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COMPETITIVE STRATEGY, ALLIANCE NETWORKS, AND FIRM PERFORMANCE

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ABSTRACT OF DISSERTATION

Goce Andrevski

The Graduate School

University of Kentucky

2009

COMPETITIVE STRATEGY, ALLIANCE NETWORKS AND FIRM PERFORMANCE

ABSTRACT OF DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
College of Business and Economics
at the University of Kentucky

By
Goce Andrevski

Lexington, Kentucky

Co-Directors: Dr. Walter J. Ferrier, Gatton Endowed Associate Professor of Management
and Dr. Daniel J. Brass, J. H. Hilliard Professor of Innovation Management

Lexington, Kentucky

2009

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COMPETITIVE STRATEGY, ALLIANCE NETWORKS, AND FIRM PERFORMANCE

This dissertation explores the interplay between competitive strategy and alliance network structure in explaining firm performance in highly volatile environments (e.g., personal computers or consumer electronics). In particular, I examine the following three questions: (1) Which competitive strategies enable firms to gain superior performance? (2) How do these strategies affect the firm's networking behavior and lead to the formation of particular network positions? (3) What optimal combinations of competitive strategies and network structures maximize firm performance?

Firms can outperform rivals by pursuing two types of competitive strategies: advantage-creating and advantage-enhancing. Each of these strategies creates different needs, motivations, and opportunities for collaborative activity. Therefore, certain regularities in the firms' strategic behavior in the previous period can lead to distinctive and recognizable patterns of networking behavior in the future period, which in turn leads to predictable types of network structure. This study shows that firms with superior advantage-creating strategies become embedded in sparse network structures and are more likely to form non-equity alliances in the future period, whereas firms with strong advantage-enhancing tendencies become embedded in dense network structures with many equity-based alliances in the future period. However, if different strategies lead to formation of different types of network structure, are these tendencies beneficial for firm performance? If not, what is the optimal combination of competitive strategy and network structure that maximizes firm performance? I argue that network structure

provides advantageous access to external resources that can both complement (enhance) the internal capabilities of the firm and substitute for the capabilities that a firm is lacking. I find that network structure plays both complementary and substitutive roles. However, my findings suggest dense network structure is more beneficial for firms that have superior either advantage-creating or advantage-enhancing capabilities, whereas firms with inferior internal capabilities can benefit more from a sparse network structure. I tested the proposed dynamic model on a sample of the largest 125 firms from computers and electronics industries that initiated 11,075 competitive actions and were embedded in a larger network of 36,766 alliances over 7 years.

KEYWORDS: Strategic Entrepreneurship, Corporate Entrepreneurship,
Alliance Networks, Social Network Theory,
Competitive Strategy

Goce Andrevski

April 28, 2009

COMPETITIVE STRATEGY, ALLIANCE NETWORKS AND FIRM PERFORMANCE

By

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To My Wife, Viki

I thank God for bringing you in my life. You make every failure bearable and every triumph memorable. I love you!

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I would like to thank my adviser, Dr. Walter Ferrier, for providing me with many insightful comments and suggestions during the development of this dissertation. I am grateful for his time and readiness to meet with me regularly through many formal and informal conversations to enhance my intellectual potential. He provided a perfect balance between direction and guidance in shaping my research ideas and autonomy and freedom to develop my own stream of research. He has been a great friend and mentor who inspired me to strive to achieve academic excellence. I also want to express my gratitude to my dissertation co-chair, Dr. Dan Brass. I was fortunate to have an opportunity to learn from him and to have his support throughout my doctoral studies at University of Kentucky. I have benefited immensely from his intellectual ability to recognize the gist of complex problems and to ask thought-provoking questions. His comments and suggestions have been invaluable for developing my research ideas. We should all aspire to the personal and professional standards of Dan and Wally. I hope I will be able to inspire other students as these mentors have inspired me.

