were not detailed enough to permit calculation of continuous measures of alliance strength or cospecialization.
rivals, and when firm $j$ was a partner of firm $i$’s rivals. Both conditions were equally relevant and were aggregated in the measures. To aggregate among all possible third parties, I calculated a weight $p_{kij}$ for each third party $k$ equal to the percentage that $k$ accounted for of total revenues for all airlines in the sample except firms $i$ and $j$ (that is, the percentage of all third-party revenues). Therefore, for each dyad, the sum of the weights added up to 1. The weights provided a consistent scaling for the effects through different third parties. The variables, which measured whether a potential partner had cospecialized or nonspecialized alliances with a firm’s rivals, were formally defined as:

\[
\text{Rivals’ cospecialized partner}_{ijt} = \sum_{k \neq i,j} (s_{ik} \alpha_{jk} + S_{jk} \alpha_{ik},i) p_{kt, ij}
\]

and

\[
\text{Rivals’ nonspecialized partner}_{ijt} = \sum_{k \neq i,j} (ns_{ik} \alpha_{jk} + ns_{jk} \alpha_{ik},i) p_{kt, ij}.
\]

The second set of independent variables measured whether potential partners had congruent competitive relations that would motivate countervailing alliances against a rival entity (either a rival alliance or a common rival). The variables cospecialized rival alliances and nonspecialized rival alliances evaluated whether the respective rivals of two potential partners maintained cospecialized or nonspecialized alliances. The measures were the sums of the number of such cospecialized and nonspecialized alliances, weighted by the competitive relations of those rival firms with the potential partners. The countervailing logic discussed above requires that the competitive relations of potential partners with the members of rival alliances be stronger than those with each other. For example, if firms $i$ and $j$ had rivals $k$ and $l$, respectively, the condition requires that $\alpha_{ik}$ be greater than $\alpha_{ip}$ and $\alpha_{jl}$ greater than $\alpha_{ji}$. The variables looped through all the alliances in the industry involving different firms and aggregated those that involved rivals of the potential partners. I aggregated these relations using weights reflecting the combined revenues of both members of the rival alliances.

\[
\text{Cospecialized rival alliances}_{ijt} = \sum_{k \neq l, j} \sum_{l \neq j, k} \alpha_{ik} S_{kl} \alpha_{jl}(p_{kt, ij} + p_{ln, ij})
\]

and

\[
\text{Nonspecialized rival alliances}_{ijt} = \sum_{k \neq l, j} \sum_{l \neq j, k} \alpha_{ik} ns_{kl} \alpha_{jl}(p_{kt, ij} + p_{ln, ij}).
\]

The variable common rivals measured whether potential partners had competitive relations with third-party rivals that were more intense than the competitive relations with each other. The variable was the sum of the combined competitive ties to common rivals, provided that those ties were greater than those linking the pair to each other, and weighted by the revenues of those common rivals:

\[
\text{Common rivals}_{ijt} = \sum_{a \neq i,j} \alpha_{ik} \alpha_{jl} p_{kt, ij}.
\]

I chose a unit scale of the rival alliances and common rivals variables that facilitated comparison of coefficients. Thus, the magnitude of the effect on alliance formation of an alliance between two nonoverlapping rivals who jointly captured 5 percent of the revenues of third parties in the sample would be comparable to the effect magnitude of a single common rival with the same combined scope that alone controlled 5 percent of the third-party revenues.

**Control Variables**

To avoid spurious correlations, it was important to control for other variables that might influence alliance formation. Such control was particularly important in this study because the independent variables represented structural measures based on competitive and cooperative networks, yet other network dimensions might also affect alliance formation.

First, I controlled for previously used antecedents of alliance formation, such as size and performance (Burgers, Hill, & Kim, 1993; Gulati, 1995). Larger or better-performing firms may be more attractive partners as they can bring superior resource endowments to alliances. The tendency for firms with high status to ally with other high-status firms may encourage alliance formation among firms of similar size and performance. To account for these effects, I controlled for the size of the larger firm of a dyad (the logarithm of the sales of the larger firm) and for the ratio of the sizes in a dyad (the log of the ratio of the smaller firm’s sales to the larger firm’s sales). I also controlled for the average performance of firms (the mean return on sales) and for the difference in performance (the absolute difference between two firms’ performance levels). I also included year dummy vari-
ables to control for industry-level effects influencing alliance formation propensities in different years. The effects captured by these year dummies may be exogenous, such as regulation or macroeconomic context, or endogenous, such as the global alliance density in the industry.

Second, I controlled for the level of dyadic niche overlap between potential partners. Moderate niche overlap between firms might facilitate the efficient integration of networks and the potential for consolidation of activities and scale economies in some routes, but substantial niche overlap might indicate excessive duplication and a strong competitive orientation. I controlled for the linear and quadratic effect of dyadic niche overlap, after centering the variable. Since niche overlap is asymmetric, I used the maximum directional level of niche overlap (a maximum of $\alpha_{ij}$ and $\alpha_{ji}$) as the control variable. Moreover, since the emphasis was on international alliance formation, I excluded from the risk set any pairs of firms from the same country.

