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COOPERATIVE NETWORKS AND COMPETITIVE DYNAMICS: A STRUCTURAL EMBEDDEDNESS PERSPECTIVE

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Firms are embedded in networks of cooperative relationships that influence the flow of resources among them. Dynamic resource flows and differentiated structural positions lead to asymmetries and influence firms' competitive behavior toward others in the network. We develop a multilevel conceptual model relating key network properties to competitive action and response. A structural embeddedness perspective with a focus on simultaneous cooperation and competition advances our understanding of competitive dynamics and provides intriguing possibilities for future research.

The competitive dynamics literature has evolved from an early focus on specific action characteristics to an emphasis on action repertoires (Ferrier, Smith, & Grimm, 1999; Miller & Chen, 1994) and the firm, dyad, and industry predictors of competitive action and response (Chen, 1996; Smith, Grimm, Gannon, & Chen, 1991; Young, Smith, & Grimm, 1996). Compared to how firm and action *attributes* influence competitive behavior, however, the effects of *relationships* among competitors have received little attention (Chen, 1996), with the exception of the effects of industry associations (e.g., Scherer & Ross, 1990) and multimarket contact (e.g., Baum & Korn, 1999; Gimeno, 1999). In recent years cooperative linkages among *competitors* have proliferated (Gomes-Casseres, 1996); according to some reports, 50 percent of new alliances are between competitors (Harbison & Pekar, 1998). Even after establishing such cooperative relationships, firms continue to compete vigorously with each other in many areas, leading to constructs such as "co-opetition" (Brandenburger & Nalebuff, 1996). Given the increasing importance of this competitive reality, we ask, "How does the network of cooperative linkages among competitors influence their competitive behavior toward each other?"

In exploring this research question, we adopt an embeddedness perspective (Baum & Dutton, 1996; Dacin, Ventresca, & Beal, 1999; Granovetter, 1985), which suggests that competitors, far from being *atomistic* entities free to undertake any competitive action within their own resource constraints, are *embedded* in a network of relationships that influences their competitive behavior. We develop a multilevel conceptual model of how the structural properties of firms, as well as the structure of the network to which they belong, influence the flow of assets, information, and status among network members. Resource asymmetries occur because of the differential flow of resources among network members, as well as their differential ability to control such flows. Therefore, network-based resource advantages vary across firms, resulting in varied levels of motivation and ability to undertake action or to respond to actions of others. Accordingly, we contribute to the literature by developing an embeddedness perspective of competitive dynamics and by specifying an empirically testable multilevel conceptual model of network effects on competitive dynamics.

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CONCEPTUAL BACKGROUND

We first establish three critical elements that serve as the conceptual scaffolding for our model: the distinctive contribution of an embeddedness approach to competitive dynamics, the importance of networks as loci of firm resources, and the theoretical boundaries of the model.

The Embeddedness of Competitive Behavior

The key embeddedness argument is that actors' purposeful actions are *embedded* in concrete and enduring strategic relationships that impact those actions and their outcomes (Baum & Dutton, 1996; Dacin et al., 1999; Granovetter, 1985). Of the four aspects of embeddedness identified in the literature (Zukin & DiMaggio, 1990)—cognitive, cultural, political, and structural—we focus on *structural embeddedness* (i.e., how the interfirm network influences competitive behavior), for two reasons.

First, although the influence of structural embeddedness on economic behavior is acknowledged in the literature (Granovetter, 1985; Uzzi, 1997) and although strategy researchers have increasingly used this approach (Gulati, Nohria, & Zaheer, 2000; Madhavan, Koka, & Prescott, 1998), the structural embeddedness of competitive dynamics has not been studied explicitly (Bhardwaj, 1997). Second, since there is substantial precedent for treating structural positions and networks as *resources* upon which the firm can draw in its strategic actions (Gulati, 1999; McEvily & Zaheer, 1999), the structural embeddedness perspective, with its focus on networks, allows us to explicitly model how external resources influence competitive behavior. For example, a superior position in the network of cooperative relations translates into resource advantage and, thence, into an increased likelihood of competitive action. Further, the network serves as a search and monitoring mechanism for each other's strategies and actions, increasing, in the process, the cognitive salience of some competitors relative to others.

Thus, the use of the network approach (Nohria, 1992) helps advance research in competitive dynamics and address prior calls for developing a better understanding of competitive phenomena (Chen & Miller, 1994; Gnyawali, 1995).

Networks As Loci of Resources

The importance of a firm's *internal* resources is widely accepted in the strategy literature in general (e.g., Barney, 1991; Mahoney & Pandian, 1992) and the competitive dynamics literature in particular (e.g., Chen, 1996; Grimm & Smith, 1997). We consolidate four sets of arguments to establish that resources also reside in the firm's external network and are important to a firm. First, relationships in a network are potential *conduits* to internal resources held by connected actors (Nohria, 1992). Second, *external economies*—that is, "capabilities created within a network of competing and cooperating firms"—often complement firms' internal resources (Langlois, 1992: 4). Third, the *rate of return* on internal resources is determined by how well structured the firm's network is (Burt, 1992). And fourth, a firm's position in a network contributes to its *acquisition* of new competitive capabilities (McEvily & Zaheer, 1999), which, in turn, enhances its ability to attract new ties (Powell, Koput, & Smith-Doerr, 1996). In addition to the *access* logic of the above four arguments, a firm's *control* over the flow of resources from itself to the connected actors and between the latter (Burt, 1992) also influences competitive behavior.