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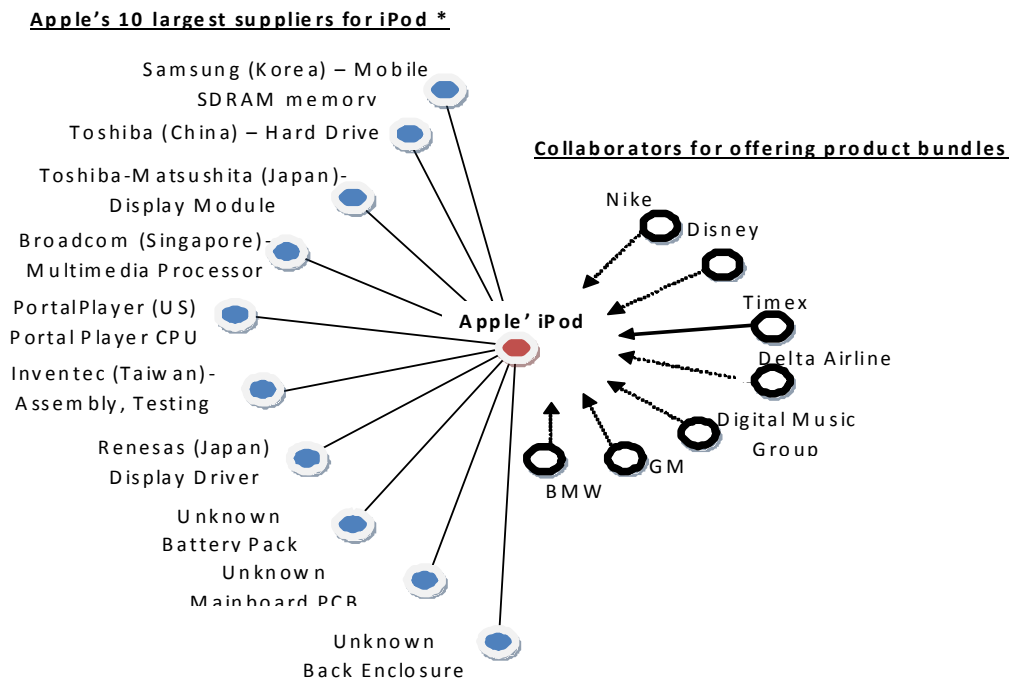
CHAPTER I: INTRODUCTION

Overview

In today's hypercompetitive environments (D'Aveni, 1994), firms do not control all resources necessary for persistently outperforming rivals. In industries such as personal computers or consumer electronics, products are complex systems that comprise many components and modules produced and supplied by a variety of independent suppliers (Garud & Kumaraswamy, 2003). For example, Apple's *iPod* consists of more than 400 components and modules, none of which is manufactured internally. Figure 1 below illustrates Apple's ten major suppliers (that account for 85% of the iPod's costs) and alliances with firms with complementary products and services that upgrade and enhance the user's experience and value of the *iPod*.

Figure 1: Apple's iPod Collaborative Network



***85% of the cost; 400 additional inputs; Apple outsources all of its manufacturing**

****Source: Linden, Kraemer, & Dedrick (2007) PCIC Alfred Sloan Foundation and Portelligent Inc.**

How do firms such as Apple frequently design innovative products, such as the *iPod* or *iPhone*? How is Apple able to continuously improve these products despite the lack of ownership and control of the resources needed for their development? To create an innovative complex product, firms need to be aware of "who knows what" in the market (i.e., the most recent technologies and competences developed by other firms). However, this information is not available to all firms; only those that closely collaborate with other firms with specialized knowledge in different technological domains have ready access to such information. The awareness of the technological possibilities is a precondition for discovering new resource combinations (O'Driscoll & Rizzo, 1996). In addition, once the product is designed, the firm needs to extensively collaborate and coordinate the activities of various suppliers as these components are continuously improved and updated (Garud & Kumaraswamy, 2003).

This suggests that the ability of the firm to frequently create innovative products and to intensively improve and enhance their value depends on successful collaboration with partners from various industries and technological domains. These interdependencies can be effectively managed through forming strategic alliances, since alliances ease transfer of fine-grained information, curb opportunistic behavior, and encourage sharing of ideas and technologies (Uzzi, 1997). Because each firm needs to collaborate with many partners, firms are constantly embedded in a complex network of alliances. The structure of these alliance networks can provide advantageous access to valuable strategic resources and information that increases firms' potential to continuously create new innovative products or intensively improve the value of the existing modular products (Gulati, Nohria & Zaheer, 2000; Gnyawali & Madhavan, 2001).

Given the importance of alliance networks for the firms' competitive success, it is critical to understand (1) how and why firms form different types of alliance networks, and (2) how and why different firms benefit from different types of alliance networks. In this dissertation, I argue that for adequate understanding of these questions, it is critical to consider the type of competitive strategy a firm is pursuing. Different competitive strategies lead to the formation of different types of alliance networks, and each type of

competitive strategy requires an optimal structure of alliance network to maximize firm performance.