Third, I controlled for dyadic complementarity between potential partners. If two potential partners occupy complementary niches, they may face alliances between their respective rivals or confront common rivals spanning their respective niches. Controlling for complementarity avoids spurious results. Complementarity requires more than just low niche overlap; it requires that the combination of scopes and capabilities result in value creation given the alternative offerings in the industry. Complementarity was measured as the ratio between the size-adjusted sum of city-pair markets not currently served by the airlines that could be served effectively if firms were to fully integrate their networks and the average size-adjusted market scope of the airlines. For example, a value of 0.1 indicated that the new markets that could be effectively served through an alliance would represent 10 percent of the firms’ current activities. The Appendix presents technical details of the calculation of this measure.

Fourth, I controlled for the different propensities of dyad members to engage in cooperative and competitive relationships. The total volume of relations of firms to all other firms in the industry may indicate a propensity by actors to form ties. Disregarding these differences in actors’ propensities to create ties may create a network autocorrelation bias, since errors in multiple dyads that share the same firm may be correlated because of the “common actor” effect (Lincoln, 1984). A solution for this problem is to control for the competitive and cooperative relations of dyad firms to all other firms in the sample, since those control variables would capture a potential common actor effect (Lincoln, 1984). Four variables controlled for the prior alliance activity of dyad members: the sum of the cospecialized alliances by both firms weighted by partner size, its square (after mean centering), and the size-weighted sum of the nonspecialized alliances of both firms, and its square (after centering) (Gulati, 1995). In addition, these variables also controlled for the tendency of firms to partner with high-centrality firms and the tendency of firms with high status in an alliance network to ally with other high-status firms.3 The quadratic effects accounted for possible reduction in alliance formation propensity for firms with large portfolios of alliances. Firms also occupy different competitive niches in an industry in terms of their overall competitive relations to other firms; some niches may be more crowded than others. Like technological crowding (Stuart, 1998), competitive crowding in a firm’s niche may influence alliance activity. I measured a firm’s competitive crowding as the revenue-weighted sum of the competitive relations of the firm to every other firm in the industry, excluding the other member of a given pair. I controlled for a dyad’s competitive crowding using the sum of the two firms’ crowding measures (Stuart, 1998) and controlled for the pair’s difference in crowding using the absolute difference in competitive crowding between potential partners.

Finally, I controlled for other network mechanisms that might lead to alliance formation. Alliance network research has shown that firms tend to select partners from others with direct and indirect network cohesion (Gulati, 1995; Gulati & Gargiulo, 1999), since a network provides knowledge and referrals about the capabilities and reliability of potential partners. The study examined dyads at risk of forming their first alliance and therefore lacking direct ties before the event. However, such firms could have indirect ties through alliances to common partners. I controlled for these indirect ties through three variables that provided revenue-weighted sums of indirect ties through common partners in three cases: when the potential partners hadcospecialized alliances with the common partners, when the ties to common partners were nonspecialized alliances, and when they were a mixture (one cospecialized, one not).

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3 Traditional network status measures should be used in directional networks, since they focus on the “in-degrees” received by an actor and the status of originating actors. For nondirectional relations such as those studied here, network status converges to centrality (Wasserman & Faust, 1994).
### TABLE 1
Descriptive Statistics and Correlations

| Variable                                      | Mean  | s.d.  | 1    | 2   | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   | 13   | 14   | 15   | 16   | 17   | 18   | 19   | 20   |
|-----------------------------------------------|-------|-------|------|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 1. Rivals' cospecialized partner              | 0.01  | 0.01  |      |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| 2. Rivals' nonspecialized partner            | 0.01  | 0.02  | -0.09|     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| 3. Nonspecialized rival alliances             | 0.01  | 0.01  | -0.04| -0.13|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| 4. Cospecialized rival alliances              | 0.01  | 0.01  | -0.39| -0.04| -0.09|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| 5. Common rivals                              | 0.00  | 0.01  | -0.16| -0.12| -0.18|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| 6. Large firm sales                          | 8.10  | 0.96  | -0.26| -0.07| -0.05| -0.03| -0.05|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| 7. Small/large firm sales                     | -1.28 | 0.91  | -0.06| -0.07| -0.01| -0.02| -0.02| -0.64|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| 8. Mean performance                          | 0.00  | 0.07  | -0.06| -0.06| -0.07| -0.06| -0.03| -0.08| -0.05|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| 9. Performance difference                    | 0.09  | 0.12  | -0.04| 0.00 | -0.14| -0.03| -0.04| -0.07| -0.08| -0.55|      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| 10. Niche overlap                            | -0.01 | 0.07  | -0.05| -0.01| -0.20| -0.18| 0.10 | 0.24 | -0.09| -0.01| -0.02|      |      |      |      |      |      |      |      |      |      |      |      |      |
| 11. Niche overlap squared                    | 0.01  | 0.03  | -0.00| -0.02| -0.07| -0.11| -0.08| -0.05| -0.00| -0.01| -0.72|      |      |      |      |      |      |      |      |      |      |      |      |      |
| 12. Complementarity                          | 0.04  | 0.07  | -0.15| -0.05| -0.19| -0.03| -0.07| -0.06| -0.03| -0.02| -0.02| -0.02| -0.03| -0.02|      |      |      |      |      |      |      |      |      |
| 13. Dyad's cospecialized alliances           | -0.01 | 0.08  | -0.58| -0.08| -0.02| -0.15| -0.09| -0.45| -0.11| -0.13| -0.06| -0.17| -0.04| -0.04|      |      |      |      |      |      |      |      |      |
| 14. Dyad's cospecialized alliances squared   | 0.01  | 0.01  | -0.34| -0.04| -0.02| -0.05| -0.09| -0.05| -0.08| -0.04| -0.06| -0.08| -0.04| -0.02| -0.47|      |      |      |      |      |      |      |      |
| 15. Dyad's nonspecialized alliances          | 0.00  | 0.11  | -0.52| -0.04| -0.16| -0.12| -0.26| -0.01| -0.10| -0.02| -0.09| -0.04| -0.03| -0.21| -0.02|      |      |      |      |      |      |      |      |
| 16. Dyad's nonspecialized alliances squared  | 0.01  | 0.02  | -0.07| -0.27| -0.03| -0.05| -0.07| -0.08| -0.00| -0.07| -0.02| -0.03| -0.01| -0.01| -0.04| -0.48|      |      |      |      |      |      |      |      |
| 17. Competitive crowding, sum                | 0.12  | 0.05  | -0.36| -0.14| -0.39| -0.69| -0.45| -0.11| -0.06| -0.06| -0.03| -0.07| -0.01| -0.23| -0.12| -0.06| -0.20| -0.04|      |      |      |      |      |
| 18. Competitive crowding, difference         | 0.04  | 0.03  | -0.14| -0.10| -0.20| -0.36| -0.16| -0.03| -0.03| -0.07| -0.03| -0.14| -0.03| -0.13| -0.03| -0.01| -0.21| -0.06| -0.69|      |      |      |      |
| 19. Common partners, cospecialized          | 0.00  | 0.01  | -0.17| -0.06| -0.01| -0.03| -0.04| -0.10| -0.03| -0.03| -0.00| -0.05| -0.02| -0.02| -0.32| -0.32| -0.11| -0.07| -0.03| -0.01|      |      |
| 20. Common partners, mixed                  | 0.01  | 0.02  | -0.16| -0.19| -0.01| -0.02| -0.01| -0.16| -0.03| -0.07| -0.02| -0.06| -0.00| -0.00| -0.36| -0.33| -0.20| -0.01| -0.06| -0.02|      |      |
| 21. Common partners, nonspecialized         | 0.01  | 0.02  | -0.05| -0.35| -0.01| -0.11| -0.06| -0.09| -0.08| -0.07| -0.01| -0.07| -0.01| -0.04| -0.12| -0.04| -0.55| -0.52| -0.14| -0.16| -0.12| -0.14|

