

**THEORETICAL FOUNDATION FOR THE STUDY OF COMPETITION NETWORKS
AND THEIR PERFORMANCE IMPLICATIONS †**

DOVEV LAVIE

Department of Management & Technology
Bocconi University
Via Roentgen 1 - 20136 Milano, Italy
Tel. +39-02-5836-2646
Email. dovev.lavie@unibocconi.it

Current version: October 31, 2021

Forthcoming in the *Strategic Management Review*

†I appreciate the feedback received from Joel Baum, Wally Ferrier, Yuval Kalish, Martin Kilduff, Ravi Madhavan, Joe Porac, Margarethe Wiersema, and participants at the 2013 Organizations, Networks and Complexity Conference at the Hebrew University of Jerusalem, the 2013 and 2015 Academy of Management meetings in Orlando and Vancouver, the 2014 Strategic Management Society conference in Madrid, the 2014 INSEAD Conference on Network Evolution, and the 2021 Strategy Science Conference. I also appreciate the feedback received from seminar participants at the London Business School, Bocconi University, Imperial College, University College London, the University of Lugano, and the University of Catania. I acknowledge my fellowship with the Invernizzi Center for Innovation, Organization, Strategy and Entrepreneurship (ICRIOS) and the Bocconi University Senior Researcher grant.

THEORETICAL FOUNDATION FOR THE STUDY OF COMPETITION NETWORKS AND THEIR PERFORMANCE IMPLICATIONS

ABSTRACT

Laying the foundation for competition network theory, this study underscores the differences between competitive and cooperative relations and explains how the network of competitive relations in which a firm is situated can affect its performance. The study extends strategic management research on competition by shifting focus from the industry or firm to the network level of analysis, thus offering new insights into the implications of competition. Specifically, it suggests that firm performance declines with the intensity of the firm's competitive relations, yet mutual forbearance that emerges due to multimarket contact can mitigate this effect. In addition, firm performance is negatively related to degree centrality of the firm in its competition network. In turn, the centrality of the firm's competitors in their competition networks can enhance the firm's performance, although an increasing proportion of shared third-party competitive relations of the firm and its competitors in their competition networks mitigate this effect. Hence, besides industry structure and the firm's resource configuration, the firm's position in its competition network and the nature of its competitive relations can shape its performance. This study advances competition research by introducing a network perspective that extends the literature on competitive dynamics while informing empirical research on competition networks. Directions for future research on competition networks are discussed.

INTRODUCTION

Interfirm competition has received considerable attention in strategic management research. In fact, one of the most fundamental questions in the field of strategy concerns the drivers of a firm's success in competition (Rumelt, Schendel and Teece, 1994). Even though a firm's strategy involves decisions that are interdependent with those made by its competitors, "determining who is and who is not in a market game is a fundamental issue often overlooked in formal accounts of market competition" (Leiblein, Reuer, and Zenger, 2018: 564). Traditionally, scholars have identified competitors based on their industry affiliation (Porter, 1980), yet industry affiliation does not necessarily imply direct competition between all firms in the industry (Porac and Thomas, 1990). In addition, firms may compete in multiple markets (Karnani and Wernerfelt, 1985), so that the intensity of their competitive relations varies across markets. Moreover, convergence of technologies, disintegration of industries, and the emergence of ecosystems have blurred industry boundaries, making the standard industry classification less relevant for studying competition (Brusoni et al., 2009). This classification falls short of accounting for competition among firms that originate from different industries. To overcome this caveat, prior research has identified competitors based on their strategic group affiliation or based on the assessments of managers or customers (Gur & Greckhamer, 2019). Some scholars have categorized firms using content analysis of their business descriptions (Hoberg and Phillips, 2010, 2016) or self-claimed membership in market categories (Pontikes and Barnett, 2015). However, much like industry classification, these approaches are insufficiently finely grained for analyzing the idiosyncratic intensity of competition faced by a firm within its industry or market segment.

To study firms in their competitive environments, strategy scholars have adopted frameworks anchored mostly in industrial organization economics and resource-based theory. Less attention has been paid to firms' idiosyncratic patterns of competitive relations and their implications. How do a firm's competitive relations affect its likely behavior and performance? This important question has been studied primarily at the dyad level, matching a firm's reaction to particular actions of a rival. Nevertheless, scholars have argued that "although the dyad focus and the firm-level pair-wise emphasis represent a critical first step, the proposed approach nonetheless should be complemented by the group or structural approach in which the

social nature of competition is considered” (Chen, 1996: 127). Studying the nature and structure of competitive relations can shed new light on the underlying forces that shape firm performance. Indeed, a recent study suggests that “most promising is the use of network analysis...for studying competition networks that are composed of competitive relations between firms.” (Hoffmann et al., 2018: 3037). Accordingly, the current study introduces a network theory for analyzing competition. By assuming the competition network as the focal level of analysis, this theory unpacks heterogeneity in competitive relations and explains interfirm performance differences beyond those attributed to industry or firms’ characteristics.

A competition network is defined as the set of competitive relations in which firms are embedded. These relations can be inferred from firms’ market communality, resource similarity, or perceived rivalry. To illustrate the notion of competition network and competitive relations within a well-defined industry, Table 1 reports revenue data for U.S.-based airlines in 2011. Considering the pre-consolidation period in this industry offers richer data on competition. Ideally, the competition network should encompass all competitors, including foreign airlines that do not necessarily operate in the United States. This table reveals that although all listed competitors operated in the U.S. market, competition was more exclusive in the Atlantic, Latin America, and Pacific markets, where subsets of airlines operate. The intensity of competitive relations of an airline in each market segment is proportional to the relative importance of that market and to the competitors’ dominance in that market (Chen, 1996). The overall intensity of competition that an airline faces can be inferred by aggregating the competitive relations across market segments. Figure 1 shows the competition network in each market segment, with arrows distinguishing inbound from outbound competitive relations and arc widths indicating the intensity of competitive relations. This illustrative example reveals the complexity of the phenomenon and hints at the pitfalls of studying competition as a cumulative characteristic of an industry without accounting for its inherent relational properties (Kilduff et al. 2010). For example, the intensity of competition that American Airlines encountered in the Atlantic market was weaker than that encountered by United Airlines, even though these firms operated under similar industry conditions. Although research rooted in industrial organization economics has alluded to the intensity of competition in an industry (Caves and Porter, 1977) or strategic group (Cool and Schendel,

1987; Fiegenbaum and Thomas, 1990), it has not studied the specific pattern of competitive relations in which each firm is situated. Whereas industry analysis can be applied at the segment level, this becomes practically impossible when the segments are defined at a fine-grained level, e.g., product functions, in which case the analysis must be repeated at each segment. Even if one manages to perform this task, such analysis cannot provide a perspective on the overall intensity of competition faced by a particular firm that operates in multiple segments. Figure 1 reveals that firms that operate in the same industry vary by the network structure and nature of their competitive relations, which may account for performance heterogeneity. A theory of competition networks can elucidate the implications of a firm's pattern of competitive relations, irrespective of industry boundaries.

***** Insert Table 1 and Figure 1 about here *****

Emerging research on competition networks has made some strides by applying social network analysis to study the implications of competition networks for strategic behavior, rivalry and market entry (Gimeno, 2004; Hsieh and Vermeulen, 2014; Skilton and Bernardes, 2015; Thatchenkery and Katila, 2021; Tsai et al., 2011; Yamanoi, 2011). Although network analysis is a method that can be applied for studying various phenomena, prior research has gone one step further when applying concepts and assumptions underlying social network theories in the study of competition networks: “[s]cholars have begun to apply this method to study network properties... the underlying assumption has been that the mechanisms that drive behavior in competition networks are similar to those applicable in social networks (Tsai, Su, & Chen, 2011). Future research could challenge this assumption and develop a theory for the evolution and performance implications of competition networks.” (Hoffmann et al., 2018: 3037). Indeed, social network theories were meant to analyze cooperative relations, not competitive relations, which are fundamentally distinct (Lavie, 2013). For instance, cooperative relations are voluntary and facilitate information exchange by partners (Uzzi, 1996), whereas competitive relations entail no mutual consent and discourage resource sharing and spillover of proprietary knowledge to competitors. Hence, the framework proposed here avoids social network mechanisms that underscore social influence and information sharing (Gulati et al., 2011; Kilduff and Brass, 2010). Instead, it underscores competitive dynamics mechanisms such as awareness of

competitive threats and the inclinations to initiate and react to competitive actions. As recently demonstrated (Downing et al., 2019), these mechanisms explain how competitive relations and firms' positions in the competition network shape the intensity of competition.

The current study offers important contributions to strategic management research by analyzing the idiosyncratic performance consequences of competition networks for individual firms. It underscores the merits of applying a network perspective for analyzing competition, which complements established approaches using a network lens for studying cooperation (e.g., Gulati et al., 2011). In contrast to emerging research on competition networks which has applied social network theories, the current study underscores the critical differences between cooperative and competitive relations and warns against the practice of following conventions in network analysis irrespective of the nature of network relations. In particular, relying on traditional structural network mechanisms for studying competition can produce anomalies and prevent a correct interpretation of findings. Instead of applying social network theories that underscore information flows and interpersonal exchange, this study introduces a coherent network perspective that relates to firms' competitive relations. Additionally, by focusing on firm performance, the proposed theory moves beyond the study of consequences at the dyad level (Chen, 1996; Downing et al., 2019; Hsieh and Vermeulen, 2014; Yamanoi, 2011) or consequences for awareness of competitors and product market entry (Tsai et al., 2011; Downing et al., 2019; Skilton and Bernardes, 2015). Given that the conventions of social network theories cannot be applied, the study redefines fundamental concepts, e.g., a relation, in the context of competition, alluding to its unique properties such as asymmetry, lack of formalization and mutual consent, and to the fact that it does not entail ongoing interaction. It then contrasts alternative definitions based on market communality, resource similarity, perceived rivalry, structural equivalence and strategic group affiliation, to make recommendations for conceptualization and operationalization.