More specifically, different strategies create different needs, incentives, and motives for collaboration with rivals. As a result, firms with different strategies engage in different patterns of collaborative activity. These networking patterns are stable over time and form a recognizable interfirm network structure, which is defined as a set of firms and a pattern of alliance ties that connect these firms (Brass, Galaskiewicz, Greve, & Tsai, 2004). Thus, to understand why firms form different types of network structures, we need to know their competitive strategies.

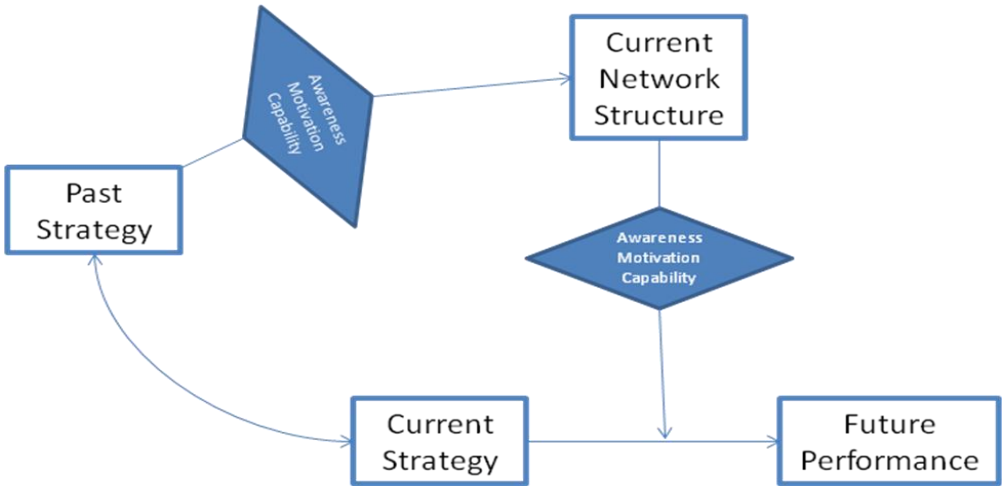
Furthermore, if firms pursue different strategies and each strategy leads to a distinctive type of network structure, do these combinations of strategies and network structures have a positive effect on firms' performance? If not, what is the optimal network structure for each strategy type that maximizes firm performance? To answer these questions, I also examine which type of network structure is the most beneficial for each type of competitive strategy. Once the network structure is formed, it provides network level benefits for the firm beyond the immediate gains from each alliance. Different network structures provide firms with access to different types of network resources. The extent to which a firm will exploit such external resource potential depends on its competitive strategies. Different strategies may benefit from different types of network resources, and therefore it is important to examine which network structure is optimal for each strategy type. Hence, this dissertation examines the following three research questions:

1. Which competitive strategies enable firms to gain superior performance in highly volatile environments?
2. How do these strategies affect the firm's networking behavior and lead to the formation of particular network positions?
3. What are the optimal combinations of competitive strategies and network positions for firms to gain superior performance?

Figure 2 below shows the proposed theoretical model in this dissertation. Chapter 2 examines the link between current strategy and future performance (question 1 above); Chapter 3 examines the relationship between past strategy and current network structure

(question 2 above); and Chapter 4 explores how current network structure and current competitive strategy interact in explaining future firm performance (question 3 above). I briefly discuss the content of each of these chapters below.

Figure 2: Theoretical Model



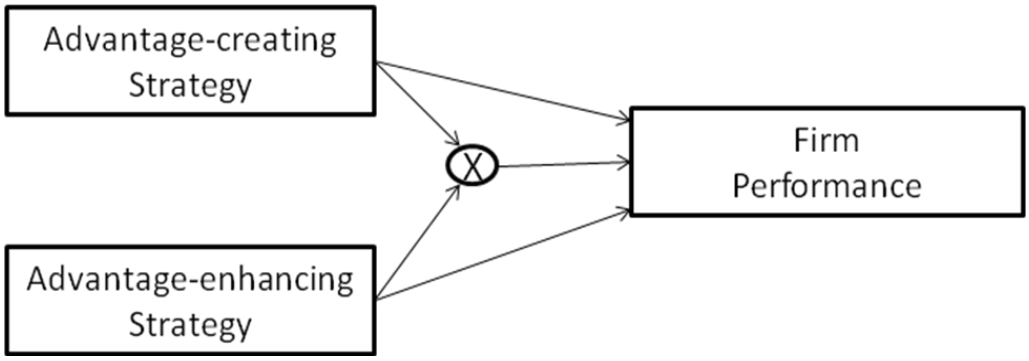
Competitive Strategy and Firm Performance