*a = 6,835; |r| > .02 implies significance at p < .05.

Logarithm.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Effect Multipliers Based on Model 4</th>
</tr>
</thead>
<tbody>
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<td>Rivals’ cospecialized partner</td>
<td>$b_1$</td>
<td>-47.67* (13.73)</td>
<td>-47.86* (13.47)</td>
<td>-70.23* (17.68)</td>
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<td>10.22 (6.44)</td>
<td>10.09 (6.62)</td>
<td>10.09 (6.62)</td>
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<td>Non-specialized rival alliances</td>
<td>$b_3$</td>
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<td>5.28 (9.96)</td>
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<td>70.23* (17.68)</td>
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<tr>
<td>Common rivals</td>
<td>$b_5$</td>
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<td>99.36* (22.12)</td>
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<td>0.53* (0.19)</td>
<td>0.74* (0.19)</td>
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<td>Niche overlap</td>
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<td>5.74* (1.87)</td>
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<td>1.23 (2.25)</td>
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<td>-3.36 (4.17)</td>
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<td>11.76* (3.92)</td>
<td>11.79* (3.90)</td>
<td>12.28* (3.89)</td>
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<td>-0.24 (3.61)</td>
<td>-2.59 (3.71)</td>
<td>-0.61 (3.61)</td>
<td>-2.92 (3.73)</td>
<td></td>
</tr>
<tr>
<td>Year 1995</td>
<td></td>
<td>0.48* (0.24)</td>
<td>0.50* (0.24)</td>
<td>0.52* (0.24)</td>
<td>0.55* (0.24)</td>
<td></td>
</tr>
<tr>
<td>Year 1996</td>
<td></td>
<td>-0.21 (0.29)</td>
<td>-0.24 (0.29)</td>
<td>-0.38 (0.30)</td>
<td>-0.40 (0.29)</td>
<td></td>
</tr>
<tr>
<td>Year 1997</td>
<td></td>
<td>0.10 (0.29)</td>
<td>0.03 (0.29)</td>
<td>-0.04 (0.30)</td>
<td>-0.10 (0.30)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td>-6.78* (1.52)</td>
<td>-7.08* (1.43)</td>
<td>-7.63* (1.51)</td>
<td>-7.93* (1.44)</td>
<td></td>
</tr>
</tbody>
</table>

Hypothesis tests:
- **H1:** $b_1 < b_2$, 19.29* 19.55*
- **H3:** $b_1 > b_3$, 7.75* 13.85*
- **H5:** $b_3 > b_4$, 4.51* 1.80

Observations: 6,835 6,835 6,835 6,835
Log-likelihood (df) -624.18 (19) -614.15 (21) -611.51 (22) -601.79 (24)
Log-likelihood, null model -698.31 -698.31 -698.31 -698.31
Likelihood ratio chi-square, relative to null model 204.10* 229.05 205.02 215.77*

McFadden’s $R^2$ .11 .12 .12 .14

---

* Robust estimates of standard errors are in parentheses.

* Logarithm.

* Values are Wald chi-squares with one degree of freedom.