Building on the notion of networks as loci of resources, we derive the causal logic of our model from three types of network resource flows: asset flows, information flows, and status flows. *Asset flows* involve resources such as money, equipment, technology, and organizational skills that flow between connected firms in a network. For example, joint ventures in the U.S. steel industry have led to substantial transfers of technology between American and Japanese steelmakers who simultaneously compete for steel markets worldwide (Madhavan et al., 1998). *Information flows* include information and knowledge gathered from connected firms about their competitive intent, strategies, and resources, even in the absence of any asset flows (Harrigan, 1986). Finally, *status flows* are flows of legitimacy, power, and recognition from high-status firms to lower-status firms (cf. Padgett & Ansell, 1993). For example, a start-up company involved in a strategic alliance with Intel Corporation instantly gains legitimacy.

Boundaries of the Theory

The task of defining a network involves specifying the set of nodes and the relationships between them (Laumann, Galaskiewicz, & Marsden, 1978). Since our interest is in how cooperative networks affect member firms' competitive behavior toward each other, we define nodes as competing firms that have cooperative relationships with one another. Rather than specify a particular *instance* of networks (such as strategic alliances) to indicate the relevant type of relationship, we suggest that the three resource flows identified above represent the *deep features* of the types of relationships relevant to our model. This approach is theoretically more appealing and helps us to identify classes of networks that possess the relevant deep features, as well as to be causally explicit about how network resource flows influence competitive behavior. Thus, we define the relevant network as consisting of *formalized cooperative relationships among competitors that involve flows of assets, information, and status*. Our model will hold in cooperative networks comprising formal, contractual ties, such as joint programs and joint ventures that involve these three resource flows. Strategic alliances among competitors, for example, involve all three flows.

As noted earlier, firms often engage in complex and simultaneous competitive-collaborative relationships with each other (Brandenburger & Nalebuff, 1996). We suggest that cooperation and competition are distinct, orthogonal constructs. Through cooperative relationships, firms work together to collectively enhance performance by sharing resources and committing to common task goals in some domains (e.g., product-market or value-chain activity). At the same time, partners also compete by taking independent actions in other domains to improve their own performance. It is important to note that competition and cooperation may take place across different contexts (e.g., cooperate in a given product market and compete in others; cooperate in one value-chain activity and compete in others) and that structural influences may vary accordingly. For example, there is ample evidence that the extent of multimarket contact influences competitive behavior (Baum & Korn, 1999; Chen, 1996; Gimeno, 1999). Similarly, different modes of cooperation (such as joint programs versus joint ventures) also define another context. However, in the interest of parsimony, we have chosen to leave the incorporation of such contextual influences to future research. Thus, our model applies in the *general* situation in which simultaneous cooperation and competition exist in a network.[1]

CONCEPTUAL MODEL AND PROPOSITIONS

Building on the above, we develop a multilevel conceptual model, with independent and dependent constructs at multiple levels (Klein, Dansereau, & Hall, 1994), to specify how structural properties of cooperative networks influence competitive dynamics. There are three key reasons why a multilevel theoretical model is appropriate for our research. First, competitive dynamics is a multilevel phenomenon. In prior research scholars have examined firm-level (Smith et al., 1991), pair-level (Chen, 1996), and industry-level (Young et al., 1996) influences on competitive actions and responses. Second, embeddedness is a multilevel phenomenon (Granovetter, 1985), with causal processes that cross a number of levels of analysis (Pettigrew, 1992). Third, multilevel models provide a "deeper, richer portrait" of organizational phenomena (Klein, Tosi, & Cannella, 1999: 243) and allow "more integrated inquiry" (Kostova, 1999: 320)—both very useful considerations in examining competitive dynamics. We should also point out that a key strength of the network approach is its potential for multilevel analysis[2] (Contractor, Wasserman, & Faust, 2000; Marsden, 1990)—that is, actor-level, pair-level, and network-level analyses[3] (Wasserman & Faust, 1994: 24).

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[1] We thank an anonymous reviewer for pointing out the potential significance of contextual factors. In the discussion section we suggest ways in which future research could incorporate such contextual effects, including multimarket contact.

[2] Although current network analysis tools are adequate for independent statistical tests of theoretical predictions at each level of analysis, new tools, such as p-star (Contractor et al., 2000), are being developed to combine and compare multiple-level effects *simultaneously*.

[3] Another possible level of analysis is the subgroup (or clique) level, which is often useful in examining subsets of homogeneous actors within a larger network. This is a very interesting direction for analysis, but it is beyond the scope of this paper.

Network Constructs

We applied three "tests" in selecting the independent constructs. First, the constructs should be the most appropriate for modeling multilevel competitive dynamics phenomena. The embeddedness literature has largely focused on the firm and network levels (Granovetter, 1985), both of which are relevant to competitive dynamics. In addition, pair-level interactions are critical in explaining competitive behavior (Chen, 1996; Ferrier et al., 1999), consistent with dyad-level analyses in the network literature (Wasserman & Faust, 1994). Second, the constructs should have direct implications for the three resource flows identified and, thence, for competitive behavior, yet they should be conceptually distinct from one another. Finally, the constructs should have sufficient theoretical and empirical support in the literature.

Four constructs met the above tests, and we consider them most relevant in explaining the structural embeddedness of competitive behavior. These are (1) centrality and (2) structural autonomy (firm-level structural properties), (3) structural equivalence (a pair-level structural property), and (4) density (a network-level structural property).