In developing conjectures concerning performance implications, this study contributes by alluding to both relational and structural properties of the competition network and explaining their interplay. The study revisits the underlying reasoning behind the implications of constructs such as degree centrality and third-party relations, which have distinct implications in a competition network. Concepts such as the intensity

of competition are revisited and contrasted with their traditional conceptualization in industrial organization economics. The resulting theory advances understanding of the performance implications of competition by directly relating it to the particular pattern of the firm's competitive relations rather than to the industry structure or the firm's resource configuration. By specifying boundary conditions, the theory offers a unique approach for resolving the seeming contradiction between the negative implications of the intensity of competitive relations and the positive performance effect of multimarket contact (e.g., Amir et al., 2019). Then, by replacing the commonly applied mechanisms of social network theories with mechanisms suitable for competition networks, the theory offers new insights that challenge previous observations concerning the implications of central network positions, thus pointing to negative performance implications. The theory further goes beyond dyadic concerns to analyze the performance implications of degree centrality in the competition network of the firm's competitors, suggesting a positive performance effect. This effect is not ascribed to enhanced status or power, as suggested by social network theories (e.g., Wasserman and Faust, 1994), but rather to competitors' diverted attention. Finally, the theory explains how the structure of third-party competitive relations shapes the performance effects of the competition network. The proposed logic departs from social network research which has highlighted homophily and mutual influence and progresses beyond emerging research on competition networks, which has centered on awareness (Tsai et al., 2011). Instead, it points to the improved ability of competitors to react to the firm's competitive actions despite their competitive interactions with other competitors. Accordingly, the study contributes to the literature by developing foundations for competition network theory as well as by offering a nuanced account of the performance implications of competition networks, which enhance our understanding of interfirm performance heterogeneity and guide empirical research on this emerging topic.

NETWORK THEORIES AND THE STUDY OF COMPETITION

Strategic management research has traditionally drawn from social network theories to study strategic alliances and other cooperative relations such as board interlocks (Gulati et al., 2000). The underlying supposition has been that structural properties of the social networks in which firms are embedded shape these firms' behavior and performance (Kilduff and Brass, 2010). Scholars have considered properties such

as structural holes (Burt, 1992), centrality (Bonacich, 1987; Freeman, 1979; Podolny, 1993) and density (Coleman, 1988) when describing the structure of alliance networks and relating it to firm performance (Ahuja, 2000a; Baum et al., 2000; Rothaermel 2001; Rowley et al., 2000; Stuart et al., 1999; Zaheer and Bell, 2005). Even when studying the social structure of markets, scholars have focused on cooperative transactions between buyers and suppliers (Burt, 1988). Hence, network theories have served for studying cooperation rather than competition, despite the latter's central role in strategic management. The possibility that the intensity of competition accumulates at the network rather than the industry or firm level was assumed away. In light of the well-developed literature that has applied network theories to study cooperation, this study shifts focus to developing a network theory of competition.

Emerging research has begun to study competition networks that emerge from the competitive relations that firms maintain among them (Chen, 1996; Gimeno, 2004). The notion of competition network identifies the set of competitors that each firm encounters and alludes to the competitive interactions among firms as network ties. This research has borrowed concepts from social network theories, such as relational and structural embeddedness (Granovetter, 1985), to describe a firm's relations with its competitors and its position in the network of competitive relations. Scholars have resorted to social network theories to explain the dynamics by which information flows in competition networks. Nevertheless, such dynamics are likely to differ from those typical of alliance networks because of the inherently different nature of relations.

Competitive relations differ from cooperative relations on multiple counts. Whereas cooperative relations such as alliances serve as a platform for facilitating exchange of knowledge and other types of resources (Dyer and Singh, 1998; Uzzi, 1996), firms often seek to avoid the leakage of knowledge and information to their competitors (Cohen et al., 2000). Whereas in alliance networks, firms' brokerage positions are meaningful and information can flow via indirect ties, such transitivity often does not characterize competition networks, wherein a competitor's competitor does not necessarily compete with the focal firm. Further, although social network theories acknowledge that information flows in networks may affect firms' behavior and performance outcomes, they disregard the intensity of competition (Porter, 1980). In a competition network, relations may convey information and firms may learn from each other,

yet competitive tension or actual competitive actions of competitors are a more relevant type of flow for studying the performance implications of such a network. Thus, little insight can be gained by drawing analogies from cooperative relations to competitive relations between firms.

Partially overcoming this caveat, one stream of research on social networks has distinguished between positive and negative network ties (Emerson, 1972). This research alludes to some negative aspects of friendship ties wherein engaging with one individual may come at the expense of another. More recent research portrays negative ties as relations in which individuals dislike or intend to harm each other (Labianca and Brass, 2006). Negative ties can reduce trust, hinder assistance, and prevent individuals from seeking advice from others (Casciaro and Lobo, 2008; Chua et al., 2008; Venkataramani and Dalal, 2007), thus undermining task performance (Seibert, 2001). Thus, some scholars have considered competitive relations among firms as negative ties (Yamanoi, 2011), underscoring the negative judgments, feelings, and behavioral intentions of competitors. In particular, Kilduff (2019) noted that firms' similarity and repeated and evenly matched competition can generate relational rivalry that increases the volume, aggressiveness, and complexity of competitive action. This approach, however, assumes that network effects cut across levels, so it draws analogies between interpersonal ties and interfirm ties. Whereas managers' judgments and feelings indeed reinforce competitive actions; this account is insufficient for relating the network structure of competition to performance outcomes. A theory of competition networks should scrutinize the conventions of social network theories and apply mechanisms at the interfirm level of analysis.

Despite the above caveats, early research on competition networks has drawn from established social network theories while underplaying the distinction between cooperative and competitive relations in networks: “[n]etwork theory has been applied to all different kinds of relationships (including cooperative and competitive ones) in prior research” (Tsai et al., 2011: 764). Thus, the distinction between cooperative relations and competitive relations has been blurred. For example, Ingram and Roberts (2000) examined the benefits of friendship ties to competitors, and Gnyawali et al. (2006) explained how the structure of alliance networks affects the likely response to competitive action, whereas Gimeno (2004) considered alliance formation as a competitive reaction to competitors' alliances. These studies focus on the network structure

of cooperative relations rather than on the structure of the competition network. In turn, other studies examined the structure of competition networks, yet concentrated on consequences at the dyad level (Chen, 1996; Downing et al., 2019; Hsieh and Vermeulen, 2014; Yamanoi, 2011). The few exceptions include Tsai et al. (2011), who study how competitive interactions in a dyad and across joint competitors in that dyad influence a firm's ability to accurately perceive the competition network from its competitor's standpoint. In turn, such competitor acumen with respect to a certain competitor can increase the firm's relative market share in that dyad. Downing et al. (2019) qualify that besides direct rivals, firms should be aware of indirect rivals up to the third level. Finally, Skilton and Bernardes (2015) relate a firm's product introductions to the size, density, and diversity of its competition network, whereas Thantchenkery and Katila (2021) relate it to churn, spanning structural holes, and identifying peripheral competitors in the competition network. While these studies offer important insights, we still lack a coherent theoretical foundation to relate the structure of the competition network in which a firm is embedded to its performance.

Both cooperation and competition can be studied using a network framing, yet network scholars have focused almost exclusively on the former phenomenon. A theory of competition networks can contribute to strategic management research and advance network theorizing beyond the mere application of traditional structural reasoning in a new context. By promoting a reasoning that applies to competitive relations, the theory presented here departs from traditional social network theories, which have dealt with cooperative relations; it shifts from the dyad to the ego-network level of analysis; and it considers the implications of competition networks for firm performance rather than for corporate behavior that encompasses the assessment of competitors (Tsai et al. 2011), competitive action and reaction (Chen, 1996; Downing et al., 2019; Yamanoi, 2011), imitation of competitors (Hsieh and Vermeulen, 2014), product market entry (Skilton and Bernardes, 2015; Thantchenkery and Katila, 2021), or alliance formation (Gimeno, 2004). Hence, this theory contributes to emerging research on competition networks and informs research on competitive dynamics and performance heterogeneity. The next sections lay the foundation for a theory of competition networks: offering definitions and discussing how the intensity of dyadic competitive relations and a firm and its competitors' network positions shape the firm's performance.

FOUNDATION OF COMPETITION NETWORK THEORY

Unlike traditional theories of competition that concentrate on the firm or industry, competition network theory identifies the network of competitive relations as the relevant level of analysis. It conceptualizes a firm (actor) as a discrete entity that forms competitive ties with other firms. The collection of competitive ties in a dyad defines the two firms' competitive relation. For example, US Airways and Delta Airlines maintained a competitive relation that encompassed their competitive ties in the United States, Atlantic, and Latin America markets (see Figure 1). A competitive tie can be defined at an even more refined level—for instance, relating to competing service that the two airlines offer on a particular route in the United States. In addition, a competitive relation can correspond to a firm and its competitor's common operation in various industries, thus cutting across industry boundaries (e.g., Downing et al., 2019). Accordingly, a competition network is defined as a confined set of firms and their competitive relations.

Competitive relations are fundamentally different from cooperative relations. Unlike a cooperative tie, such as a strategic alliance, which entails the mutual consent of partner firms to form a tie that is then formalized in an agreement, in the case of a competitive tie, a firm can unilaterally decide to form the tie by entering the market of another firm, irrespective of the latter's consent. Whereas an alliance is a bilateral arrangement that establishes mutual interdependence between partners, a competitive relation can be unilateral in that it may be initiated by one firm without the consent of another. Furthermore, a firm may perceive another as its competitor even though the reverse may not be true. For instance, in the early 20th century, Pepsi considered Coca-Cola as its main competitor, whereas Coca-Cola ignored most of the competitive actions of Pepsi until the latter gained significant market share by the 1980s. In fact, firms can maintain different levels of presence in a market, so that their competitive relation is asymmetric. To the extent that one firm's revenue in a market is significantly higher than that of its competitor in that market, the latter poses limited competitive threat on the firm, whereas the firm exerts substantial competitive threat on that competitor. Table 1 reveals variation in the earnings of airlines operating in the same geographical market segment, suggesting differences in the levels of competitive threats that they pose to each other. For

example, in the Latin America market segment, American Airlines posed greater competitive threat to Continental Airlines than vice versa. The notion of asymmetric relations has not received much attention in the literature on cooperative networks (Labianca and Brass, 2006) but is essential in competition networks.

Additionally, the notion of cooperative tie in social network theories is straightforward because it entails an explicit collaborative agreement, such as a joint venture contract that has a clear starting date and a set of formal clauses that defines its scope and content (Oxley, 1997). In turn, firms neither formalize their competitive relations nor do they necessarily interact directly by virtue of such relations. Furthermore, a cooperative tie entails exchange or combination of the partners' resources and their joint engagement in value chain activities. However, a firm that maintains a competitive tie with a competitor may not even be aware of the independent actions of that competitor. Engaging in ongoing competitive interaction (Baum and Korn, 1999) is not necessary to defining a competitive relation between firms. Hence, it is essential to consider what constitutes a competitive relation between two firms.

Defining a competitive relation

Alternative definitions have been offered for a competitive relation and its constituent ties. Common definitions are based on market communality, resource similarity, or perceived rivalry.