† $p < .10$

* $p < .05$

Two-tailed tests.
Statistical Technique

Because alliance formation is inherently dynamic, I modeled it using a discrete-time event history approach based on logistic regression (Allison, 1982), in which the odds of an alliance formation event in a given year is a function of time-varying covariates. I divided event histories for each dyad into yearly spells and used logistic regression analysis to determine whether an alliance had not formed yet or had formed in that year. The year 1994 was taken as the initial network condition, and models evaluated alliance formation from 1995 to 1998. Alliances that had not formed by 1998 were considered right-censored.

Since there was a remaining risk of unobserved heterogeneity among the dyads in the model, I tested random-effects “logit” models with dyad-level unobserved heterogeneity (Gulati, 1995). The random effects were insignificant in all cases. The lack of significance may indicate lower unobserved heterogeneity in this single-industry sample than there would be in a multi-industry sample (Gulati, 1995). Nevertheless, to avoid any potential effects of autocorrelation, I based results on a robust estimation of the logistic regression that relaxed the assumption of independence of errors within dyads (Rogers, 1993).

I used a competing-risks discrete-time event history approach to model the formation of cospecialized and nonspecialized alliances by dyads (Allison, 1982; Hachen, 1988). The competing risks approach allowed me to simultaneously model the hazards of forming cospecialized and nonspecialized alliances in a given dyad and to compare the effect of independent variables on both hazards. Following Allison (1982), I estimated the discrete-time version of the competing-risks model using a multinomial logit model, where each pair-year spell has three possible outcomes: no alliance yet (a right-censored observation); weak alliance formed; and strong alliance formed. Dyads stayed in the sample until an alliance of some type was formed or until the end of the sample window. The “no alliance yet” category was used as the baseline outcome. I report results based on a robust estimation of the multinomial logit model that relaxed the assumption of independence of errors within dyads.

RESULTS

Table 1 presents descriptive statistics and correlations. Table 2 presents the results of the discrete-time event history analysis of alliance formation, using a logistic regression model, described above. Table 3 presents the competing risks analysis of cospecialized and nonspecialized alliance formation, using a multinomial logit model in which these risks are jointly estimated. Since the hypothesis tests are based on comparisons between coefficients, the tables present the relevant Wald tests of comparisons of coefficients. Beyond statistical significance, the relative magnitude of the effects should also be assessed. Coefficients that share the same scale can be compared directly in raw form. All hypothesis tests were based on comparisons of raw coefficients. I also present effect multipliers to compare coefficients on different scales. These multipliers are akin to standardized coefficients and reflect the relative magnitude of the effects. They describe the change in the odds-ratio associated with a one standard deviation increase in the respective independent variable, calculated as $\exp(\beta_i\sigma_i)$.

Hypothesis 1 states that the likelihood of alliance formation between a firm and its rivals’ partners is lower when the rivals’ alliances are cospecialized rather than nonspecialized. Models 2 and 4 of Table 2 (the first two rows) show the relevant effects. Alliance formation was significantly lower when potential partners have cospecialized alliances with rivals, but not when they had nonspecialized alliances. With multipliers assessing the magnitude of the effect, an increment of one standard deviation in cospecialized alliances between rivals and potential partners decreased the odds of alliance formation by 45 percent; an increment of one standard deviation in nonspecialized alliances between rivals and potential partners increased alliance formation by 17 percent (a statistically insignificant effect). The specific test of Hypothesis 1 involved the comparison of the coefficients for these two effects. These two coefficients were significantly different from each other ($p < .01$), supporting Hypothesis 1. The differences suggest that the tendency toward competitive exclusion is not a general feature of alliance networks but contingent on the level of cospecialization among the alliances linking rivals with potential partners. Competitive exclusion results when rivals are tied to potential partners with cospecialized alliances, but not when rivals are tied to potential partners with nonspecialized ties.