Competitive Dynamics Constructs

In addressing competitive dynamics, we focus on two critical aspects: (1) the likelihood of a firm's initiating a competitive action (Chen, 1996; Young et al., 1996) and (2) the likelihood of a competitor's responding to that action (Chen, 1996; Chen & Miller, 1994; Grimm & Smith, 1997). Action is a specific, observable competitive move initiated by a firm to improve or defend its competitive position (Grimm & Smith, 1997). Prior research indicates that the likelihood of a firm's undertaking an action is higher when it has information and resource advantages (Chen, 1996) and when a competitor's likelihood of response is low (Chen & Miller, 1994). Response is a move undertaken to counter the initial competitive action of a competitor (Chen, 1996; Grimm & Smith, 1997). The response likelihood largely depends on the relative information and resource advantage of the responder (Chen, 1996; Smith et al., 1991).

Our focus on action likelihood and response likelihood is justified by prior findings that attackers often gain or maintain market share (Chen & MacMillan, 1992; Ferrier et al., 1999) and that the lower the likelihood of competitor response to an action, the greater the advantage to the attacker (Grimm & Smith, 1997). Overall, firms that initiate competitive actions and are able to deter their competitors from responding to those actions enjoy greater advantage from their actions.

We examine these constructs at the firm level (likelihood of a focal firm's undertaking an action or receiving a response to the action), pair level (likelihood of action and response between a given pair of firms), and network level (likelihood of any firm's undertaking an action against any other firm in its network or receiving a response to the action).

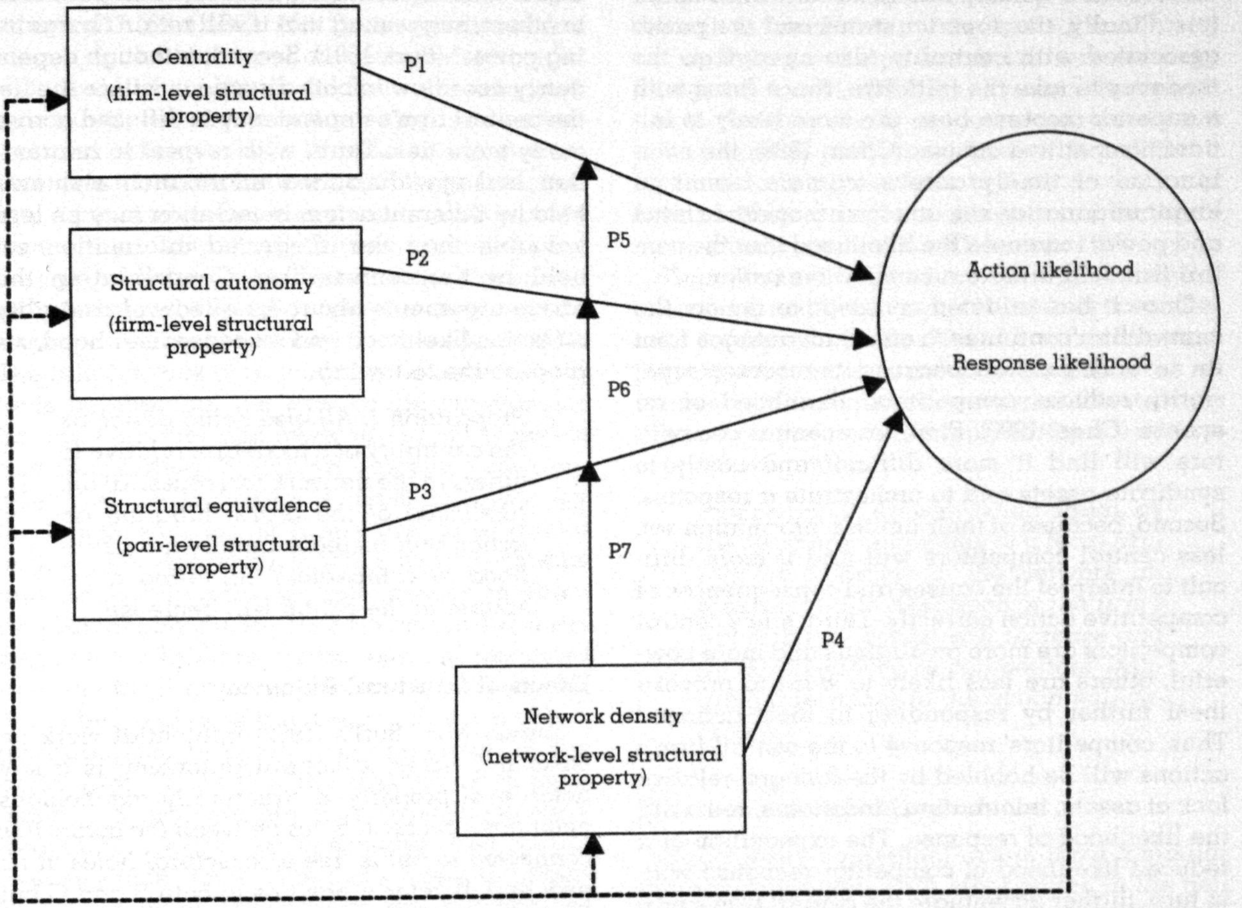
Figure 1 depicts our multilevel conceptual model graphically. The model shows that the two dependent constructs—action likelihood and response likelihood—are influenced by four structural properties: centrality, structural autonomy, structural equivalence, and network density. Because of differential flow, control, and asymmetry of resources among members of the network, each structural property differently influences what firms know about others, what actions they are willing to undertake, and what they are capable of undertaking. Consequently, the likelihood of a firm's undertaking a competitive action and the likelihood of its competitors' responding to that action will be influenced by the structural properties.