According to the first definition, the prevalence of a competitive tie is inferred from firms' simultaneous operations in the same market segment (Gimeno, 2004). The formation of a competitive tie is thus associated with the entry of a firm into the market of another firm, whereas the dissolution of a competitive tie is ascribed to existing another firm's market. When studying the evolution of competition networks, one should examine a firm's motivation to enter or exit certain markets. Decisions about market entry and exit can be independent of or interdependent with other firms' decisions (Baum and Korn, 1999). A competitive tie serves as a channel for conveying competitive actions of firms in the competition network. Considering competitive actions as the flow in a competition network is in line with the definition of cooperative tie as a conduit of potential resources or information flows between alliance partners (Gulati, 2007). Even though a competitive tie only indicates the possibility that a firm or its competitor may take competitive actions against the other, market communality is a conservative definition of competitive tie,

since it implies that such action has already taken place, so that both the firm and its competitor have established operations in the same market. Subsequently, the firm and its competitor may not necessarily take further competitive actions. Still, the approach taken here circumvents the need to decide what types of competitive actions should be considered. Research on competitive dynamics has identified a repertoire of competitive actions which can vary in diversity (e.g., Ferrier, 2001). Whereas in that literature, the definition of competition is sensitive to the scope of actions, this is not the case in competition network theory. This theory focuses on competitive ties as conduits of competitive actions, which prevail regardless of the type and frequency of competitive actions taken by the parties. Furthermore, unlike research on competitive dynamics in dyads, wherein it is important to specify which competitor the firm has targeted with its competitive action, in competition network theory the intention of the firm does not matter for determining consequences for firms that maintain market communality.

A more inclusive definition of a competitive tie assumes resource similarity. Two firms are considered competitors if they possess similar types and amounts of resource endowments (Chen, 1996). The underlying assumption here is that such firms nurture similar capabilities and pursue similar strategies that support their repertoire of competitive actions (Barney, 1991). Although this definition does not assume that firms that maintain a competitive tie have already initiated competitive action against each other, it is based on the expectation that these firms would take such action. This definition can capture a competitive tie between potential competitors who have yet to enter each other's market. However, since the theory's focus is on competition in the product market, market communality is more immediate and thus more relevant than resource similarity for defining a competitive tie in a dyad (Chen, 1996). Market communality is also more easily observed than resource similarity when seeking to measure competitive ties. Still, given that competitive action can be taken in both product markets and factor markets (Markman et al., 2009), considering both conditions in tandem can help validate the prevalence of a tie.

A third, more liberal approach defines a competitive tie based on managers' perceptions of competitive threat. This approach acknowledges that competition is socially constructed and that firms devise competitive actions based on perceptions of other firms' behaviors. From this standpoint, it is sufficient that

a firm's managers believe that another firm poses a competitive threat (Dutton and Jackson, 1987) to consider it as the firm's competitor (Porac and Thomas, 1990; Reger and Huff, 1993). Although a perceived threat can emerge as a result of market communality or resource similarity, it can also arise as a result of a firm's aspirations, statements, or actions that elicit the competitive reaction (Ferrier, 2001). In this regard, some scholars have distinguished competition from rivalry, defined as the subjective orientation of one firm toward the other while paying increased attention to that other firm's characteristics and competitive actions (Kilduff et al., 2010; Kilduff, 2019; Porac et al., 1995). Perceived rivalry motivates competitive action, but to observe it, one needs to survey the firm's managers or follow their public announcements, which may complicate the measurement of competitive ties. Further complication may arise as a result of managers' diverse perceptions, which can limit the consistency at which the competitive tie can be defined. Even if competitive actions are driven by perceived rivalry, the performance implications of competitive ties depend on competitors' actual actions in the product market. A related approach for defining a competitive tie is based on firms' structural equivalence in the social network, i.e., two firms are considered competitors if they maintain the same pattern of cooperative relations with resource providers (Burt and Talmud, 1993). The assumption here is that these firms compete by virtue of their dependence on the same set of resources, yet this logic is better captured by resource similarity. The notion of strategic group generalizes this approach by distinguishing groups of firms in an industry that pursue similar strategies with respect to their cost structure, product differentiation, vertical integration, diversification, and formal organization (Cool and Schendel 1987). But affiliation with a business group need not imply competition in the product market.

Assuming that a competitive tie is defined by the simultaneous operations of two firms in the same market segment (Gimeno, 2004), i.e., market communality, a remaining question is whether a competitive tie entails awareness (Smith et al., 2001). A competitive tie defined based on perceived rivalry suggests that the firm is aware of its competitor. That firm may perceive another firm as its competitor even though the latter has yet to enter its market (Porac and Thomas 1990). Although it is unlikely, a dyad of firms may operate in the same product market without one firm knowing about the operations of the other. Competitive tension may prevail even if these firms are not mutually aware of each other (Park 1992). Whereas

awareness of competitors' actions is not necessary for a firm to respond to changing market conditions, awareness does facilitate competitive action and determines the likelihood of competitive reaction. A case in point is the competitive dynamics that emerged between Coca-Cola and Pepsi in the 1980s, wherein the two firms promptly responded to each other's advertising campaigns, product packages, and new tastes once Roberto Goizueta took office as Coca-Cola's CEO and considered the competitive threat posed by Pepsi as more serious than his predecessors. Hence, awareness is not necessary for defining a competitive tie between two firms even though it can facilitate their competitive interaction.

The proposed theory holds regardless of whether one defines a competitive tie based on market communality, resource similarity, or perceived rivalry. Taking a conservative approach, let us define a competitive tie based on market communality. Accordingly, two firms are considered competitors when both operate in the same market regardless of the information available to them on each other's operations. When two firms operate in overlapping market segments, they offer comparable products or services to a shared group of customers (Aldrich et al. 1984; McPherson 1983). One caveat of relying on market communality is that the boundaries of market segments become inherent to the definition of competitive ties. Therefore, unlike a cooperative relation, which is defined based on bilateral agreements between two firms, in a competition network all firms that operate in a product domain or market segment maintain competitive relations with each other, and are thus structurally equivalent in that market segment (see Figure 1). The ego-network structures of firms do vary, however, once we account for their different product lines or the multiple market segments in which they operate.

Finally, in studying competitive relations, an important distinction should be made between the mere prevalence of a competitive relation and its corresponding intensity. Competitive relations elicit different levels of competitive threats (Chen et al., 2007; Kilduff et al., 2010). Market communality serves only for identifying competitors, but not for assessing the intensity of their competitive relations. A perceived threat from a rival or resource similarity may be considered a less intense form of competitive threat than one defined by a competitor's introduction of a product into the firm's market. The competition is likely to become more intense when that competitor introduces several products into that market.

The intensity of competitive relations

The intensity of competition is a fundamental mechanism in industrial organization economics. According to that tradition, the association between competition intensity and firm performance derives from exogenous properties of the industry such as barriers to entry, industry concentration, and product differentiation (Caves and Porter 1977). In turn, competition network theory ascribes the intensity of competition to competitive relations. Whereas industry structure may relate to product attributes, information asymmetries, and firms' bargaining power relative to suppliers, among various other characteristics of the industry (Porter 1980), according to competition network theory, the intensity of competition encountered by a firm derives, in part, from the intensity of the competitive relations in which it is embedded. Different firms operating in the same market segment would experience different levels of competitive threat based on their specific relations with competitors. Consequently, competition network theory can explain performance heterogeneity among firms that operate in the same market and face similar industry conditions irrespective of their idiosyncratic resource endowments.

The intensity of a competitive relation is represented by the value of the constituent network ties. The value of ties has received limited attention in social network theories (Granovetter 1973), but it is consequential for competition networks. The intensity of a competitive relation in a dyad may correspond to the number of competing products that two firms offer in markets where they both operate, or to the proportion of sales that these firms generate in common markets relative to their total sales. One may also proxy for the intensity of a competitive relation with resource similarity in a dyad. These alternative proxies differ with respect to the unit of accrual—e.g., products versus revenues or resources—but conceptually they all represent the intensity of a competitive relation based on the potential scope of competitive action.

According to established research in industrial organization economics, the intensity of competition can be induced by some industry conditions such as slow industry growth, a high proportion of fixed costs, lack of product differentiation or switching costs, and high exit barriers (Porter 1980). In turn, according to competition network theory, the intensity of a competitive relation between two firms is ascribed to the extent of overlap in these firms' product (or resource) portfolios in that dyad. As the proportion of overlap

in the firms' products increases, competition becomes more intense, which makes the competitive threat more visible and consequential (Smith et al. 1991). The underlying logic is that similarity between competitors enhances their rivalry (Kilduff et al., 2010). Under such conditions, it is increasingly likely that the competitor initiates competitive actions against the firm or reacts to the firm's competitive actions (Chen et al., 2007). Although increased market communality enables a firm to become more familiar with its competitor and its likely behavior (Tsai et al., 2011), the indirect gain from knowing the competitor is likely to be offset by the direct loss ascribed to the competitor's actions and more intense competition. Hence, the extent of market communality (or resource similarity) contributes to the intensity of a competitive relation.

Nevertheless, the intensity of a competitive relation that each firm experiences in a dyad is asymmetric. From a focal firm's standpoint, the intensity of a competitive relation can be captured by the proportion of its products, sales, or resources that are contested by the competitor. For example, from American Airlines' standpoint, the intensity of its competitive relation with Delta Airlines in the United States was greater than that of its relation with United Airlines, given the higher share of Delta in that market (see Table 1). More generally, the intensity of a competitive relation between a firm and its competitor in a given market is expected to be related to the importance of that market to the firm and the dominance of the competitor in that market (Chen, 1996). Market importance can be captured by the proportion of the firm's revenue in that market relative to its total revenue. The competitor's dominance can be inferred from its market share in that market. Similarly, if one relies on the number of products as a proxy, the greater the proportion of products that a firm has in a market relative to its total number of products, the stronger the competitive threat created by its competitors' actions in that market. In addition, the greater the share of products that a competitor has in that market out of the total number of products offered by firms in that market, the stronger the competitive threat that it poses in that market. The interplay of market importance and competitor dominance in common markets defines the intensity of their competitive relation from the firm's standpoint.