In Chapter 2, I introduce two distinctive strategies: advantage-creating and advantage-enhancing, and examine how these strategies enable firms to outperform rivals in hypercompetitive environments. Strategy in this study is conceptualized as a pattern in the stream of firms' actions over time (Mintzberg, 1978) or a tendency of firms to act in a particular way. I use the term tendency to emphasize that firms engage in recurring patterns of strategic actions over time. For example, some firms show tendencies to be frequently first to introduce new products and services and to develop radically new technologies. Because these strategic tendencies enable firms to create new competitive advantages, I will refer to them as advantage-creating tendencies. Other firms exhibit strong tendencies to aggressively initiate competitive actions (such as product improvements, price cuts, advertising, capacity building) that enable them to protect or extend their existing market position. These tendencies enhance the existing competitive advantages of the firm, and I refer to them as advantage-enhancing tendencies. Firms

differ in their abilities to pursue each tendency. Some firms outperform rivals by possessing superior advantage-creating capabilities, whereas others have superior capabilities to aggressively protect and enhance their existing competitive advantages. Firms that possess superior abilities to exhibit simultaneously high advantage-creating and high advantage-enhancing tendencies will exhibit the best performance (Ireland, Hitt, & Sirmon, 2003). I will refer to this combined strategic tendency as strategic entrepreneurship.

Figure 3 shows the propositions developed in this chapter. I will argue that each type of strategy positively affects firm performance and that firms that are capable of simultaneously pursuing both advantage-creating and advantage-enhancing strategies (i.e., firms capable of pursuing strategic entrepreneurship) will exhibit the best performance.

Figure 3: Competitive Strategy and Firm Performance

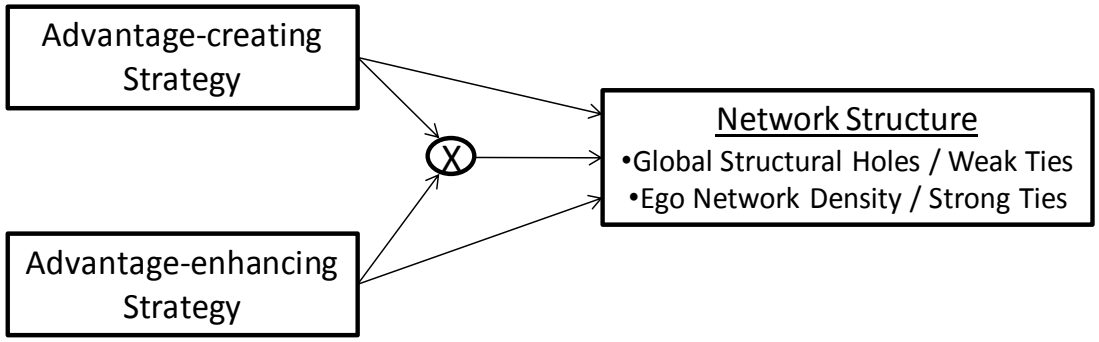


Competitive Strategy and Network Formation

In today's competitive landscape, firms cannot rely on internally controlled resources alone to pursue advantage-creating and advantage-enhancing strategies. They must collaborate with other firms to gain access to information, skills, expertise, assets, and technologies and thus leverage their internal resources. Different strategic tendencies create different needs, motivations and opportunities for collaboration with other market participants (e.g., competitors, distributors, suppliers, and customers). Thus, certain regularities in firms' strategic behavior can lead to distinctive and recognizable patterns

of networking behavior, which in turn leads to predictable types of network structure. I focus on two types of alliance network structure: dense and sparse. A dense network structure refers to the degree of interconnectedness among a firm's partners, whereas a sparse network structure refers to the degree to which a firm maintains ties with firms from disconnected clusters. Figure 4 below shows the propositions developed in Chapter 3. I will argue that firms with superior advantage-creating strategies will become embedded in sparse network structures and have many non-equity alliances (weak ties), whereas firms with strong advantage-enhancing tendencies will be embedded in dense network structures with many equity-based alliances (strong ties) in the future. When firms are strategically entrepreneurial, they dynamically change the network structure over time. They create many new structural holes (i.e., connections with partners who are themselves disconnected), and subsequently stimulate collaborative activity among partners to sustain their newly created advantages.