While our propositions focus on the effects of structural properties on competitive behavior (the solid arrows in Figure 1), the feedback loops imply that firms' competitive actions and responses, in turn, influence the network structure. Since prior researchers (e.g., Chen & MacMillan, 1992; Ferrier et al., 1999; Smith et al., 1991; Miller & Chen, 1994) have demonstrated that attributes of action (e.g., visibility, complexity, radicality), actor (e.g., size, reputation, management experience), and responder (e.g., size, organizational slack and inertia, management experience) are important predictors of competitive action and response, we assumed them constant when developing the propositions that follow.

Effects of Centrality

Centrality, which refers to the position of an individual actor in the network, denotes *the ex-*

FIGURE 1
The Structural Embeddedness of Competitive Dynamics: A Multilevel Model



tent to which the focal actor occupies a strategic position in the network by virtue of being involved in many significant ties (Wasserman & Faust, 1994). Employing the multiple-resource-flow logic identified earlier, we propose that high centrality leads to higher volume and speed of asset, information, and status flows, since network ties are conduits for all three resources (Galaskiewicz, 1979). First, a central actor has greater access to external assets, such as technology, money, and management skills, from connected actors. Second, being at the confluence of a larger number of information sources through their ties, central actors are likely to receive new information sooner than less central actors (Rogers, 1995), as well as to enjoy earlier access to important new developments (Valente, 1995). Third, high centrality implies higher status and power (Wasserman & Faust, 1994), because an actor who is the recipient of many ties is considered to be a prestigious actor (Brass & Burkhardt, 1992). Thus, a central actor generally has access to better and more resources and opportunities (Gulati et al., 2000) and, therefore, benefits from a positive resource asymmetry.

The above resource flows and resulting asymmetry among competitors in a network have predictable influences on competitive behavior. First, greater access to assets through network ties enables the central firm to undertake more (as well as more asset-intensive) competitive actions. Second, earlier access to relevant new information and technological developments puts the central firm in a good position to initiate competitive action. Access to a larger information set also serves to broaden the central firm's range of feasible competitive actions and, thus, to strengthen its competitive capability. Further, a more central firm is better informed about what is going on with others and can assess others' motives and behaviors more accurately and quickly than less central competitors. Finally, the superior status and the power associated with centrality also strengthen the tendency to take the initiative. Since firms with a superior resource base are more likely to initiate competitive actions (Chen, 1996), the combination of timely access to more assets, a larger information set, and the associated status and power increases the likelihood that the central firm will initiate a competitive action.

Once it has initiated competitive action, the central firm continues to enjoy advantages from its network position, because its resource superiority reduces competitors' likelihood of response (Chen, 1996). First, less central competitors will find it more difficult and costly to syndicate assets and to orchestrate a response. Second, because of their limited information set, less central competitors will find it more difficult to interpret the causes and consequences of competitive action correctly. Third, since central competitors are more prestigious and more powerful, others are less likely to want to provoke them further by responding to their actions.[4] Thus, competitors' response to the central firm's actions will be hobbled by the formers' relative lack of assets, information, and status, reducing the likelihood of response. The expectation of a reduced likelihood of competitor response will, in turn, further accentuate the central firm's propensity to initiate competitive action (Chen, 1996; Chen & MacMillan, 1992).

Centrality may have two important negative consequences as well: (1) the central firm is highly dependent upon its network by virtue of being involved in a large number of ties, and (2) the central firm may also be at a disadvantage since each network tie is not only an opportunity to gain information but also a potential "leakage point" (Harrigan, 1986). However, we argue that the central firm still has the advantage, on balance, for three key reasons. First, high centrality implies that the actor who is the object of many relations has something of value to others, suggesting that it will retain "bargaining power" (Burt, 1991). Second, although dependency does flow in both directions within the tie, the central firm's dependency is diffused across many more ties. Third, with respect to information leakage, disjointed information elements held by different actors in isolation may be less valuable than the *integrated* information set held by the central firm. Consolidating the above arguments about the effects of centrality on action likelihood and response likelihood, we propose the following.

> *Proposition 1: All else being equal, as the centrality of a focal firm relative to others in the network increases, (a) the likelihood of the firm's initiating an action will increase and (b) the likelihood of competitors' initiating a response to the action will decrease.*

Effects of Structural Autonomy

Drawn from Burt's (1992) influential work on structural holes, structural autonomy is a key actor-level property: *a structurally autonomous actor has structural holes between the actors it is connected to but is free of structural holes at its own end*. If actor A has ties to both B and C but B and C are not tied directly to each other—that is, B and C can reach each other only through A—a structural hole exists between B and C, which can be exploited by A. Structural holes enhance information benefits in several ways: diversity of contacts across unconnected groups means less redundancy and higher quality of information, earlier access to new information, and inclusion in more interactions (Burt, 1998). Similarly, a network rich in structural holes presents opportunities for control, in that the focal actor can "put a spin on" information flows between disconnected actors.[5] While structural holes are the underlying phenomena, structural

[4] A contrasting argument to acknowledge here is that both institutional theory (Zucker, 1987) and diffusion research (Rogers, 1995) indicate that highly central actors are often imitated. However, even if less central firms imitate the competitive actions of the central firms, such imitative actions may be directed toward other firms, rather than toward the central competitors, in a manner consistent with both our model and the institutional and diffusion literature. In other words, imitation does not necessarily imply retaliation.