From the firm's standpoint, the greater the intensity of its competitive relation to a competitor, the more likely that competitor is to initiate competitive actions against the firm or retaliate with counteractions to competitive actions initiated by the firm. Competitive actions can take various forms such as price cuts,

advertising campaigns, enhanced service offerings, or new product introductions into markets in which the firm operates. Such actions serve as purposeful and observable moves aimed at enhancing the position of the acting competitor vis-à-vis the firm and mitigating the competitive threat which that competitor experiences (Chen and MacMillan, 1992). The firm's awareness of such competitive action can facilitate and intensify the firm's reaction, but it is not a necessary condition for reaction, since the competitor's action is likely to undermine the firm's market position and thus prompt its reaction regardless of the origin of the competitive threat. The firm's reaction can elicit competitive dynamics that reinforce the competitive tension as a result of the competitor's subsequent reaction to the firm's actions (Baum and Korn, 1996; Weigelt and MacMillan, 1988). As the perceived competitive tension intensifies, so do the severity and volume of competitive action and reaction (Chen et al., 2007). In turn, firm performance is negatively related to the number of competitor actions (Chen and Miller, 1994) and their aggressiveness (Ferrier, 2001). The increased likelihood, frequency, and severity of the competitor's actions are, in turn, expected to undermine the firm's performance. Therefore, firm performance is expected to be negatively related to the intensity of the firm's competitive relations, as captured by the extent of market communality (or resource similarity) and weighted by each market's importance to the firm and the dominance of competitors in that market. Besides market importance and competitor dominance, it is reasonable to assume an equal contribution of each competitor to the intensity of competition. However, this assumption is violated when the firm's competitive relations are not independent. For instance, when two of the firm's competitors form an alliance (Gimeno, 2004), they can pose a competitive threat greater than the sum of their individual threats. Finally, the intensity of competitive relations can be studied at the ego-network level by considering the firm's complete set of relations to immediate competitors. But a question remains concerning the implications of variation in the intensity of competition in the network, since that intensity may be driven by extreme values. On the one hand, high variation in the intensity of competitive relations in the firm's network can increase the probability of encountering a dominant competitor that can launch a massive attack against the firm (Chen et al., 2007). On the other hand, such variation may make it easier for the firm to identify competitive actions of its competitors (Smith et al., 1991). Studying the performance implications of variation in the

intensity of the firm's competitive relations requires empirical inquiry to uncover whether the threat of dominant competitors outweighs the enhanced ability to identify competitive actions of competitors.

Multimarket contact and the intensity of competitive relations

The negative association between market communality and firm performance seems to challenge conventional wisdom in established research on multimarket contact (Baum and Korn, 1996; Gimeno and Woo, 1999; Karnani and Wernerfelt, 1985). Such research suggests that two firms that simultaneously compete in multiple markets nurture mutual forbearance that mitigates their tendency to initiate competitive actions against each other in one market in fear of retaliation in other markets in which they both operate, thus attenuating the intensity of competition in the dyad and enhancing each firm's performance (Alexander, 1985; Fienberg, 1984; Gimeno, 1999). This incongruence can be resolved, however, by recognizing that competition network theory ascribes the intensity of competition to the extent to which a firm's products or sales are endangered by a competitor, irrespective of the number of common markets or distribution of products or sales across common markets. The intensity of competition can be defined based on a count of overlapping products or revenues in the market segments in which both the firm and its competitor operate, whereas multimarket contact can be proxied by the count of such overlapping market segments. Additionally, irrespective of the number of market segments in which the firm and its competitor operate, forbearance would not be mutual if only a small proportion of a firm's products or sales are threatened by those of the competitor. The fact that firms follow similar diversification strategies and enter the same markets is insufficient in and of itself to establish deterrence. When a firm assesses the likelihood of retaliation by its competitor, it weighs the overall proportion of endangered products or sales across common market segments, rather than focuses on the number of common market segments per se.

Therefore, although multimarket contact can transpire across narrowly defined market segments, it becomes relevant only insofar as the intensity of competitive relations in a dyad is approaching symmetry, while competitors maintain asymmetric presence in each other's markets (Hsieh and Vermeulen, 2014; Karnani and Wernerfelt, 1985). Stated differently, mutual forbearance emerges when the overall strengths of a firm and its competitor are relatively similar yet each maintains dominance in markets where the other

suffers weakness. Under such conditions forbearance is mutual, since each competitor can effectively retaliate in a market where its counterpart demonstrates weakness. For example, mutual forbearance may have emerged between American and United, which earned relatively similar revenue figures, with American revealing stronger sales in Latin America and United showing strength in the Pacific. However, mutual forbearance was less likely to prevail between Delta and US Airways, even though they overlapped in most markets, because Delta was stronger in each of these markets (see Table 1). Hence, multimarket contact can lead to mutual forbearance that attenuates competitive tension under strict conditions (Bernheim and Whinston, 1990). Multimarket contact is a necessary but insufficient condition for mutual forbearance. In most cases, market communality is expected to intensify competition rather than attenuate it, so that a firm's performance improves with reduced intensity of its competitive relations.

Therefore, mutual forbearance sets a boundary condition for the performance implications of the intensity of competitive relations. Indeed, market communality, weighted by the importance of each market and the competitors' dominance in that market, generally prompts competitive interaction that can undermine a firm's performance (Baum and Korn, 1996). However, to the extent that mutual forbearance is established by virtue of the firm and its competitor's equal strengths and asymmetric presence in their multiple common markets (Bernheim and Whinston, 1990), the negative performance consequences of their intense competitive relation are mitigated as a result of their efforts to restrict their competitive interaction. In particular, the asymmetric presence of the firm and its competitor in certain markets establishes reciprocity, whereby the firm would seek to defend markets in which it dominates its competitor, whereas the inferior position of the competitor in those markets would encourage its retaliation to the firm's aggression in other markets in which it dominates the firm (Sorenson, 2007). The credible threat posed by such mutual forbearance is likely to deter the firm and its competitor from taking competitive action that can elicit effective retaliation in the markets in which the firm or its competitor reveals weakness, thus attenuating the negative performance effects of their intense competitive relation. Mutual forbearance mitigates competitive tension and demotivates tendencies to increase the severity, volume, and frequency of competitive action and reaction that otherwise undermine firm performance in common markets in which

the firm and its competitor maintain an intense competitive relation. Of course, the likelihood that the firm would initiate competitive action in a particular market depends not only on the intensity of its competitive relation and mutual forbearance with a particular competitor that operates in that common market, but also on its competitive relations with other competitors that it encounters in that market.

A firm's network position and the intensity of competition

Whereas relational approaches such as competitive dynamics and multimarket contact offer insights on the intensity of competition that evolves in dyads of competitors (e.g., Baum and Korn, 1999; Chen, 1996), competition network theory considers how the intensity of competition is shaped by both relational and structural properties of its competition network. A firm embedded in a competition network is involved in several competitive relations with multiple competitors. Thus, the intensity of competition that a focal firm faces depends not only on the intensity of a competitive relation but also on the firm's position in the competition network. Accordingly, firm performance is likely to be shaped by the interplay of the intensity of the firm's competitive relations and its position in the overall structure of the competition network.

A firm's network position defines the structural properties of the network in which it is embedded. Emerging research on competition networks has sought to analyze the implications of the structural properties of competition networks by following established social network theories. For instance, Yamanoi (2011) has adopted Freeman's (1979) concept of centrality, suggesting that competitive actions spread like information flows in a social network. Similarly, Skilton and Bernardes (2015) followed Burt (1992, 2007) in arguing that a dense network structure elicits homogenous patterns of product market entry in a competition network, while Thatchenkery and Katila (2021) related product introductions to spanning structural holes in the competition network. Nevertheless, the control and brokerage that serve as the underlying mechanisms of these structural properties in social networks need to be revisited when considering competition networks, wherein network relations shape competition intensity rather than induce information flows or social influence. Studying the effects of a firm's position in a competition network entails relying on distinctive mechanisms that differ from those characterizing social networks. Once these distinctive mechanisms are accounted for, the conclusions may challenge those obtained, while assuming

mechanisms typical of social networks, as in the case of Yamanoi (2011) who concluded that the more central a firm is in the competition network, the less intensive the competitive activity that it engages in.

A fundamental structural property of a network concerns a firm's degree centrality (Freeman, 1979), which corresponds to the number of relations in which the firm is involved with other firms in its network. In a competition network, degree centrality pertains to the count of competitive relations that a firm maintains with other firms in its network, which can be standardized by dividing it by the number of possible relations in the network (Wasserman and Faust, 1994). In contrast to industrial organization economics, which relates firm performance to overall industry concentration, competition network theory refers only to those competitors that maintain market communality or resource similarity with the firm. Unlike social network theories that relate degree centrality to prominent firms that can access information or influence other firms in their network (Knoke and Burt, 1983), degree centrality in a competition network influences the intensity of competition faced by the focal firm. Note that when considering a firm's position in a particular market segment, its degree centrality may be similar to that of its competitors in that market segment, yet structural properties such as degree centrality are defined across the multiple market segments in which the firm operates. As argued next, degree centrality in the competition network is expected to negatively affect firm performance as a result of increased competitive threat and weaker ability of the firm to identify and react to competitive actions of its competitors.

Holding constant the intensity of competitive relations, a firm is expected to face intensifying competitive threats when its degree centrality in the competition network increases. As the number of relations in the firm's competition network increases, coordinating competitors' actions becomes more difficult (Porter 1980; Tirole 1988), thus increasing the intensity of competition encountered by the firm. Additionally, degree centrality is associated with aggressive actions of competitors. For example, the large number of competing airlines that American Airlines encountered on some routes in the United States increased the likelihood that its competitors offer discounted fares in an effort to increase their load factors on these routes, which in turn could undermine American Airlines' performance.

Besides the intense competitive threat associated with degree centrality, degree centrality in the firm's

competition network increases the frequency of competitors' actions, which makes it more challenging for the focal firm to monitor, identify, and react to relevant competitive actions (Smith et al., 1991). As degree centrality increases, the firm must invest more effort in monitoring a large number of competitive relations and collecting relevant information on competitors' actions. Bounded rationality (Simon, 1972) can further limit managers' ability to process such information. Thus, because of their cognitive constraints, managers may limit their attention to a relatively small set of competitive relations (Porac and Thomas 1994; White and Eccles, 1987). Information overload may slow down their decision making and encourage the use of suboptimal heuristics, which can limit the firm's competitive reactions. Even though certain heuristics can facilitate decision making (Bingham and Eisenhardt, 2011), when they involve responses to an increasing number of competitors, speed and effectiveness of decisions are likely to trade off. Therefore, the reduced likelihood and speed of the firm's competitive actions can impair firm performance (Young et al., 1996).

Irrespective of the intensity of competitive relations and the aggressiveness of competitors' actions, as degree centrality increases, the firm may find it more difficult to devise competitive actions that effectively neutralize competitive threats posed by an increasing number of competitive relations. Reacting to the competitive actions of one competitor may not suffice for coping with the competitive actions of another competitor, so, as degree centrality increases, the firm's competitive actions and counteractions may become ineffective. For example, to the extent that American Airlines offers a discounted fare on a particular route in response to a price cut by US Airways, this may undermine American's efforts to react to United, which may have enhanced the quality of its service and charged premium prices for its Economy Plus fares on that route. Such implications have gone unnoticed by research on competitive dynamics at the dyad level, which disregards the firm's interactions with other competitors in the network. The challenge of responding to competitive threats posed by numerous competitive relations increases to the extent that competitors pursue diverse competitive actions, thereby making it difficult for the firm to comprehend and react to their actions (Young et al., 1996). A firm may be able to devise strategies that neutralize competitive threats posed by several competitors, but degree centrality makes investment in such robust strategies exorbitant while exposing the firm to the competitive actions of competitors whose actions have been overlooked. In sum,

as the firm's degree centrality in its competition network increases, its performance declines because of the firm's inability to devise and execute effective competitive actions against its competitors. Hence, firm performance is expected to be negatively related to the firm's degree centrality in its competition network.