Figure 4: Competitive Strategy and Network Structure

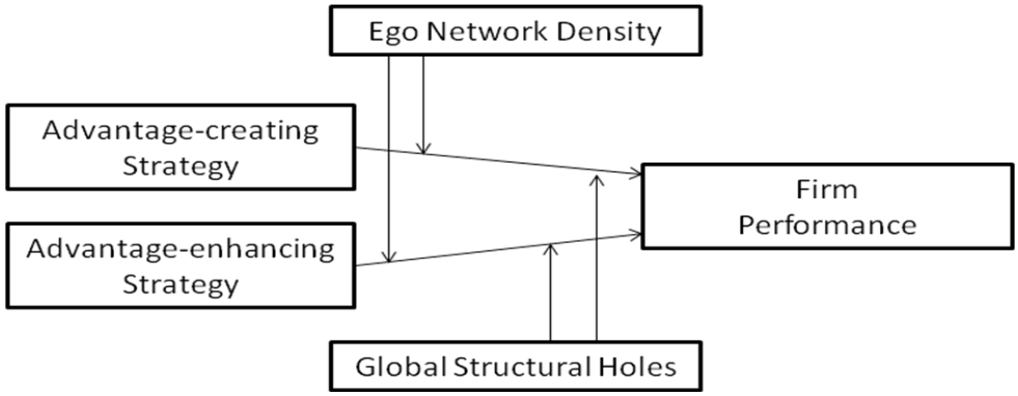


Competitive Strategy, Network Structure, and Firm Performance

If some firms pursue advantage-creating strategic tendencies and become embedded sparse network structures, whereas other firms exhibit advantage-enhancing strategic tendencies and form dense network structures, are these combinations of competitive strategies and network structures beneficial for firm performance? I examine this question in Chapter 4. Different network structure provides firms with distinctive benefits. A dense network structure stimulates efficient exchange of information, assets, expertise, and ideas and provides effective mechanisms for reducing the partners'

opportunistic behavior and free riding. A sparse network structure provides firms with exclusive information about the most recent technological advances in different industries, increased power to control competitive information in the network, and access to diverse resources and capabilities controlled by the other market participants (Burt, 1992; Coleman, 1988; Gnyawali & Madhavan, 2001; Rowley, Behrens, & Krackhardt, 2000; Ahuja, 2000a). However, the extent to which a firm can capitalize on such network potential depends on the type of competitive strategy a firm is pursuing. Thus, different network structures and competitive strategies will interact in explaining firm performance.

Figure 5: Competitive Strategy, Network Structure and Firm Performance



I propose two alternative theoretical arguments for the interplay between the network structure and competitive strategy in explaining firm performance. First, network structure can play a role of complementor (or enhancer) of firms' capabilities by providing firms with resource potential needed for successful pursuit of a given strategy. For example, firms with strong advantage-creating capability will be better able to exploit the advantageous access to diverse network resources than firms that lack such capabilities. Similarly, firms with strong advantage-enhancing capabilities will have greater potential to exploit the advantages that dense network brings about. Second, the network structure can play a role of substitutor for *capabilities* that a firm is lacking. For example, a firm that has superior advantage-creating capability may use a dense network of collaborators as a substitute for its advantage-enhancing capability. A firm embedded in a dense network structure, in which all firms contribute significantly in improving an existing complex product, can use the advantage-enhancing capabilities of network partners to complement its advantage-creating capabilities.

Intended Contributions for Research and Practice

This dissertation contributes to the research in corporate entrepreneurship, strategic alliance networks, and strategic management in general. It extends the research in corporate entrepreneurship area by emphasizing the role of advantage-enhancing capabilities (i.e., capabilities to protect and further extend the newly created competitive advantages) in explaining how firms gain superior performance in hypercompetitive environments. Corporate entrepreneurship research mainly focuses on firms' abilities to create consistently new competitive advantages and, through this intensive entrepreneurial activity, to earn above-average profits that persist over time (Sharma & Chrisman, 1999; Covin & Miles, 1999). This study shows how advantage-enhancing capabilities of firms strengthen the effect of entrepreneurial strategies on firm performance. As such, this study is among the first to empirically examine the Ireland, Hitt, and Sirmon (2003) proposition that firms need to be "strategically entrepreneurial" to outperform rivals consistently.