[5] This feature of structural holes may be a source of inherent instability in a hole-rich network: actors that leverage structural holes to control information opportunistically provide incentive for connected actors at the receiving end to forge new links "around" the former, changing the shape of the network in the process. We address this point in the discussion section.

autonomy is the network property of actors who have "relationships free of structural holes at their own end and rich in structural holes at the other end" (Burt 1992: 45). Thus, our discussion hinges on the structural autonomy construct.[6]

Because of its structural hole advantage, a structurally autonomous firm enjoys more effective and efficient flows of assets, information, and status from its network, and these translate into a positive resource asymmetry and provide competitive advantage. Further, structural autonomy provides control benefits: the competitor with structural holes can play its less autonomous partners against one another (Burt, 1992). The relative lack of redundancy in network contacts implies that the structurally autonomous firm has a richer and more varied set of assets and information. Structural autonomy also implies that the focal firm is depended upon (by the actors with whom it has ties) to a greater degree than vice versa, leading to greater status and power. The bridging role implicit in structural autonomy means that connected firms depend on the bridging tie not only for resources from the focal firm but also for indirect contact with (and resources from) each other—in effect, according the bridging firm significant status and power. Given that the structurally autonomous firm enjoys a stronger asset base, early information access, greater status, and control over resource flows, it is more likely to undertake competitive actions than less autonomous firms.

Once the structurally autonomous firm initiates an action, its less autonomous competitors will find it more difficult to respond. To begin with, the less structurally autonomous competitors will find it more difficult to syndicate the resources necessary to mount a strong response, since their networks are relatively less efficient and effective (Burt, 1992). Second, because of the absence of structural holes, such firms do not have information and control benefits, and this makes it difficult for them to understand the action and its implications; thus, they will be less likely to initiate a response. Further, a structurally autonomous actor is more difficult to "read" competitively, for the diversity of its linkages helps mask its true strategy (Padgett & Ansell, 1993). Finally, since firms with ties to the structurally autonomous actor do not have alternate paths to each other, it is difficult for them to bring pressure to bear on the latter from multiple directions, which could facilitate more effective sanctions (Coleman, 1988).

Thus, if attacked by a firm with high structural autonomy, competitors are less likely to undertake a response (Burt, 1992). As with centrality, the expectation of a reduced likelihood of response, in turn, further accentuates the structurally autonomous firm's propensity to initiate competitive action.

> *Proposition 2: All else being equal, as the structural autonomy of a focal firm relative to others in the network increases, (a) the likelihood of the firm's initiating an action will increase and (b) the likelihood of competitors' initiating a response to the action will decrease.*

Effects of Structural Equivalence

Structurally equivalent actors have a similar pattern of relations with other actors in the network, although they need not have direct ties with each other (Rice & Aydin, 1991; Wasserman & Faust, 1994).[7] Thus, structural equivalence is a *pair-level measure of how similar the actors' network patterns are—the greater the similarity in the actors' networks, the greater the structural equivalence of these actors* (Valente, 1995). Structurally equivalent actors tend to have similar profiles and behaviors, for two reasons

[6] Structural autonomy may also have a dark side. Notably, in a discussion of social capital, Coleman (1988) focuses on the benefits of dense networks—that is, trust and close support. The trust- and support-enhancing role of density may be particularly relevant in the case of multiparty alliances, such as research consortia (e.g., Doz, Olk, & Ring, 2000). We return to the benefits of dense networks when we consider the moderating role of network density.

[7] Strictly speaking, two actors are structurally equivalent if they have identical ties to and from all other actors in the network (Wasserman & Faust, 1994: 356). A less rigid notion of equivalence is regular equivalence, which does not require actors to have identical ties to identical other actors (Wasserman & Faust, 1994: 473)—that is, actors are regularly equivalent if they relate in the same ways with similar other actors. Although the causal logic we outline here applies to both forms of equivalence, we refer to structural equivalence for the sake of being conservative (i.e., focusing on the stronger form of equivalence) and consistent (i.e., emphasizing the structural aspect).

(Burt, 1983). The *socialization* argument is that such actors tend to interact with similar others in similar ways, leading to similar attitudes, resources, and behaviors. The *symbolic* argument is that structurally equivalent actors actively model themselves on each other and tend to imitate each other.

Given the above features of structural equivalence, structurally equivalent firms can be viewed as having similar asset, information, and status flows and, therefore, being somewhat symmetrical in their resource profiles. Two related arguments suggest that structurally equivalent firms will tend not to directly confront each other. First, the competitive dynamics literature has shown that resource asymmetry is an important predictor of competitive attack (Chen, 1996). Second, there is ample evidence to suggest that firms with similar resource endowments will recognize their mutual dependence and tend to avoid initiating direct conflict (Caves & Porter, 1977; Smith, Grimm, Young, & Wally, 1997). The proposed effect rests on two process mechanisms: (1) active monitoring through symbolic communication (Burt, 1983), leading to increased cognitive salience of structurally equivalent competitors, and (2) mutual coordination (tacit or otherwise) to avoid conflict. Accordingly, we suggest that structurally equivalent firms will tend not to attack each other.

However, if attacked by a firm with similar resource profiles, competitors could more easily mobilize resources and respond swiftly to the attack (Chen, 1996). Further, since structurally equivalent firms view themselves as being similar to each other, they are more likely to interpret the initial action as a threat, increasing the likelihood of a response (Dutton & Jackson, 1987). The likelihood of response is further enhanced because these firms continuously monitor each other and have similar resource and behavioral profiles. Thus, although the likelihood of attack between structurally equivalent firms is low, the likelihood of response by other structurally equivalent firms, once attacked, is high. The high likelihood of a response, in turn, further reduces the likelihood of action by a firm against its structurally equivalent peers.