A competitor's network position and the intensity of competition

A firm's performance varies with its position in the network of relations with direct competitors. Nevertheless, this effect goes beyond direct ties and depends also on the positions of the firm's competitors in their own networks. The structure of the competition network shapes competitor behavior, which, because of competitive dynamics, influences the firm's own behavior and performance outcomes (Baum and Korn, 1996; Downing et al., 2019). Increased degree centrality in its competition network limits the firm's ability to identify and react effectively to particular competitive threats. Thus, a competitor that is itself embedded in an extensive network of competitive relations is less likely to react to the firm's competitive actions. Specifically, such a competitor's attention may be distributed across many other competitors besides the firm in question (Ocasio, 1997; Porac and Thomas, 1994), so that it becomes more difficult for that competitor to track the firm's actions such as new product introductions, price cuts, and promotions. Furthermore, this competitor's efforts cannot be effectively allocated in response to diverse competitive actions, so that the competitor either makes limited effort to react to the competitive actions of a wide range of its competitors or concentrates its efforts in reaction to a small subset of its competitors. In any case, the competitive threat posed by the focal competitor is mitigated by either its lack of awareness or limited ability to react (Chen et al., 2007), especially when that competitor faces substantial threats from competitors other than the firm. Consequently, a firm whose competitors are central in the competition network experiences mitigated intensity of competition. Such a firm can initiate competitive action that enhances its competitive position and performance (Ferrier et al., 1999; Young et al., 1996) with less concern about counteractions of its competitors that can offset the effectiveness of its own competitive actions (Smith et al., 2001).

According to social network theories, an individual with relations to central alters in a social network enjoys greater prestige or power (Wasserman and Faust, 1994). Some scholars use eigenvector centrality to capture this notion by defining the popularity or status of an individual as a linear function of the number

of relations that her alters maintain in the social network (Bonacich, 1972). In a competition network, the centrality of competitors also generates a positive effect on firm performance, but for a completely different reason. A firm that competes with competitors that face many other competitors experiences mitigated competitive threats from its competitors, who must devote attention to various other competitors. Increased degree centrality of competitors also offers opportunities for new entrants that can take competitive actions with reduced risk of counteractions from such competitors. As a result, a firm that competes against other firms that are central in their competition networks is likely to witness enhanced performance. In sum, there is a positive association between firm performance and the degree centrality of the firm's competitors in their own competition networks. Such association cannot be derived from dyadic analysis of competition that does not consider the competitor's relations with other competitors besides the focal firm. And while recent research suggests that a competitor of a competitor may become a direct competitor (Downing et al., 2019), the theory presented here posits that the firm's performance is shaped by indirect competition as a result of seemingly unrelated competitive relations between the firm's competitor and its other competitors. Hence, an unrelated competitive interaction between a competitor and its own competitors in the network generates positive spillover effects for the bystander firm irrespective of its competitive interaction with the competitor in question. This insight has not been picked up by either research in industrial organization economics or by research in competitive dynamics, which has followed a dyadic approach.

Shared third-party relations and the intensity of competition

The argument concerning the positive performance implications of the degree centrality of competitors in the network rests on the supposition that a competitor embedded in an extensive network of competitive relations has limited ability to effectively react to the firm's competitive actions. The latent assumption here is that competitive interactions between that focal competitor and its other competitors do not adversely affect the firm. However, this assumption may not hold when that competitor's competitors also compete directly with the firm. In this case, the reactions of those competitors to the competitive actions of the focal competitor may pose competitive threats to the firm. Hence, it is essential to consider the shared third-party competitive relations of the firm and its competitors.

The notion of structural equivalence in social networks (Burt, 1976; Lorrain and White, 1971) refers to the extent to which two firms capture similar positions in the network, i.e., maintain relations with the same third-party competitor. In social networks, structural equivalence has been associated with similar patterns of behavior as a result of mutual influence or competition for favors from the same alters (Burt, 1982). These mechanisms, which are valid for interpersonal relations in a social network, cannot be bluntly applied when studying competitive relations among firms. In the context of competition networks, some scholars have suggested that structural equivalence allows a firm to “stand in its competitor’s shoes” and thus gain insight into its competitive behavior (Tsai et al., 2011). Nevertheless, structural equivalence also means that the competitor stands in the firm’s shoes, and thus becomes more familiar with the firm’s competitive behavior. The greater mutual awareness and attention to the competitive actions and intentions of competitors facilitate rivalry that can increase competitive interaction (Kilduff et al., 2010).

Whereas the notion of structural equivalence suggests that the firm and its competitor occupy the exact same position in the network (Burt, 1976), i.e., maintain similar relations to all other firms in the competition network, it is sufficient that they maintain some shared competitive relations to such third-party competitors in order to become familiar with each other’s competitive behavior. Another implication of maintaining shared third-party relations in the competition network arises from the fact that competitive actions of a shared third-party competitor affect the firm and its competitor in a similar manner. Thus, even if the firm’s competitor does not direct its competitive action against the firm, such as when introducing a new product or cutting prices as part of its competitive interaction with another competitor, this action may still influence the firm’s position in the market. Furthermore, the response of the targeted competitor can undermine the firm’s performance to the extent that the firm maintains competitive relations with both competitors. Competitive action in a triad of competitors can create spillover and competitive tension even if the attacker captures a central network position that otherwise limits its attention and ability to react to the firm’s particular actions. Not only do shared third-party competitive relations enhance the competitor’s awareness of the firm’s actions (Tsai et al., 2011), but also the actions of the competitor against its other competitors are likely to spill over and influence the firm. A greater proportion of shared third-party competitive relations

in the competition network enables the competitor to react more effectively to the firm's competitive actions and better manage its competitive reaction and corresponding efforts to cope with competitors despite its central position in its competition network. Hence, an increasing proportion of shared third-party competitive relations between the firm and its competitors can reduce the firm's gain from the degree centrality of its competitors in the firm's competition network. One of the implications of this insight is that unlike research on competitive dynamics, which has focused on action-counteraction in a dyad, the theory presented here suggests that competitive interactions of a firm's competitors with third parties can be consequential for the firm, intendedly or unintendedly. In turn, the valence of the performance effect depends on the overall pattern in the network of competitive relations, not only to the structure of the firm's own competition network. Overall, the proposed theory advances research on competition and enriches network research by extending its application in the field of strategic management. Whereas the framework encompasses not only propositions but also the theoretical foundation for competition network theory, the particular conjectures that can be derived from the framework are illustrated in Figure 2. Future research may further extend the theory by offering additional propositions that build on its foundation.

CONCLUSION

The study of competition in strategic management has traditionally followed frameworks anchored in industrial organization economics that underscore the importance of industry boundaries for characterizing the conditions that shape the intensity of competition. Nevertheless, convergence of technologies and the emergence of ecosystems, among other recent trends, have led to the blurring of industry boundaries, thus calling for new approaches for studying competition independent of such boundaries. A network perspective is a mezzo approach that straddles the industry and firm levels of analysis.

Although network theories have gained prominence in strategic management research, they have primarily informed the study of alliance networks (Gulati et al., 2000). Recent research has sought to also employ such theories for investigating the phenomenon of competition (e.g., Hsieh and Vermeulen, 2014; Thantchenkery and Katila, 2021; Tsai et al., 2011; Yamanoi, 2011). Nevertheless, the foundation of social network theories that have originally served for studying cooperative exchange must be revisited when

studying competition. The underlying mechanisms in competition networks differ from those prevalent in cooperative networks, in part because competition networks are neither transitive nor formal, yet they are unilateral and asymmetric. Features such as asymmetric relations have not received much attention in social networks, so this study offers insights on their application in competition networks. Although competitors can establish a cooperative relation and benefit from involuntary information flow or knowledge spillover, one cannot disregard the negative performance implications of their competitive relation.

The current study builds the foundation for a network theory of competition by extending prior research on dyadic competition (Chen, 1996). This theory complements established theories such as industrial organization economics (Caves 1984; Porter 1980; Scherer and Ross 1990) and resource-based theory (Barney, 1991; Dierickx and Cool, 1989; Wernerfelt, 1984). Whereas industrial organization economics has ascribed performance differences to industry affiliation, and resource-based theory has further accounted for performance heterogeneity at the firm level, competition network theory attributes performance heterogeneity to the relational and structural properties of the competition network. This network is idiosyncratic to each firm given its unique set of competitive relations. Studying competition as a network phenomenon can thus enhance our ability to explain performance differences across firms. It can also help identify the sources of competitive threats that each firm faces.

Competition network theory complements established frameworks in strategic management that study the implications of competition without referring to particular competitive relations among firms. Competition network theory introduces a novel approach by conceiving of competition as a network and acknowledging the structure of competition emerging from competitive relations. It focuses on the web of competitive relations among firms, accounts for the intensity of competition emanating from that network as a mechanism that shapes firm performance, and underscores the roles of network structure and competitive relations irrespective of industry conditions and firms' resource portfolios.

Competition network theory goes beyond research on competitive dynamics by shifting from the dyad to the network level of analysis. The theory suggests that besides the intensity of competitive relations, the positions of a firm and its competitors in the competition network shape the firm's performance. This theory

calls for considering the complete set of a firm's competitors as well as the competitors of its competitors. It accounts for the performance effects of indirect competitive relations and similarities in the competition networks of competitors, while underscoring the structural properties of these networks, thus extending the dyadic analysis of competition (Chen, 1996). The theory suggests that the implications of competitive interactions in a dyad of firms depend in part on third party relations. As a result, a competitor's interactions with its other competitors impact the firm's performance, depending on the extent to which the firm also competes with these third parties. Accordingly, competition network theory overcomes some limitations of dyadic approaches for studying competition that may reach boundary conditions. Thus, the conjectures on the performance implications of competition networks inform empirical research on competitive heterogeneity that has disregarded network effects (McGahan and Porter, 1997). It is possible that some of the heterogeneity ascribed to the industry, corporate or business level should be associated with the network.