In addition, corporate entrepreneurship research generally assumes that firms act entrepreneurially because of purposeful enactment of internal organizational processes, methods, and practices that stimulate entrepreneurial discoveries (Lumpkin & Dess, 1996; Dess, Lumpkin & Covin, 1997; Ireland, Covin & Kuratko, 2009). However, entrepreneurship is an act of removing market ignorance (Mises, 1949). A discovery of new things necessarily implies that other market participants were unaware of the existence of available resources and technologies that could produce resource configurations that provide superior value for customers (Kirzner, 1979). However, the opportunities for removing this market ignorance are unequally accessible to firms. Firms are unevenly aware of such opportunities in part because of their position in the overall alliance network structure. Alliances provide access to preferential information about the newly developed resource potential by other market participants; and therefore, a firm favorably positioned in the alliance network structure will be more aware of the opportunities for developing more productive resource combinations (Burt, 1992; 2005). Thus, to understand why some firms (and not others) are capable of systematically outperforming rivals in hypercompetitive environments, we need to consider both the

entrepreneurial abilities of firms and the potential for entrepreneurial discovery in the network in which they are embedded. Chapter 4 integrates the research in corporate entrepreneurship and social network theory to explain more completely the sources of performance differences across firms in hypercompetitive environments.

This integrative approach of strategy and structure also extends the research in interfirm alliance networks. This research has rarely examined how firms' strategies (and their strategic resources) enable firms to exploit the advantages provided by the favorable positions in the network structure. Recently, Zaheer and Bell (2005) examined how certain innovative capabilities of firms enhance the relationship between network structure and firm performance, and Zahra and George (2002) emphasized the importance of internal capabilities of firms in exploiting the external resources available through network structure. This study extends this research by arguing that different strategies can benefit from different types of network structures and, therefore, network structures (e.g., dense or sparse networks) are not universally beneficial for firms' performance. Firms need to construct their alliance networks according to their strategic needs. Hence, this dissertation has some important managerial implications.

Finally, Chapter 3 addresses the paucity of research on the antecedents of network formation. Several researches have emphasized the importance of understanding the origins of network formation and have called for more research on how firms can strategically shape their positions in the network structure (Stuart & Sorenson, 2007; Salancik, 1995). This is especially critical for strategy research as several researchers have shown that certain network positions enable firms to improve their performances (e.g., Baum, Calabrese, & Silverman, 2000; Powell, Koput & Smith-Doerr, 1996; Rowley, Behrens, & Krackhardt, 2000; Zaheer & Bell, 2005; Uzzi, 1997; Ahuja, 2000a). Previous research on the antecedents of network formation has mostly examined contextual factors such as key industry events (Madhavan, Koka, & Prescott, 1998), prior alliance experience (Powell, Koput, & Smith-Doerr, 1996), the competitive environment and market stages (Eisenhardt & Schoonhoven, 1996), and structural network properties such as past network centrality (Gulati, 1999; Gulati & Gargiulo, 1999) and network density (Sorenson & Stuart, 2008). Eisenhardt and Schoonhoven's study (1996) is among the few that examined some agent-based antecedents of the rate of alliance formation.

Although these studies have advanced our understanding of the likelihood of firms to form alliances, they have not addressed the question of how and why different strategies lead to different types of network structure and why some firms are embedded in networks with many structural holes whereas others tend to get embedded in dense network structures with many strong ties among network partners. Chapter 4 shows that different types of competitive strategies lead to different types of network structures.

CHAPTER II: COMPETITIVE STRATEGY AND FIRM PERFORMANCE

Introduction

This chapter introduces two competitive strategies that enable firms to gain superior performance in hypercompetitive environments: advantage-creating and advantage enhancing strategies. *Advantage-creating strategic tendencies* refer to firms' tendencies to frequently create new competitive advantages by discovering radically new technologies (i.e., innovativeness) and proactively introducing new products (i.e., proactiveness). *Advantage-enhancing strategic tendencies* refer to firms' tendencies to aggressively introduce competitive actions (e.g., quality improvements, new product versions, creative advertising, price cuts, sale incentives, market expansions) that protect or enhance the competitive position of its existing products and services.

I argue that firms that exhibit superior advantage-creating or advantage-enhancing strategic tendencies will outperform rivals. In addition, I posit that when a firm is capable of simultaneously pursuing both types of strategies, it will maximize its performance. Understanding how these two strategies affect firm performance is important for at least two reasons. First, empirical examination of the interplay between these two strategies will advance the research in corporate entrepreneurship and strategic entrepreneurship. This study is among the first to empirically investigate (at the firm level of analysis) how the interaction between these two strategies affects firm performance. Second, by showing that these strategies enable firms to outperform rivals, I provide relevance and justification for using these strategies in explaining how firms become embedded in different network structures (I examine this question in Chapter 3).