> *Proposition 3: All else being equal, as the structural equivalence between the focal firm and a given competitor increases, (a) the likelihood of the focal firm's initiating an action against the latter will decrease and (b) the likelihood of the latter's initiating a response to the action will increase.*

Effects of Network Density

Density is a key network-level property that refers to *the extent of interconnection among the actors of the network—the greater the interconnectedness, the higher the density*. For example, a network in which "everyone knows everyone else" is a very dense network. Dense networks have special characteristics that impact actor behaviors and outcomes. First, they facilitate faster and more efficient flows of information and other resources because of the many interconnections and shared routines for information collection and distribution (Coleman, 1990; Valente, 1995). Second, since dense networks function as "closed" systems, trust, shared norms, and common behavioral patterns develop more easily (Burt, 1998; Coleman, 1990). Third, dense networks facilitate effective sanctions (Burt, 1998); Granovetter (1985) has pointed out that the threat of sanctions is more likely and more effective in dense networks, since they amplify the reputation effects of sanctions.

Given the above characteristics of dense networks, the likelihood of action and response among firms of a dense network will be different from what it would be in a less dense network. Because densely connected firms are likely to have access to the same information (Granovetter, 1973), the scope for "information variation"—that is, the likelihood that any firm will be exposed to unique information or other competitive stimuli—is lower. Similarly, no particular firm is likely to have sole access to unique assets or other resources. This argument suggests that dense networks will be associated with less competitive variety (Nayyar & Bantel, 1994; Smith & Grimm, 1991) among members. A firm wishing to create unique resource advantages in a dense network is under greater pressure to structure its own network of ties more efficiently (e.g., by eliminating redundant ties) and effectively (e.g., by linking to an area of the network previously unreached). Also, because of high cohesion and the development of shared behavioral norms, dense networks function as "cliques," creating strong behavioral pressures to conform rather than to be radically different (Kraatz, 1998). Therefore, as a result of higher information velocity, shared norms and behaviors, and the threat of sanctions, firms in high-density networks will initiate less competitive action against each other, as compared to their counterparts in lower-density networks.

We also propose that network density influences response likelihood. First, a competitor who initiates an action against another in a high-density network might be viewed as breaking a behavioral norm and be subject to immediate sanctions. Second, dense networks provide for multiple avenues through which concerted sanctions might be brought to bear on firms who attack the members of the same network (Burt, 1992; Coleman, 1988). Third, because of high information velocity, firms in a high-density network are more likely to be familiar with each other's practices and behaviors, making it easier for them to correctly interpret each other's competitive action and to respond appropriately. As with the earlier propositions, the high likelihood of competitive response also reduces the likelihood of action. Therefore, in dense networks those firms that do initiate competitive action against other firms of the network are likely to receive an immediate response from their competitors.

> *Proposition 4: All else being equal, as network density increases, (a) the likelihood of any firm's initiating an action against other firms in the network will decrease and (b) the likelihood of other firms' initiating a response to the action will increase.*

Moderating Role of Network Density

We argue that network density also has a moderating influence on the relationships suggested in Propositions 1 through 3. Specifically, an increase in density will *decrease* the main effects of centrality, *increase* the main effects of structural autonomy, and *decrease* the main effects of structural equivalence. The crux of this differential impact is that centrality's main effects depend primarily on the *volume and speed of resource flow,* structural autonomy's main effects depend primarily on network *efficiency and effectiveness stemming from nonredundancy,* and structural equivalence's main effects depend primarily on the *avoidance of conflict initiation due to the active monitoring of and coordination with resource-symmetric peers.* Density increases the overall volume and speed of resource flows in the network, thus dampening the centrality advantage. Density increases the redundancy of flows for firms in general, whereas a more structurally autonomous firm enjoys a greater advantage because its network is less redundant, while its indirect access to the resources of a more interconnected network is higher. Density also increases the number of structurally equivalent peers, which makes the avoidance of direct conflict more difficult and problematic. We discuss each moderating effect in detail below.

Network density diminishes centrality effects. The key driver of the centrality main effect is the superior resource advantage stemming from centrality. *Because of the rapid resource flow that occurs in a dense network, the benefits of flows and asymmetry enjoyed by the central firm are likely to be dampened as density increases.*[8] In a dense network the higher velocity of resource flow suggests that even relatively less central firms can have improved access to resources through their network ties. Another important factor relates to the potential negative effects of centrality in a dense network: increased density makes it easier for those with ties to a central firm to integrate the isolated information elements and use them against the central firm. Overall, because of the rapid flow of information and other resources that occurs in a dense network, the central firm's resource advantage (created by high and timely access and the resultant asymmetry) diminishes, thus reducing the likelihood of its initiating action and increasing the likelihood of competitor response. The increased likelihood of competitor response further reduces the likelihood that a central firm in a dense network will undertake a competitive action.

> *Proposition 5: All else being equal, an increase in network density will weaken (a) the positive relationship between centrality and action likelihood and (b) the negative relationship*

[8] Note that we focus on how density moderates the effects of centrality on competitive behavior, not on how density and centrality themselves may be related.

between centrality and response likelihood.

It is worth clarifying here what we mean by "weakening" a negative relationship: as network density increases, we expect the correlation between centrality and response likelihood, posited as being negative in Proposition 1, to move closer to zero. In other words, our model suggests that network density moderates the *strength* of relationship between the independent and dependent constructs and not the *form* of relationship (Prescott, 1986).