Hypothesis 2 proposes that alliances between rivals and potential partners have a greater exclusion
### TABLE 3
Discrete-Time Competing Risks Model of Alliance Formation Using Multinomial Logit Analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Model 5</th>
<th>Model 6</th>
<th>Wald Tests</th>
<th>Effect Multipliers based on Model 6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Nonspecialized</td>
<td>Cospecialized</td>
<td></td>
<td>Nonspecialized Cospecialized</td>
</tr>
<tr>
<td>Rivals’ cospecialized partner</td>
<td>$b_1$</td>
<td>$-31.10^{*}$ (16.79)</td>
<td>$-122.52^{*}$ (30.93)</td>
<td>H2: $b_{ns} &gt; b_s$</td>
<td>$5.42^{<em>}$ 0.68† 0.25</em>&gt;</td>
</tr>
<tr>
<td>Rivals’ nonspecialized partner</td>
<td>$b_2$</td>
<td>$22.23^{*}$ (7.14)</td>
<td>$-32.56$ (20.03)</td>
<td>H2: $b_{ns} &gt; b_s$</td>
<td>$6.76^{<em>}$ 1.42</em> 0.60</td>
</tr>
<tr>
<td>Nonspecialized rival alliances</td>
<td>$b_3$</td>
<td>$7.24$ (11.73)</td>
<td>$-4.69$ (18.01)</td>
<td>H2: $b_{ns} &gt; b_s$</td>
<td>$0.33$ 1.09 0.95</td>
</tr>
<tr>
<td>Cospecialized rival alliances</td>
<td>$b_4$</td>
<td>$41.46^{*}$ (23.76)</td>
<td>$136.43^{*}$ (32.55)</td>
<td>H4: $b_{ns} &gt; b_s$</td>
<td>$7.37$ 3.85* 3.85*</td>
</tr>
<tr>
<td>Common rivals</td>
<td>$b_5$</td>
<td>$83.88^{*}$ (23.83)</td>
<td>$157.74^{*}$ (47.96)</td>
<td></td>
<td>$2.09$ 1.53* 2.24*</td>
</tr>
<tr>
<td>Large firm sales $^a$</td>
<td></td>
<td>$0.34$ (0.22)</td>
<td>$1.15^{*}$ (0.43)</td>
<td></td>
<td>$0.57^{<em>}$ 1.72</em> 5.92*</td>
</tr>
<tr>
<td>Small/large firm sales</td>
<td></td>
<td>$0.31^{*}$ (0.15)</td>
<td>$0.48^{*}$ (0.25)</td>
<td></td>
<td>$0.40^{<em>}$ 1.44</em> 2.31*</td>
</tr>
<tr>
<td>Mean performance</td>
<td></td>
<td>$-1.39$ (1.89)</td>
<td>$-1.13$ (2.21)</td>
<td></td>
<td>$-1.88$ (2.00) 2.57 (2.26)</td>
</tr>
<tr>
<td>Performance difference</td>
<td></td>
<td>$-1.32$ (1.23)</td>
<td>$-0.04$ (2.11)</td>
<td></td>
<td>$-1.20$ (1.34) 2.60 (2.60)</td>
</tr>
<tr>
<td>Niche overlap</td>
<td></td>
<td>$5.52^{*}$ (1.70)</td>
<td>$6.98$ (4.95)</td>
<td></td>
<td>$6.04^{*}$ (2.05) 7.37 (5.26)</td>
</tr>
<tr>
<td>Niche overlap squared</td>
<td></td>
<td>$-6.44$ (4.48)</td>
<td>$-26.30$ (23.62)</td>
<td></td>
<td>$-8.25^{*}$ (4.32) 32.31 (24.52)</td>
</tr>
<tr>
<td>Complementarity</td>
<td></td>
<td>$-1.76$ (2.34)</td>
<td>$0.51$ (2.45)</td>
<td></td>
<td>$0.45$ (1.48) 2.97 (1.30)</td>
</tr>
<tr>
<td>Dyad’s cospecialized alliances</td>
<td></td>
<td>$1.26$ (2.63)</td>
<td>$2.68$ (5.06)</td>
<td></td>
<td>$2.97$ (2.67) 8.82 (4.28)</td>
</tr>
<tr>
<td>Dyad’s cospecialized alliances squared</td>
<td></td>
<td>$-26.22$ (21.78)</td>
<td>$-6.06$ (16.62)</td>
<td></td>
<td>$-23.24$ (20.17) 19.87 (19.87)</td>
</tr>
<tr>
<td>Dyad’s nonspecialized alliances</td>
<td></td>
<td>$2.86^{*}$ (1.46)</td>
<td>$-1.43$ (2.97)</td>
<td></td>
<td>$1.11$ (1.57) 4.14 (3.52)</td>
</tr>
<tr>
<td>Dyad’s nonspecialized alliances squared</td>
<td></td>
<td>$-11.71^{*}$ (6.18)</td>
<td>$-3.58$ (16.19)</td>
<td></td>
<td>$-11.54^{*}$ (6.50) 12.41 (22.60)</td>
</tr>
<tr>
<td>Competitive crowding, sum</td>
<td></td>
<td>$-6.50$ (4.63)</td>
<td>$0.46$ (7.20)</td>
<td></td>
<td>$-23.74^{*}$ (7.07) 34.10 (12.48)</td>
</tr>
<tr>
<td>Competitive crowding, difference</td>
<td></td>
<td>$-8.82$ (7.33)</td>
<td>$5.23$ (9.51)</td>
<td></td>
<td>$-5.24$ (7.54) 28.64 (11.81)</td>
</tr>
<tr>
<td>Common partners, cospecialized</td>
<td></td>
<td>$20.25^{*}$ (5.91)</td>
<td>$30.03^{*}$ (7.20)</td>
<td></td>
<td>$20.25^{*}$ (5.84) 31.31 (7.91)</td>
</tr>
<tr>
<td>Common partners, mixed</td>
<td></td>
<td>$10.66^{*}$ (4.35)</td>
<td>$12.88^{*}$ (7.72)</td>
<td></td>
<td>$11.28^{*}$ (4.32) 14.53 (7.76)</td>
</tr>
<tr>
<td>Common partners, nonspecialized</td>
<td></td>
<td>$0.25$ (4.00)</td>
<td>$1.02$ (7.44)</td>
<td></td>
<td>$-2.98$ (3.94) -1.54 (8.48)</td>
</tr>
<tr>
<td>Year 1995</td>
<td></td>
<td>$0.39$ (0.27)</td>
<td>$0.84$ (0.61)</td>
<td></td>
<td>$0.44^{*}$ (0.27) 1.05 (0.51)</td>
</tr>
<tr>
<td>Year 1996</td>
<td></td>
<td>$-0.20$ (0.32)</td>
<td>$-0.12$ (0.76)</td>
<td></td>
<td>$-0.33$ (0.32) -0.62 (0.69)</td>
</tr>
<tr>
<td>Year 1997</td>
<td></td>
<td>$0.12$ (0.32)</td>
<td>$0.20$ (0.68)</td>
<td></td>
<td>$0.02$ (0.32) -0.53 (0.71)</td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td>$-5.40^{*}$ (1.69)</td>
<td>$-15.36^{*}$ (3.65)</td>
<td></td>
<td>$-6.38^{*}$ (1.63) 18.58 (3.62)</td>
</tr>
</tbody>
</table>