Theoretical Background

Conceptualization of competitive strategy

Researchers have taken different approaches in conceptualizing and operationalizing firm strategy. For example, strategy can be viewed as a plan that defines long-term goals and objectives (Chandler, 1962), or as a distinctive, favorable and defendable positioning in the industry (vis-à-vis rivals) (Porter, 1985), or as a pattern or

consistency in the firm's actions over time (Mintzberg & Waters, 1985). In this study, I follow Mintzberg and Waters's (1985) view of strategy and conceptualize (and operationalize) competitive strategy as a recurring pattern (or a tendency) in a firm's competitive behavior (Mintzberg, 1978). For example, a firm can exhibit a consistent pattern (tendency) of entrepreneurial behavior by frequently discovering radically new products and technologies. Other firms may focus more on protecting and enhancing their existing products and services and exhibit a tendency to intensively introduce actions such as new product versions, price cuts, advertising, promotions, capacity expansions, or new product features.

I also assume that strategy is driven by the firm's ability to manage its resources strategically (Barney, 1991). As Penrose (1959: 84) noted "the type of product in which the consumer might be interested is in effect very often suggested…by the firm's resources." Managers continuously face many choices about restructuring, bundling, and leveraging their internally controlled resources (Sirmon, Hitt & Ireland, 2007; Ireland et al., 2003). The pattern of these resource allocation choices is reflected in the patterns of the firm's actual competitive behavior over time. Because the researchers often cannot observe resource allocation decisions, this dissertation focuses on examining the patterns in the firm's externally-oriented and observable competitive activity (Grimm & Smith, 1997). For example, a firm's ability to strategically use its resource potential to enhance its existing market position (i.e., to pursue advantage-enhancing tendency) is reflected in its intensity of introducing competitive actions such as updates and improvements of existing products, and new product versions, advertising campaigns, promotional events, price cuts, sale incentives, extended warranties, new capacity, new distribution channels, and extended dealership networks. Likewise, firms with strong advantage-creating capabilities will be frequently first to introduce new products and services and will frequently generate path-breaking technologies. The focus is, therefore, on the actual (i.e., realized) and observable strategic tendencies of firms, and it is assumed that these tendencies are reflections of the firm's capabilities. The term capabilities refers to the concept of dynamic capabilities defined as "the firm's ability to integrate, build, and reconfigure internal and external [resources] to address rapidly changing environments" (Teece, Pisano, & Shuen, 1997:516). *Resources* include all production factors,

organizational routines, processes, technologies, reputation, status, competences, and other tangible and intangible assets available to a firm (either owned by the firm or available through network partners).

Figures 6 and 7 below illustrate how I conceptualize competitive strategy in this dissertation. The firms' internal capabilities (advantage-creating and advantage-enhancing), although unobserved, are reflected in firms' observed competitive behavior. For example, advantage-enhancing capability is reflected in firms' intensity of introducing price cuts, sales incentives, advertising and promotional campaigns, product versions and improvements, building new capacity and distributional channels, or market expansions. Advantage-creating capability is reflected in the frequency with which a firm issues patents, the extent to which patents have impact on subsequent technologies, and the extent to which the firm is first to commercialize new products and technologies.

Figure 6: Conceptualization of Competitive Strategy

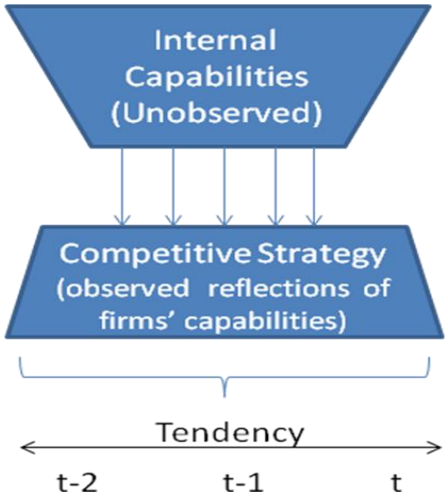
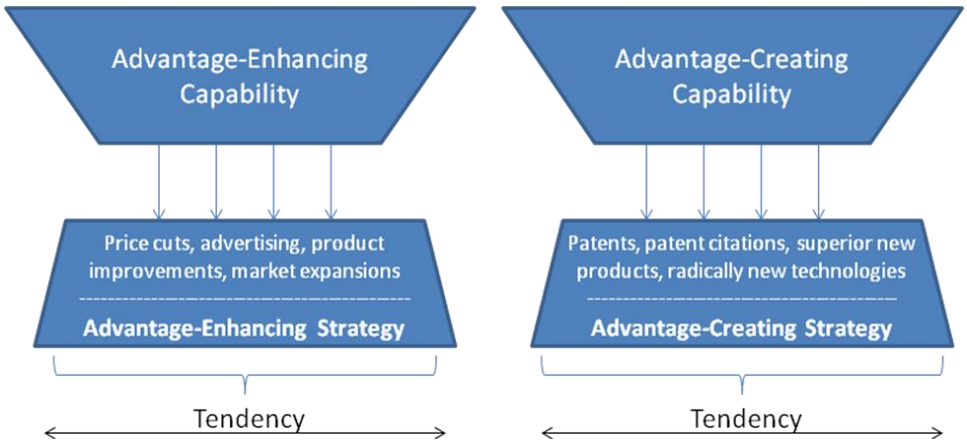