Last but not least, the proposed theory advances network research by challenging the received wisdom that network theories are agnostic to the nature of relations. Competitive relations are fundamentally different from cooperative relations, so that established measures of degree centrality, structural holes, eigenvector centrality, or structural equivalence receive a new meaning and entail distinct mechanisms in this context. This theory further contributes to network research by promoting concepts that have received limited attention in prior network studies. In particular, this theory contributes to research on negative ties (e.g., Labianca and Brass, 2006; Yamanoi, 2011) by shifting from the interpersonal level to the interfirm level and by uncovering mechanisms that underscore the intensity of competition rather than negative sentiment and behavior of managers that accompany these mechanisms. Similarly, competition network theory underscores the notion of asymmetry in relations, which has not received much attention in established social network theories (Labianca and Brass, 2006). By demonstrating how the competition networks of competitors benefit the firm, the proposed theory further advances research on neighbor networks (Burt, 2010) that has considered the spillover of network advantages. Whereas Burt (2007) reveals that social capital in the form of brokerage benefits is limited to the immediate network of associates in a cooperative network, the theory advanced here claims that in a competition network, spillover benefits are

prevalent, so that a firm does gain from relations to competitors that are central in their competition networks. Overall, the current study advances research on competition and enriches network research by extending its application in the field of strategic management.

This study also points to some important managerial implications. Managers have traditionally focused on managing competition in an industry, market segment or with a particular competitor, focusing on competitive actions which are directed to or from such competitors. The theory advanced here, however, suggests that managers should take a broader perspective to understand the overall pattern of competitive relations in which the firm is situated and be aware of the competitive interactions of their competitors with their other competitors, given that they are consequential for firm performance. This requires a broader scanning and a more intimate familiarity with the competitive actions of competitors, even when not directly related to the firm. Another implication is the consideration of second-order effects of competitive actions. In particular, when taking competitive action in order to improve the firm's position vis-à-vis a particular competitor, the firm's managers should be aware of the other competitors of that competitor, which may be negatively affected by the firm's action and may take counter actions that adversely affect the firm. With the proliferation of ecosystems, traditional industry affiliations may no longer apply, so managers should assess competitive threats and devise corresponding strategies to attenuate the intensity of competition based on more nuanced definitions of competitive relations, as proposed here. These are but a few of the various insights that emerge when taking a network approach for analyzing competition.

DIRECTIONS FOR FUTURE RESEARCH

This study makes some strides toward formalizing a theory of competition by using the network framing. Specifically, it has suggested ways to assess the intensity of competition, which in turn affects firm performance. It has also accounted for multimarket contact and third-party relations when assessing the performance implications of competitive relations and degree centrality in the competition network. Future research may consider the performance implications of additional structural properties of the competition network. Indeed, scholars have tended to adopt properties such as structural holes (Thantchenkery and Katila, 2021; Yamanoi, 2011), yet the distinctive nature of competitive relations questions the predictions

of social network theories in this context. For instance, a firm that bridges two otherwise disconnected partners in a cooperative network gains brokerage benefits. In contrast, a firm competing with two competitors that do not compete with each other is likely to be worse off relative to a triad in which its two competitors also compete with each other, because this constrains their ability to allocate sufficient attention and react to the firm's competitive actions. This illustrates the need to rely on a distinct theory of competition networks rather than draw analogies from social network theories.

Another avenue for future research involves considering alternative outcomes, such as competitive actions that may take the form of market entry or exit. These outcomes have already received some attention in prior research on competitive dynamics (Baum and Korn, 1999; Chen, 1996). Accordingly, scholars may study the propensity of a firm to enter a particular market as a function of the structural properties of its competition network (e.g., Skilton and Bernardes, 2015). For instance, a firm may avoid entering a market that is already populated by many competitors relative to less populated markets. To the extent that scholars consider how firms react to structural properties of their competition networks by entering or exiting markets, which endogenously shapes the structure of competition networks, a dynamic perspective can be introduced that does not limit concern to the immediate performance implications of competition networks.

Future research may also extend the formulation of network effects by going beyond indirect ties to consider second-order network effects. Specifically, the proposed theory has accounted for the competition networks of the focal firm's competitors and their effects on the intensity of competition faced by the firm. Thus, it has considered the competitors of the firm's competitors. Following literature on competitive dynamics (Baum and Korn, 1996; Weigelt and MacMillan, 1988), one may consider the network positions of the competitors of the firm's competitors in order to generate more refined predictions of firm behavior and performance (e.g., Downing et al., 2019). Nevertheless, as the path length increases, the magnitude of the network effects is expected to diminish, while the increasing complexity of the specification may inhibit empirical analysis or require non-analytic methods such as a simulation. A more fruitful avenue, perhaps, involves examining boundary conditions. For instance, besides the immediate implications of competitors' degree centrality, it is possible that such centrality in their competition networks also mitigates the effect of

the intensity of their competitive relations with the firm. Hence, even if a competitor is prompted to respond to competitive actions in a market in which it is dominant, its centrality in the network may limit its motivation and ability to respond to such actions.

Another extension involves simultaneously analyzing competition networks and cooperative networks. Such analysis is vital in industries that feature extensive alliance formation. However, there is little value in mere juxtaposition of research insights from the separate streams of research on each type of network. More interesting is the case of their interplay (Hoffmann et al., 2018), whereby competitive actions influence the evolution of alliance networks, while alliances shape the competition network. Prior research has begun to consider the competitive implications of alliance formation (Gimeno, 2004), yet it is worthwhile examining the structure of competitive relations of firms that are also tied to alliance partners via buyer-supplier relations, joint ventures, or other cooperative relations. For instance, in the airline industry example, many of the competitors were also affiliated with global alliance networks, such as the Star Alliance. In this case, cooperative relations can offset competitive tension, while competition among alliance networks can shape firm performance (Lazzarini, 2007). The two types of networks may be intertwined, as alliance partners may enter each other's markets, whereas competitors may decide to mitigate a competitive threat by joining certain alliance networks. Future research may further the investigation of the interplay of competition and cooperation using a network perspective. Nevertheless, before scholars can link competitive and cooperative relations in networks, they should fully understand the independent implications of the competition network. Once this has been established, scholars can proceed with inquiries concerning cross-network effects. A relevant question involves the implications of various structures of the competition network for the tendency to form alliances or select a particular partner. Another question is how forming alliances with competitors that are distinctively positioned in a firm's competition network can influence the intensity of competition which the firm faces. However, when studying such interdependencies scholars should bear in mind that the two networks are not equivalent. For instance, whereas alliance formation entails mutual consent with the partner, a competitive relation can be unilaterally formed by either firm. Hence, while scholars have often studied alliances from a focal firm's standpoint, the study of competition networks requires the simultaneous

consideration of the motivations and actions of firms that opt into or out of such networks.

Moreover, a theory of competition networks should study not only the consequences but also the antecedents of these networks, identifying factors that drive their emergence and evolution over time. In parallel to the study of alliance networks, scholars should examine the extent to which inducement and opportunities (Ahuja, 2000b), path dependence (Gulati, 1995; Gulati and Gargiulo, 1999), and other strategic considerations (Chung et al., 2000) guide the formation of competitive relations and shape the structure of competition networks (e.g., Downing et al., 2019). There is also an opportunity to explore the association between competitive relations at the interfirm level and negative ties at the interpersonal level in order to test the latent assumption that the two corresponding networks are aligned (Kilduff, 2019). Hence, future research may account for endogeneity in the evolution of competition networks. Nevertheless, unlike alliance networks, in which alliance formation and partner selection are conscious decisions, competition networks can be derived from firms' independent decisions to enter certain markets irrespective of their competitors' decisions. These decisions, in turn, depend on industry structure and corresponding conditions such as product differentiation and entry barriers that have been studied in industrial organization economics. Hence, future research may relax the market homogeneity assumption of competition network theory and account for market heterogeneity when studying the formation and performance effects of competition networks. Furthermore, industry conditions and firms' resource configurations may explain market entry decisions, and thus shape the structure of competition networks. It is possible that competition networks partially mediate the performance implications of industry conditions and resource positions. Still, competition network theory offers important insights, since competitive relations have remained latent in industrial organization economics despite their more immediate performance implications relative to industry conditions that may shape the structure of competition networks.

Competition network theory underscores the implications of interdependence of competitive relations, e.g., studying how the competitive interactions between a competitor and its other competitors affect the intensity of competition faced by the firm. In turn, the theory makes a simplifying assumption by not considering how competition in one market affect the intensity of competition in another market. Still, firms

often diversify into related markets, in which they can leverage similar or complementary resources and enjoy economies of scope (Nayyar and Kazanjian, 1993; Rumelt, 1982). The intensity of competition that a firm encounters in one market may be influenced by its competitive relations in related markets—for instance, when considering markets for substitute products. The more related the markets are, the stronger the effects of competitive relations in one market on the intensity of competition in the other market. This relatedness can be determined based on standard industry classification (Robins and Wiersema, 2003) or structural equivalence of firms' product portfolios (Tanriverdi and Lee, 2008). Even without considering market relatedness, competition network theory enables the juxtaposition of multiple markets in which a firm operates, whereas other analytic approaches, such as Porter's (1980) framework, concentrate on competition in a single industry or market. Finally, by adopting the resource-similarity criterion, scholars can extend competition network theory to the study of competitive relations in the factor market, thus complementing the resource-based view (Barney, 1991; Markman et al., 2009). Much like the industry level analysis is sensitive to the classification of industries, network analysis is sensitive to a definition of a competitive tie. Hence, future empirical research may contrast the findings obtained for competition networks defined by market communality, resource similarity, and perceived rivalry. Future research may also consider the diverse implications of various aspects of organizational similarity between firms and potential nonlinear effects of their market communality (e.g, Naumovska and Lavie, 2021). Another unresolved question concerns the implications of variation in the intensity of competition in the network. Although there is ample room for future research on competition networks, this study contributes by underscoring the importance of competition networks, providing the foundation for and introducing theory that can enhance understanding of this phenomenon, and promoting an emerging field of research.