Observations 6,835 6,835 6,835 6,835 6,835 6,835 6,835
Log-likelihood $-682.74$ (38) $-648.77$ (48) $-774.59$ $-774.59$ $348.85$
Likelihood ratio chi-square, relative to null model
McFadden’s $R^2$ .12 .16

$^a$ Robust estimates of standard errors are in parentheses.
$^b$ Logarithm.
$^c$ $b_{ns} \neq b_s$.
$^* p < .10$
$^† p < .05$
Two-tailed tests.
The presence of cospecialized rival alliances had a very powerful effect on the formation of cospecialized countervailing alliances \((p < .01)\) and, more marginally, on the formation of nonspecialized countervailing alliances \((p < .1)\). Whereas an increment of one standard deviation in cospecialized rival alliances increased the odds of nonspecialized alliance formation by 51 percent, the same change increased the odds of cospecialized alliance formation by 285 percent. A Wald test showed that these two coefficients were statistically significant from one another in the expected direction \((p < .05)\).

Finally, Hypothesis 5 compares the effect on the likelihood of alliance formation of common rivals and cospecialized rival alliances. Models 3 and 4 in Table 2 (rows 4 and 5) provide the results. The results suggested that both cospecialized rival alliances and common rivals lead to the formation of countervailing alliances \((p < .01)\). A one standard deviation increase in common rivals would increase the odds of alliance formation by 66 percent. Specifically, it would increase the odds of formation of nonspecialized alliances by 53 percent, and those of formation of cospecialized alliances by 124 percent (multipliers in Table 3). Yet a Wald comparison of the coefficients of common rivals and cospecialized alliances showed that these effects were not significantly different from each other, failing to support the hypothesis. Countervailing alliance formation in response to common rival entities was the same whether the rival entity was an integrated rival or a cospecialized rival alliance.

**DISCUSSION AND CONCLUSIONS**

This study examined the embeddedness of dyadic alliance formation in the context of competitive and alliance relations with third parties. I found that partner selection and the type of alliances formed were influenced by competitive embeddedness. In particular, when responding to the alliances made by their rivals, firms focused on aligning with their rivals’ partners (generating intranetwork competition) or on forming countervailing alliances against the rivals and their partners (generating intranetwork competition). The findings do not support a naive view that inter- or intranetwork competition will be systematically predominant: the outcome depends on the level of alliance cospecialization. Intranetwork competition is favored when alliances by rivals involve low cospecialization, but it is avoided when alliances by rivals are highly cospecialized. In situations of high alliance cospecialization, intranetwork competition is favored. Thus, the effects of competitive embeddedness on alliance formation are contingent on the level of cospecialization of alliances.
Given the dearth of research that carefully models the interactions between alliance and competitive networks, this is a promising avenue for future research in alliance competition (Gomes-Casseres, 1996; Silverman & Baum, 2002; Stuart, 1998).

This finding provides a point of convergence between two current logics of competition in alliance networks: internetwork competition, emphasizing the emergence of polarized and exclusive alliance constellations, and intranetwork competition, emphasizing the selection of powerful brokering and bridging positions within networks. Effective alliance strategies in one context may not be effective in the other. Researchers and managers should not assume that one logic of competition systematically predominates in all contexts. The results suggest that alliance cospecialization determines which type of network competition will predominate in a given context. Most industries, like the airline industry, probably have a mixture of intra- and inter-network competition, and changes in alliance cospecialization would shift that balance. In the airline industry, the network of cospecialized alliances seem to follow the logic of rival and exclusive complementary blocks described by Nohria and Garcia-Pont (1991), while nonspecialized alliances allow rivals to share common partners. The increased levels of alliance cospecialization in the mid-1990s triggered the emergence of competing alliance groups.

The model describes some rules of alliance formation and partner selection that, after interactions, could lead to the emergence of particular network structures. In the cospecialized alliance network, alliances influence the formation of countervailing alliances by rivals, and the avoidance of alliances with rivals’ partners. When combined with the strong tendency of firms to partner with those firms with which they have prior direct or indirect ties, these competitive influences would lead to the formation of internally cohesive groups that are separate from other groups. Judging from the effect multipliers, it appears that competitive exclusion and countervailing alliance effects are at least as important as the effect of indirect alliance ties (referrals from common partners) in selecting partners and structuring these constellations. In a way that resembles Heider’s (1946) famous theory of balanced triads, in the present results group formation is not only driven by the inclusion of the friends of one’s friends, but also, critically, by the tendency to include the enemy’s enemy and to exclude the friend’s enemy and the enemy’s friend. Without the latter pressures to exclude rivals, a highly connected but inclusive group would eventually emerge from the interaction of actors. In the network of nonspecialized alliances, however, the tendency is for inclusive networks in which direct rivals can connect to (and compete for) the same partners.