Network density enhances structural autonomy effects. The key argument regarding this moderating effect is that *while it may be more difficult to attain structural autonomy in a dense network, once attained, its benefits are enhanced because the other firms are more likely to be locked in a dense network of redundant relationships.*[9] Consider the simple example of the structurally autonomous firm A, with ties to B and C, which are themselves unconnected to each other, and no ties to D, which is isolated. Now, suppose that B and C establish a direct tie with each other, effectively extinguishing A's structural hole advantage. A can then retain its structural autonomy by terminating one of its current ties—for example, if A retains the tie with B but terminates the tie with C, it can potentially still get information about C from B, since B and C are now connected—and invest the resources thus freed up in a new tie with D. Thus, entrepreneurial firms can potentially maintain their structural autonomy through local strategic action, even in a network characterized by increasing density. In a large network there could be several such local opportunities for network structuring, suggesting that multiple firms could attempt such a strategy.

The key driver of the structural autonomy main effect is the "efficiency-effectiveness" advantage (Burt, 1992), which hinges on the gap between the hole-rich network of the focal firm and the redundant networks of others. If the structurally autonomous firm retains its hole-rich network, while increasing density increases the redundancies in the larger network, the firm's advantage will be strengthened, because the efficiency-effectiveness gap will have increased. As density increases, those firms with ties to the structurally autonomous firm will likely have more ties among themselves, thus increasing the scope of information and other resources accessible to the latter, without the extra costs of managing redundant relationships.

Thus, a structurally autonomous firm enjoys the benefits of a rapid flow of information and other resources (provided by the increasing density among the firms it is tied to) and of nonredundancy of information (provided by the structural hole it sustains). Therefore, to the extent that a structurally autonomous firm can maintain or reduce its level of redundant contacts and yet be able to access the wider information set and resource base provided by the interconnected network, it enjoys *greater* advantage through its structural autonomy.[10] The threat of sanctions that exists in a dense network is also less of a concern for the structurally autonomous firm, because others tied to the structurally autonomous firm depend on it to play a critical bridging role and will find it difficult to impose coordinated sanctions (Burt, 1992).

> *Proposition 6: All else being equal, an increase in network density will* strengthen *(a) the positive relationship between structural autonomy and action likelihood and (b) the negative relationship between structural autonomy and response likelihood.*

Network density diminishes structural equivalence effects. The main argument concerning the final moderating effect is that *increasing network density serves to dampen the competitive effects of structural equivalence because of the increasing number of structurally equivalent pairs.* The key driver of structural equivalence's main effects is that structurally equivalent

[9] As with centrality, note that we focus on how density moderates the *effects* of structural autonomy, not on how density and structural autonomy themselves may be related. Please see Burt (1992, especially pages 56–60) for a discussion of the latter.

[10] Note that an increase in overall density decreases the *overall* level of competitive action within the network (Proposition 4), while increasing the likelihood that a structurally autonomous actor will take the initiative (Proposition 6). Thus, we are not proposing a monolithic effect for increasing density; rather, we incorporate different effects at different levels (Klein et al., 1994), which allows us to perform more fine-grained analysis of competitive dynamics.

peers avoid initiating direct competitive action against each other, which rests on two processes mechanisms: the active monitoring of peers and coordination to avoid conflict. As the network becomes denser through the creation of new ties among previously unconnected firms, the network as a whole tends to become more cohesive. In a fully cohesive network, where everyone is connected to everyone else, all actors are structurally equivalent to each other since they have similar relations to similar others (Burt, 1983), therefore increasing the number of structurally equivalent pairs.

We posit that this increase in the number of structurally equivalent firms threatens each of the two process mechanisms at work in the main effects. First, as the number of peers increases, mutual monitoring becomes costlier and less effective because of information overload. Thus, the benefits of easier interpretation and quicker resource mobilization are also reduced for both actor and responder firms, with corresponding implications for action and response likelihood. Second, there is substantial evidence that any type of competitive coordination becomes more difficult as the number of firms increases (Oster, 1994), indicating that an increase in structural equivalence makes it more difficult to sustain the resolve to avoid confrontation. (We assume in the proposed moderating effect that there is no increase in environmental munificence; for example, in a growing industry, firms may be able to sustain the avoidance of conflict with a larger number of peers). Thus, the net implication of increased density is that competitive action aimed at structurally equivalent peers will become increasingly more likely. Further, since there will be more structurally equivalent firms to monitor, potential responders face information overload and resource constraints, both of which will limit their ability to respond to the actions of many structurally equivalent firms.

> *Proposition 7: All else being equal, an increase in network density will* weaken *(a) the negative relationship between structural equivalence and action likelihood and (b) the positive relationship between structural equivalence and response likelihood.*

DISCUSSION AND IMPLICATIONS

We have argued that the firm's network position and the overall network properties influence the flow of assets, information, and status, thereby creating resource asymmetries. As a result, some firms enjoy greater competitive benefits from their network of ties while others are constrained in what they can accomplish. To illustrate how our model works, consider how the network of alliances among steel firms (Madhavan et al., 1998) might influence competitive behavior in that industry. For example, *holding everything else constant*, if Kobe Steel is more central in the network than Nippon Steel, will Kobe initiate more competitive actions than Nippon, and will Kobe's actions be less likely to receive retaliation (as Proposition 1 indicates)? Similarly, as the density of the network increases over time, will the overall level of competitive activity within the network decline (as Proposition 4 indicates)? Specifically, as the network between Japanese and U.S. producers becomes denser, will there be a corresponding decrease in the number of antidumping cases brought by the U.S. producers against their Japanese counterparts?