REFERENCES

- Ahuja, G. 2000a. Collaboration networks, structural holes, and innovation: a longitudinal study. *Administrative Science Quarterly*. 45(3): 425–455.
- Ahuja, G. 2000b. The duality of collaboration: inducements and opportunities in the formation of interfirm linkages. *Strategic Management Journal*. 21(Special Issue): 317–343.
- Aldrich, H., B. McKelvey, and D. Ulrich. 1984. Design strategy from the population perspective. *Journal of Management*. 10(1): 67–86.
- Alexander, D. L. 1985. An empirical test of the mutual forbearance hypothesis: the case of bank holding companies. *Southern Economics Journal*. 52(1): 122–140.
- Amir, Y., D. Lavie, and N. Hashai. 2019. Multi-market competition and alliance formation, *Frontiers of Strategic Alliance Research: Negotiating, Structuring and Governing Partnerships*, in Contractor, F.J., & J. Reuer, (Eds.), Cambridge University Press, Chapter 18, 305-321.
- Barney, J. 1991. Firm resources and sustained competitive advantage. *Journal of Management*. 17(1): 99–120.
- Baum, J. A. C., T. Calabrese, and B.S. Silverman. 2000. Don't go it alone: alliance network composition and startups' performance in Canadian biotechnology. *Strategic Management Journal*. 21: 267–294.
- Baum, J. A. C., and H. J. Korn. 1996. Competitive dynamics of interfirm rivalry. *Academy of Management Journal*. 39(2): 255–291.
- Baum, J. A. C., and H. J. Korn. 1999. Dynamics of dyadic competitive interaction. *Strategic Management Journal*. 20: 251–278.
- Bernheim, B.D. and M.D. Whinston. 1990. Multimarket contact and collusive behavior. *RAND Journal of Economics*. 21(1): 1–26.
- Bingham, C.B. and K. M. Eisenhardt. 2011. Rational heuristics: the “simple rules” that strategists learn from process experience. *Strategic Management Journal*. 32(13): 1437–1464.
- Bonacich, P.B. 1972. Factoring and weighing approaches to status scores and clique identification. *Journal of Mathematical Sociology*. 2: 113–120.
- Bonacich P. 1987. Power and centrality: a family of measures. *American Journal of Sociology*. 92: 1170–1182.
- Brusoni, S., M. G. Jacobides, and A. Prencipe. 2009. Strategic dynamics in industry architectures and the challenge of knowledge integration. *European Management Journal*. 6: 209–216.
- Burt, R. S. 1976. Positions in networks. *Social Forces*. 55: 93–122.
- Burt, R. S. 1982. *Toward a Structural Theory of Action: Network Models of Social Structure*. Academic Press: New York.
- Burt, R. S. 1988. The stability of American markets. *American Journal of Sociology*. 94(2): 356–395.
- Burt, R. S. 1992. *Structural Holes: The Social Structure of Competition*. Harvard University Press: Cambridge, MA.
- Burt, R. S. 2007. Secondhand brokerage: Evidence on the importance of local structure for managers, bankers, and analysts. *Academy of Management Journal*. 30: 119–148.
- Burt, R. S. 2010. *Neighbor Networks: Competitive Advantage Local and Personal*. Oxford University Press: New York.
- Burt, R. S. and I. Talmud I. 1993. Market niche. *Social Networks* 15: 133–149.
- Casciaro, T. and M. S. Lobo. 2008. When competence is irrelevant: the role of interpersonal affect in task-related ties. *Administrative Science Quarterly*. 53: 655–684.
- Caves, R. E. 1984. Economic analysis and the quest for competitive advantage. *American Economic Review*. 74(2): 127–132.

- Caves, R. E. and M. E. Porter. 1977. From entry barriers to mobility barriers. *Quarterly Journal Economics*. 91: 241–262.
- Chen, M-J. 1996. Competitor analysis and interfirm rivalry: toward a theoretical integration. *Academy of Management Review*. 21(1): 100–134.
- Chen, M-J. and I. C. MacMillan. 1992. Nonresponse and delayed responses to competitive moves: the roles of competitor dependence and action irreversibility. *Academy of Management Journal*. 35: 539–570.
- Chen, M-J. and D. Miller D. 1994. Competitive attack, retaliation and performance: an expectancy-valence framework. *Strategic Management Journal*. 15: 85–102.
- Chen, M-J., K-H. Su, and W. Tsai. 2007. Competitive tension: the awareness-motivation-capability perspective. *Acad. Management Journal*. 50(1): 101–118.
- Chua, R. Y. J., P. Ingram, and M. Morris. 2008. From the head and the heart: locating cognition- and affect-based trust in managers' professional networks. *Academy of Management Journal*. 51(3): 436–452.
- Chung, S., H. Singh, and K. Lee. 2000. Complementarity, status similarity and social capital as drivers of alliance formation. *Strategic Management Journal*. 21(1): 1–22.
- Cohen, W. M., R. R. Nelson, and J. Walsh. 2000. Protecting their intellectual assets: appropriability conditions and why U.S. manufacturing firms patent (or not). NBER working paper 7552, National Bureau of Economic Research, Cambridge, MA. Available at: <http://www.nber.org/papers/w7552>.
- Coleman, J.S. 1988. Social capital in the creation of human capital. *American Journal of Sociology*. 94: S95–S120.
- Cool, K.O. and D. Schendel. 1987. Strategic group formation and performance: the case of the U.S. pharmaceutical industry, 1963–1982. *Management Science*. 33: 1102–1124.
- Dierickx, I. and K. O. Cool. 1989. Asset stock accumulation and sustainability of competitive advantage. *Management Science*. 35: 1504–1513.
- Downing, S.T., J-S. Kang, and G. D. Markman. 2019. What you don't see cannot hurt you: Awareness cues to profile indirect competitors. *Academy of Management Journal*. 62(6): 1872–1900.
- Dutton, J.E. and S.B. Jackson. 1987. Categorizing strategic issues: links to organizational action. *Academy of Management Review*. 12: 76–90.
- Dyer, J.H. and H. Singh. 1998. The relational view: cooperative strategies and sources of interorganizational competitive advantage. *Academy of Management Review*. 23(4): 660–679.
- Emerson, R. 1972. Exchange theory, Part I: a psychological basis for social exchange. In *Sociological Theories in Progress*, Berger B, Zelditch MJ, Anderson A (eds). Houghton Mifflin: Boston.
- Ferrier, W. 2001. Navigating the competitive landscape: the drivers and consequences of competitive aggressiveness. *Academy of Management Journal*. 44(4): 858–877.
- Ferrier, W., K. G. Smith, and C. M. Grimm. 1999. The role of competitive action in market share erosion and industry dethronement: a study of industry leaders and challengers. *Academy of Management Journal*. 42: 372–388.
- Fiegenbaum, A. and H. Thomas. 1990. Strategic groups and performance: the U.S. insurance industry. *Strategic Management Journal*. 11: 197–215.
- Fienberg, R. M. 1984. Mutual forbearance as an extension of oligopoly theory. *Journal of Economics & Business*. 58(2): 243–249.
- Freeman, L.C. 1979. Centrality in social networks: conceptual clarification. *Social Networks* 1: 215–239.
- Gimeno, J. 1999. Reciprocal threats in multimarket rivalry: staking out “spheres of influence” in the U.S. airline industry. *Strategic Management Journal*. 20(2): 101–128.
- Gimeno, J. 2004. Competition within and between networks: the contingent effect of competitive embeddedness on alliance formation. *Academy of Management Journal*. 47(6): 820–842.

- Gimeno, J and C. Y. Woo. 1999. Multimarket contact, economies of scope, and firm performance. *Academy of Management Journal*. 42(3): 239–259.
- Gnyawali, D.R., J. He, and R. Madhavan. 2006. Impact of co-opetition on firm competitive behavior: an empirical examination. *Journal of Management* 32: 507–530.
- Granovetter, M. 1973. The strength of weak ties. *American Journal of Sociology*. 78: 1360–1380.
- Granovetter, M. 1985. Economic action and social structure: the problem of embeddedness. *American Journal of Sociology*. 91: 481–510.
- Gulati, R. 1995. Social structure and alliance formation patterns: a longitudinal analysis. *Administrative Science Quarterly* 40(4): 619–652.
- Gulati, R. 2007. *Managing Network Resources: Alliances, Affiliations, and Other Relational Assets*. Oxford University Press: New York.
- Gulati, R and M. Gargiulo. 1999. Where do interorganizational networks come from? *American Journal of Sociology*. 104(5): 1439–1493.
- Gulati, R., D. Lavie, and R. Madhavan. 2011. Understanding performance effects in networks: reach, richness, and receptivity. *Research in Organizational Behavior*. 31: 207–224.
- Gulati, R., N. Nohria, and A. Zaheer. 2000. Strategic networks. *Strategic Management Journal*. 21(Special Issue): 203–215.
- Gur, F.A. and T. Greckhamer. 2019. Know thy enemy: A review and agenda for research on competitor identification. *Journal of Management*. 45: 2072–2100.
- Hoberg, G. and G. Phillips. 2010. Product market synergies and competition in mergers and acquisitions: A text-based analysis. *Review of Financial Studies*. 23: 3773–3811.
- Hoberg, G. and G. Phillips. 2016. Text-based network industries and endogenous product differentiation. *Journal of Political Economy*. 124: 1423–1465.
- Hoffmann, W., D. Lavie, J.J. Reuer, and A. Shiplov. 2018. The interplay of competition and cooperation. *Strategic Management Journal*. 39: 3033–3052.
- Hsieh, K-Y and F. Vermeulen. 2014. The structure of competition: how competition between one’s rivals influences imitative market entry. *Organization Science*. 25: 299–319.
- Ingram, P. and P.W. Roberts. 2000. Friendships among competitors in the Sydney hotel industry. *American Journal of Sociology*. 106(2): 387–423.
- Karnani, A. and B. Wernerfelt. 1985. Multiple point competition. *Strategic Management Journal*. 6: 87–96.
- Kilduff, G. J. 2019. Interfirm relational rivalry: Implications for competitive strategy. *Academy of Management Review*. 44(4): 775–799.
- Kilduff, G. J., H. A. Elfenbein, and B. M. Staw. 2010. The psychology of rivalry: a relationally dependent analysis of competition. *Academy of Management Journal*. 53(5): 943–969.
- Kilduff, M. and D. J. Brass. 2010. Organizational social network research: core ideas and key debates. *Academy of Management Annals*. 4: 317–357.
- Knoke, D. and R.S. Burt. 1983. Prominence. In *Applied Network Analysis*, Burt, R. S., M. J. Minor (eds). Newbury Park: Sage: 195–222.
- Labianca, G. and D.J. Brass. 2006. Exploring the social ledger: negative relationships and negative asymmetry in social networks in organizations. *Academy of Management Review*. 31(3): 596–614.
- Lavie, D. 2013. Competition networks and firm performance, *the 33rd Academy of Management Conference* at Orlando, FL
- Lazzarini, S. G. 2007. The impact of membership in competing alliance constellations: evidence on the operational performance of global airlines. *Strategic Management Journal*. 28(4): 345–367.