Figure 2 depicts some tentative evidence of how the different patterns of cospecialized and nonspecialized alliance formation resulted in emerging structural network patterns. The figure plots a measure of clusterability (the tendency of networks to form cohesive coalitions) over time for the overall alliance network and for the subnetworks of cospecialized and nonspecialized alliances. The measure is the weighted overall clustering coefficient, which measures the percentage of triads in which alliances exist between \( ik, kj, \) and \( ij \), over the triads where an alliance exists between \( ik \) and \( kj \) (Borgatti, Everett, & Freeman, 2002). During the period 1994–98, the overall alliance network had a slight tendency toward greater clusterability. Yet separating the effects of the two subnetworks reveals that this tendency was due to the increase in clusterability in the cospecialized alliance network, which nearly doubled over the period. The nonspecialized alliance network, on the other hand, displayed stable, low levels of clusterability. This descriptive evidence demonstrates a link between the competitive determinants of alliance formation and the emerging structural patterns in the network.

The study also has important implications for the research on partner selection. Researchers have traditionally viewed partner selection as primarily a quest to reduce partner uncertainty and find reliable partners. Partner selection has been depicted as a local network search among firms that have prior direct or indirect ties to the searching firm. Those ties provide knowledge and referrals about the capabilities and reliability of the potential partner and reduce partner uncertainty (Gulati, 1995; Gulati & Gargiulo, 1999). Firms then create alliances with the potential partners in the local set that provide complementary capabilities. This study extends that view in two ways. First, it suggests that competitive embeddedness guides the choice of partner beyond complementary capabilities. Given multiple potential partners with complementary capabilities, firms will select those that allow them to match or neutralize their rivals’ advantages. Second, competitive embeddedness may facilitate partner selection beyond the local network scan of direct and indirect contacts. Potential partners with compatible competitive networks (for instance, with common rivals or cospecialized rival alliances) may be less uncertain, since their competitive objectives are aligned. Potential partners with conflicting competitive networks (for instance, with cospecialized alliances to rivals) could
be avoided. Although alliance network embeddedness clearly contributes to partner selection (the odds of alliance formation are four times higher among firms with indirect connections), its importance may have been overplayed in the literature. For example, 30 percent of the alliances in the sample were formed among firms with no prior direct or indirect alliance ties. It is likely that competitive embeddedness considerations contributed to the selection of those partners.

Limitations and Extensions

Given the single-industry data used in this study, the results should be examined for their generalizability in other contexts. My theory did not rely on any idiosyncratic characteristic of the global airline industry and, therefore, the theoretical predictions should generalize to other industries. Generalizability is only claimed for the contingent predictions. The relative prevalence of inter- or intranetwork competition may vary across industries and contexts. However, the predictions that increased cospecialization of alliances should lead to greater competitive exclusion and a greater tendency toward countervailing alliances should be generalizable.

The airline industry is idiosyncratic because of regulation that limits competitive and corporate strategy choices, and the government ownership of many airlines. Regulations generally forbid airlines from establishing transfer hubs beyond their national soil, even though they may serve foreign markets through connection to their home markets. Acquisitions and large equity stakes are also severely restricted. As a result, airlines have turned to alliances as a mechanism for globalization and may maintain alliance relations to govern transactions that in other industries would perhaps be governed within firm boundaries. However, although these considerations may affect the baseline hazard of alliance formation, it is not clear that they would produce systematic coefficient biases in the directions of the results.

Several extensions appear worth exploring in future work. First, the performance effects of alliance formation choices could be examined, both at the firm and the industry levels. Research could examine the performance implications of inter- and intranetwork competition. Although internetwork competition creates value when firms cospecialize their operations, such value probably dissipates when rivals form countervailing alliances. This dissipation might lead to situations in which firms become irreversibly linked by cospecialized alliances, yet the benefits from cospecialization have been distributed away in the competition for customers. Second, the impact of environmental un-

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**FIGURE 2**

Evolution of Clusterability in the Network of Cospecialized and Nonspecialized Alliances

a The index is calculated as “nonvacuous transitive triples” divided by all “ordered triples” with indirect ties.
certainty could be examined, since it may influence the predominance of internetwork and intranetwork competition. Because of “strategic gridlock” in internetwork competition, path-dependent evolutionary processes may lead to structural inertia and “lock-in” in network structure. Firms may not be able to change partners because alternative partners are already taken up by competitors. Such a situation is hazardous in an environment with high uncertainty and variability. Less cospecialization and greater internetwork competition creates a more fluid and adaptive industry environment. Third, it would be interesting to examine competitive embeddedness in the context of vertical alliance relations, such as supply chain and distribution channel alliances (Bonaccorsi & Giuri, 2001; Fein & Anderson, 1997). In nonspecialized vertical relations, buyers and suppliers have an incentive to be inclusive in order to reach the broadest market, and thus rivals may share suppliers and channels. Yet vertical cospecialization may lead to exclusive vertical alliances, which may incite other countervailing alliances and transform a vertical market into a set of exclusive vertical networks. Fourth, it would be worth exploring the effect of firm-specific resource endowments on the structuring of networks. While this study focused on exclusivity as an efficiency-enhancing mechanism in cospecialized transactions, exclusivity may also result from asymmetries in initial bargaining power that are the consequence of heterogeneous resource endowments. Powerful firms may expect exclusivity from their partners without pledging exclusivity to them. In that sense, initial power asymmetries may affect the structure of an emerging alliance network.