Thus, our conceptualization of competitive behavior as significantly influenced by structural embeddedness—above and beyond action and firm attributes—provides a new theoretical integration of two vibrant streams of literature in strategy: competitive dynamics and the network perspective of strategy. While providing a unique perspective that complements our current understanding of competitive dynamics, the model adds value to both the industrial organization (I/O) and resource-based perspectives of competitive behavior. The impact of cooperative relationships between competitors on industry-level competitive intensity has been an important theme in I/O economics (McGahan, 1995; Scherer & Ross, 1990). Our paper complements this I/O tradition in two ways. First, our focus on the impact of firm-, pair-, and network-level structural properties on competitive action and response will be useful in stimulating further multilevel explorations of competitive behavior. Second, our propositions will facilitate more fine-grained analysis of factors that both increase and decrease competitive intensity. For example, the key role of network density as both directly influencing competitive behavior and moderating the other main effects highlights the intricacies involved in understanding how cooperative linkages influence patterns of competition. Similarly, the resource-based view has enriched our understanding of competitive behavior by emphasizing the role of resources in determining competitive action and reaction (Chen, 1996; Grimm & Smith, 1997). The structural embeddedness approach complements this line of research by extending our understanding of competitive resources to include network resources.

Directions For Future Research

The theoretical richness inherent in the structural embeddedness view of competitive dynamics is further evidenced by the future research directions suggested by our model. We outline five of the most promising areas: (1) the role of tie-level factors, (2) the role of multimarket contact and other contextual factors, (3) competition *between* networks, (4) the coevolution of networks and competitive dynamics, and (5) other forms of embeddedness.

First, in an effort to maintain conceptual clarity and parsimony, we have not differentiated between competitors who have direct ties with each other and those who do not. However, the current model may pave the way for a subtler approach analyzing how, *in the same network*, competitors with direct ties to each other might behave differently from competitors who do not have such direct ties. For example, would the establishment of a direct tie reduce the intensity of conflict between a given pair of competitors? Similarly, how does the strength of a tie (Granovetter, 1973; Krackhardt, 1992), which could be operationalized as the mode of cooperation (such as joint venture or joint program), influence competitive behavior?

A second promising area is to examine how different contextual factors, such as multimarket relationships, influence our propositions. In previous research scholars have established the significant and complex influence of multimarket competition on competitive behavior (e.g., Baum & Korn, 1999; Chen, 1996; Gimeno, 1999; Gimeno & Woo, 1996). The integration of multimarket effects with the structural effects we propose in this article is likely to yield sophisticated insights on competitive dynamics. For example, as firms collaborate in one domain and compete in another, they may gather competitive information about their partners' intent in the other competitive domains, even before the actions are seen in the market.

Third, the model can be extended to examine internetwork competition. Since the collective capability of a network critically determines its competitive behavior (Gomes-Casseres, 1996), how might network structure influence the capability of the network to attack other networks or to defend against attack by other networks? For example, it is possible that networks led by highly central actors are better coordinated, thus enjoying an advantage in resource mobilization. If so, such networks are more likely to attack other networks. Thus, our model holds promise for better understanding the newly emerging phenomenon of internetwork competition (Gomes-Casseres, 1996). Extending these ideas further, in future research scholars could examine the simultaneous effects of both internetwork and intranetwork competition.

A fourth intriguing area for research is to examine how network structure and competitive dynamics coevolve and to develop more integrative and complex models of competitive behavior. As indicated by the feedback loops in Figure 1, firms' competitive actions and responses might, in turn, influence the network structure. For example, if a focal firm takes some action, previously unlinked firms might establish linkages to fight the common competitor, or others might break their tie with the local firm. Another part of such a complex modeling would be the examination of two- and three-way interactions among the network constructs investigated in this paper. For example, would the effects of firm centrality and structural autonomy be uniform in structurally equivalent and nonequivalent situations?

Finally, although we have focused on the structural embeddedness of competitive behavior, there are natural connections and complementarities that exist between structural and other forms of embeddedness. As an illustration, the structural embeddedness approach can inform the recent literature on cognitive and social constructionist views of strategic groups, such as strategic group identity (Peteraf & Shanley, 1997; Porac & Thomas, 1990; Zajac & Bazerman, 1991). Similarly, the notion of resource asymmetry can be combined with the notion of cognitive asymmetry to better predict the impact of such asymmetries on competitive behavior.

Managerial Implications

From a management viewpoint, our model indicates the need for viewing network structure as an additional strategic "lever." While senior managers are paying increased attention to their firm's alliances and other ties (e.g., Gulati, 1999), they need to focus more on the structural aspects we have discussed in this paper. If, as we have argued, structural properties differentially influence competitive behavior, managers will benefit from more sophisticated tools for analyzing the overall network structure and their firm's position in it so as to be able to restructure the network to their advantage. Furthermore, the perspective we have developed in this article suggests that not all kinds of connections are good. Some ties provide asymmetries and enhance the competitive capability of the focal firm, whereas others constrain it. Such considerations might help a firm to strategically "reengineer" its network and enhance its competitive capability.

In conclusion, our key claim is that the structural embeddedness perspective of competitive dynamics adds considerable value to the literature by explicitly modeling competitive activity as embedded in a network of interactions that influences competitive action and response. The embeddedness view of competitive dynamics espoused here is expected not only to strengthen and enrich the theoretical foundations of competitive dynamics but also to respond to calls for studying strategic activity in the social and other contexts in which it is so richly embedded.

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