- Leiblein, M., J.J. Reuer, and T. Zenger. 2018. What makes a decision strategic? *Strategy Science*. 2018(3): 558–573
- Lorrain, F. and H. C. White. 1971. Structural equivalence of individuals in social networks. *Journal of Mathematical Sociology*. 1: 49–80.
- Markman, G.D., Gianiodis, P.T., and Buchholtz, A.K. 2009. Factor-market rivalry. *Academy of Management Review*. 34(3): 423–441.
- McGahan A. M. and M. E. Porter. 1997. How much does industry matter, really? *Strategic Management Journal*. 18(Summer Special Issue): 15–30.
- McPherson, M. 1983. An ecology of affiliation. *American Sociology Review*. 48: 519–532.
- Naumovska, I. and D. Lavie. 2021. When an industry peer is accused of financial misconduct: Stigma versus competition effects on non-accused firms. *Administrative Science Quarterly*.
- Nayyar, P.R. and R K. Kazanjian. 1993. Organizing to attain potential benefits from information asymmetries and economies of scope in related diversified firms. *Academy of Management Review*. 18(4): 735–759.
- Ocasio, W. 1997. Towards an attention-based view of the firm. *Strategic Management Journal*. 18(Summer Special Issue): 187–206.
- Oxley, J. E. 1997. Appropriability hazards and governance in strategic alliances: a transaction cost approach. *Journal of Law, Economics and Organization*. 13: 387–409.
- Park, R. E. 1992. *Human Communities*. Free Press: New York.
- Podolny, J. M. 1993. A status-based model of market competition. *American Journal of Sociology*. 98: 829–872.
- Pontikes, E. G. and W. P. Barnett. 2015. The persistence of lenient market categories. *Organization Science*. 26: 1415–1431.
- Porac, J.F. and H. Thomas. 1990. Taxonomic mental models in competitor definition. *Academy of Management Review*. 15: 224–240.
- Porac, J.F. and H. Thomas. 1994. Cognitive categorization and subjective rivalry among retailers in a small city. *Journal of Applied Psychology*. 79(1): 54–66.
- Porac, J.F., H. Thomas, F. Wilson, D. Paton, and A. Kanfer. 1995. Rivalry and the industry model of Scottish knitwear producers. *Administrative Science Quarterly* 40: 203–227.
- Porter, M. E. 1980. *Competitive Strategy: Techniques for Analyzing Industries and Competitors*. Free Press: New York.
- Reger, R. K. and A. S. Huff. 1993. Strategic groups: a cognitive perspective. *Strategic Management Journal*. 14: 103–124.
- Robins, J. A. and M. F. Wiersema. 2003. The measurement of corporate portfolio strategy: analysis of the content validity of related diversification indexes. *Strategic Management Journal*. 24: 39–59.
- Rothaermel, F. T. 2001. Incumbent's advantage through exploiting complementary assets via interfirm cooperation. *Strategic Management Journal*. 22: 687–699.
- Rowley, T., D. Behrens, and D. Krackhardt. 2000. Redundant governance structures: an analysis of structural and relational embeddedness in the steel and semiconductor industries. *Strategic Management Journal*. 21: 369–386.
- Rumelt, R.P. 1982. Diversification strategy and profitability. *Strategic Management Journal*. 3(4): 359–369.
- Rumelt, R. P., D. E. Schendel and D. J. Teece. 1994. Fundamental Issues in Strategy, In: Rumelt, R. P. ,D. E. Schendel and D. J. Teece, Eds., *Fundamental Issues in Strategy*, Harvard University Press: Boston, 9–54.

- Scherer, F. M. and D. Ross. 1990. *Industrial Market Structure and Economic Performance*. Houghton Mifflin: Boston.
- Seibert, S. E., M. L. Kraimer, and R. C. Liden. 2001. A social capital theory of career success. *Academy of Management Journal*. 44: 219–237.
- Simon, H. A. 1972. Theories of bounded rationality. In *Decision and Organization*. McGuire CB, Radner R (eds). North-Holland: Amsterdam.
- Skilton, P. F., Bernardes, E. 2015. Competition network structure and product market entry. *Strategic Management Journal*. 36(11): 1688-1696.
- Smith, K. G., W. Ferrier, and H. Ndofor. 2001. Competitive dynamics research: critique and future directions. In *Handbook of Strategic Management*, Hitt M, Freeman R, Harrison J (eds). Blackwell: London: 315–361.
- Smith, K. G., C. M. Grimm, M. J. Gannon, and M-J. Chen. 1991. Organizational information processing, competitive responses, and performance in the U.S. domestic airline industry. *Academy of Management Journal*. 34: 1–26.
- Sorenson, T. L. 2007. Credible collusion in multimarket oligopoly. *Managerial and Decision Economics*. 28: 115–128.
- Stuart, T. E., H. Hoang, and R. Hybels. 1999. Interorganizational endorsements and the performance of entrepreneurial ventures. *Administrative Science Quarterly* 44: 315–349.
- Tanriverdi, H. and C-H. Lee. 2008. Within-industry diversification and firm performance in the presence of network externalities: evidence from the software industry. *Academy of Management Journal*. 51(2): 381–397.
- Thatchenkery, S. and R. Katila. 2021. Seeing what others miss: A competition network lens on product innovation. *Organization Science*.
- Tirole, J. 1988. *The Theory of Industrial Organization*. MIT Press: Cambridge, MA.
- Tsai, W., K-H. Su, and M-J. Chen. 2011. Seeing through the eyes of a rival: competitor acumen based on rival-centric perceptions. *Academy of Management Journal*. 54: 761–778.
- Uzzi, B. 1996. The sources and consequences of embeddedness for the economic performance of organizations: the network effect. *American Sociological Review*. 61: 674–698.
- Venkataramani V. and R.S. Dalal. 2007 Who helps and harms whom? Relational antecedents of interpersonal helping and harming in organizations *Journal of Applied Psychology*. 92: 952–966.
- Wasserman, S. and K. Faust. 1994. *Social Network Analysis: Methods and Applications*. Cambridge University Press: New York.
- Weigelt, K and I. C. MacMillan. 1988. An interactive strategic analysis framework. *Strategic Management Journal*. 9: 27–40.
- Wernerfelt, B. 1984. A resource-based view of the firm. *Strategic Management Journal*. 5(2): 171–180.
- White, H. C. and R. Eccles. 1987. Producers’ markets. In *The New Palgrave: A Dictionary of Economics*, Vol. 3. Macmillan: London.
- Yamanoi, J. 2011. Competition networks: the influence of relational and structural embeddedness on competitive activity. *The 31st Annual Conference of the Strategic Management Society*, Miami, FL.
- Young, G., K. G. Smith, and C. M. Grimm. 1996. “Austrian” and industrial organization perspectives on firm-level competitive activity and performance. *Organ. Sci.* 7: 243–254.
- Zaheer, A. and G. G. Bell. 2005. Benefiting from network position: firm capabilities, structural holes, and performance. *Strategic Management Journal*. 26: 809–826.

TABLES

TABLE 1: Revenue matrix for competitors in the U.S. airline industry, in million dollars

Market Firm	United States	Atlantic	Latin America	Pacific	Total Revenue
1. American	13,783	3,499	5,460	1,216	23,958
2. Continental	8,935	3,276	2,363	1,601	16,175
3. Delta	22,492	6,625	2,030	4,084	35,230
4. United	13,048	3,483	779	3,845	21,155
5. US Airways	9,949	2,288	1,103	0	13,341
6. Southwest	13,655	0	0	0	13,655
7. JetBlue	3,742	0	767	0	4,509
8. AirTran	2,866	0	75	0	2,942
9. Frontier	1,592	0	69	0	1,662
10. Allegiant	745	0	0	0	745
11. Alaska	4,065	0	245	0	4,310
12. Hawaiian	1,274	0	0	377	1,651
13. Virgin	1,007	0	30	0	1,037
Total Revenue	97,153	19,171	12,921	11,123	140,368

Source: U.S. Department of Transportation

FIGURES

FIGURE 1: An example of competition networks in the airline industry

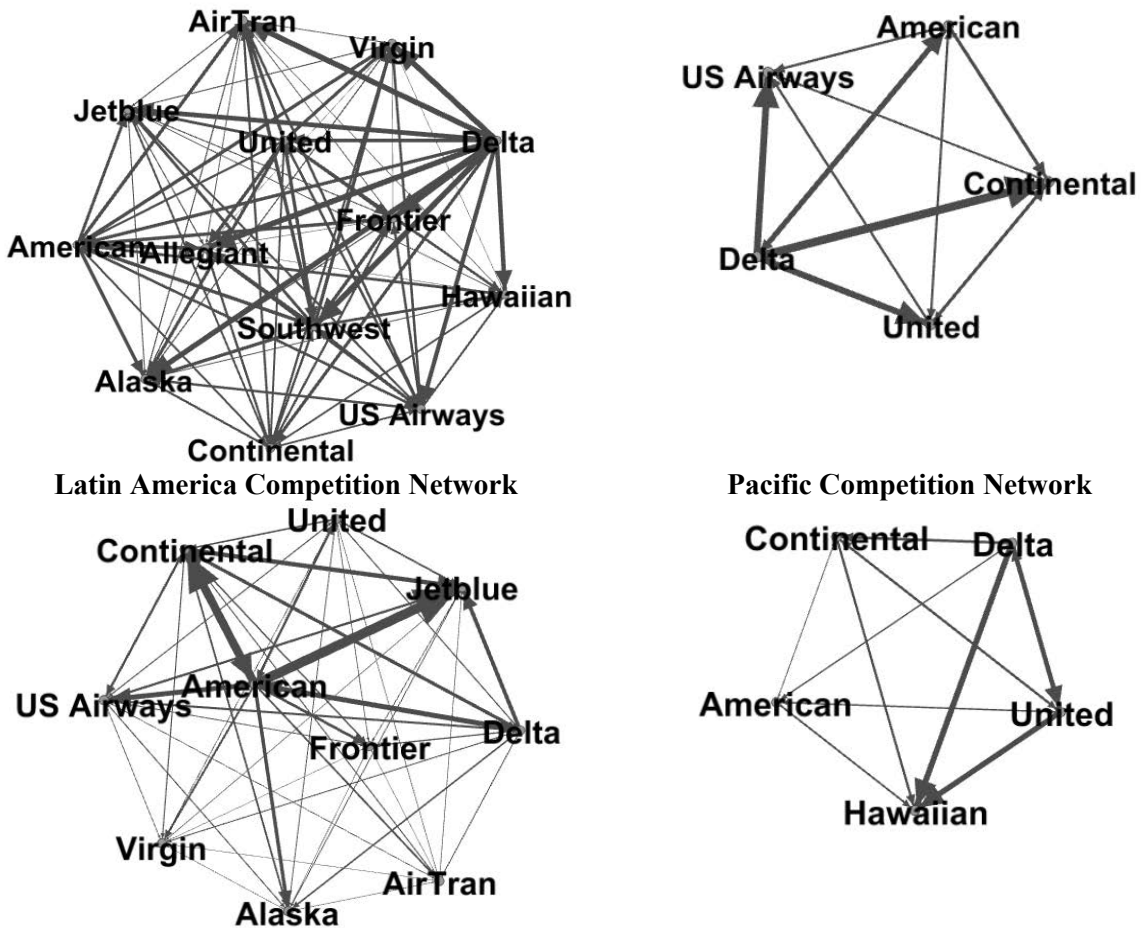


FIGURE 2: A theoretical framework for competition networks and firm performance