In conclusion, the study shows that the structure of competitive and alliance relations surrounding potential partners and the cospecialization of alliances in an industry influences alliance formation. In competitive contexts, firms with cospecialized alliances may pledge their mutual commitment by shunning alliances with their rivals’ partners and their partners’ rivals. These rivals, in return, may form countervailing alliances that attempt to replicate their opponents’ alliance benefits. That behavior influences the evolution of the network toward polarization and internetwork competition. Non-specialized alliances, on the other hand, do not require exclusivity, and therefore they facilitate a more fluid intranetwork competition. This article shows how uncoordinated alliance formation behaviors at the dyadic level aggregate into different emerging structural patterns in a network. This understanding of the link between firm behavior and emergent structure is important for developing more prescriptive formal models and simulations of how networks emerge and evolve.

REFERENCES


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**APPENDIX**

**Construction of Measures**

**Dyadic Niche Overlap**

Niche overlaps between airlines in international city-pair markets were measured using statistics from the 1993 to 1997 *Traffic by Flight Stage* of the International Civil Aviation Organization (ICAO), a United Nations agency that promotes international cooperation in civil aviation among national regulatory bodies. The data, which contained information about the international segments flown by airlines of participating countries (most countries with important airline operations), were used for reconstructing the network of operations of each airline. To restrict the number of possible city-pair markets under consideration, I considered only traffic between the world’s 200 largest cities by air traffic volume (which accounted for 91.31 percent of the international traffic in the sample). A firm’s route structure includes either direct service or one-stop service to a given market. To avoid feasible but impractical one-stop itineraries such as Los Angeles-London-Tokyo, I only considered one-stop service relevant when the ratio of the total distance flown to the direct distance between origin and destination was below 125 percent. These distances in miles were calculated from the latitude and longitude of the cities (in radians), using the great-circle distance formula:

$$\text{Distance}_{AB} = 3,959.74 \times \arccos[\sin(lat_A) \times \sin(lat_B) + \cos(lat_A) \times \cos(lat_B) \times \cos(long_A - long_B)].$$

Since customers generally consider one-stop service an inferior substitute for direct service, an airline was
deemed to be serving a city-pair market effectively (and therefore considered as an incumbent) if either: (1) it offered direct service in a city-pair market when other rivals offered direct or one-stop service or (2) it offered one-stop service in a city-pair market when other rivals offered one-stop service but no direct service.

The above procedures generated data about the activities of the 67 airlines in 12,847 international city-pair markets. All city-pair markets with origin and destination in the same country were eliminated. The variable \( N_{mt} \) captured the number of incumbents in each market; the average number of incumbent airlines per city-pair market was 2.55. To account for heterogeneity in the size of markets, I obtained an indicator of the traffic volume in each city-pair market from the gravity model, a popular traffic forecasting rule that states that traffic between two cities is proportional to the total traffic in the origin and destination cities and inversely proportional to the distance between the cities (Doganis, 1991). The variable \( MktSize_{mt} \) equals the product of origin and destination traffic divided by the great-circle distance in miles between the cities.

Niche overlap between firms \( i \) and \( j \) at time \( t \) was calculated as the ratio of the scope of overlap between \( i \) and \( j \) relative to the scope of the focal firm \( i \). The measure ranged from 0 to 1, where a value of 1 indicated that the focal firm overlapped with the rival in all the markets it served. I calculated scope overlap as the sum over all 12,847 markets of the product of two presence dummies \( I_{imt} \) and \( I_{jmt} \) that represented firm presence in each market, adjusted by the ratio of the size of the market \( MktSize_{mt} \) to the incumbent density in the market \( N_{mt} \), to account for heterogeneity in market size and market structure. Unfortunately, information about actual market shares of firms in each market was not available. The denominator captured the scope of the focal firm in the same size-adjusted terms.

\[
\alpha_{ijt} = \frac{\sum_{m=1}^{12,847} I_{imt} \times I_{jmt} \times (MktSize_{mt}/N_{mt})}{\sum_{m=1}^{12,847} I_{imt} \times (MktSize_{mt}/N_{mt})}.
\]

**Dyadic Complementarity**

Complementarity was measured as the ratio of the size-adjusted sum of international city-pair markets not currently served by the airlines that could be served effectively if firms were to fully integrate their networks, relative to the average size-adjusted market scope of the firms. To calculate this variable, I considered that a combined network could serve city-pairs by either one- or two-stop service (since a common aspect of alliances involves serving city-pairs by traveling through the hubs of both partners, such as Barcelona-Frankfurt-Chicago-Cincinnati). I assumed that an alliance served a market effectively if the flown distance was not more than 25 percent higher than the direct distance and if it did not offer service with more connections than incumbents did (that is, two-stop travel would not be considered effective in markets where companies were flying with zero or one stop). I identified those markets that could be served by the combined networks but were not served by the firms independently with a dummy, \( C_{ijmt} \). As for the calculation of niche overlap, I weighted each market by the factor \( MktSize_{mt}/N_{mt} \), the ratio of market size to number of incumbents, to account for differences in opportunities across markets. To scale the magnitude of the complementarity, I divided the measure by the average of the scope of the potential partners in size-adjusted terms:

\[
\text{Complementarity}_{ijt} = \frac{\sum_{m=1}^{M} C_{ijmt} \times (MktSize_{mt}/N_{mt})}{\left[\sum_{m=1}^{M} I_{imt} \times (MktSize_{mt}/N_{mt}) + \sum_{m=1}^{M} I_{jmt} \times (MktSize_{mt}/N_{mt})\right] / 2}.
\]

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