Figure 7: Conceptualization of Advantage-Creating and Advantage-Enhancing Strategy



Defining advantage-creating strategy

D'Aveni (1994) argued that in today's hypercompetitive environments, firms cannot gain sustainable competitive advantage over rivals. Rivals can quickly imitate or make obsolete any advantage and therefore firms can outperform rivals only when they are able to create a series of new (temporary) competitive advantages. To achieve this, research has suggested that some firms adopt an entrepreneurial strategy-making mode (Dess, Lumpkin, & Covin, 1997). This entrepreneurial strategy is often driven by the presence of an entrepreneurial mindset (McGrath & MacMillan, 2000), an entrepreneurial orientation (Lumpkin & Dess, 1996), or entrepreneurial leadership and an entrepreneurial culture within the firm (Ireland, Hitt, & Sirmon, 2003) that encourages the discovery of radically new products and technologies. Researchers have recognized that some firms exhibit systematic and recurring patterns of such entrepreneurial behavior that can be reliably and objectively studied (Covin & Slevin, 1991; Jennings & Lumpkin, 1989).

For example, researchers have identified that some firms show the tendency to be frequently first to introduce new products on the market (i.e., proactiveness) (Miles & Snow, 1978; Miller, 1983; Miller & Friesen, 1978; Covin & Slevin, 1991, Covin & Miles, 1999; Lumpkin & Dess, 1996). These *proactive* firms generate, change, and shape markets and industries rather than merely responding to the changes in their environment (Miller & Friesen, 1978). Other firms exhibit tendencies to frequently produce "significant technological breakthroughs, and reinvent themselves and retain

technological leadership in their industry" (Ahuja & Lampert, 2001). Covin and Miles (1999) argued that this *innovative* tendency enables firms to frequently rejuvenate and redefine their organizations, markets or industries. Both of these tendencies – proactiveness and innovativeness – enable firms to create new competitive advantages frequently. I refer to these two tendencies of firms – to be first to introduce innovative products and services and to pursue technological leadership – as *advantage-creating tendencies*. Following the prior research in corporate entrepreneurship area, I consider proactiveness and innovativeness as two interrelated but distinct dimensions that produce advantage-creating strategic tendency[1] (Lumpkin & Dess, 1996; 2001). Below I discuss each dimension separately.

Proactiveness

According to Jennings and Lumpkin (1989), "an organization is entrepreneurial if it develops a higher than average number of new products and/or new markets." Lumpkin and Dess (1996; 2001) clarified that proactiveness, as a dimension of the broader entrepreneurial orientation construct, captures the tendency of firms to introduce *pioneering* products in the industry. They defined proactiveness as "introducing new products or services ahead of the competition and acting in anticipation of future demand to create, change, and shape the environment" (Lumpkin & Dess, 2001; p. 431). Thus, firms with a proactive orientation are first to introduce a product, service, or technology on the market and thus to surprise their rivals and change the environment. Similarly, Miles and Snow (1978) described entrepreneurial firms as those that pursue a "prospector" strategy, which is characterized by being first on the market to introduce new products and services: "The prospector's prime capability is that of finding and exploiting new product and market opportunities" (p. 55). Finally, Miller (1983) and Miller and Friesen (1978) referred to proactive firms as those that are first to introduce innovative products, technologies, or administrative techniques intended to shape the environment rather than merely react. Consistent with previous research, I define *proactiveness* as *a firm's tendency to be first to introduce new products, services, or technologies on the market (i.e., ahead of competitors).*

[1] I discuss how these two dimensions are interrelated in more detail in the methods section (Chapter 5).

Innovativeness

Innovation is one of the major sources of a firm's ability to create new competitive advantages. Innovation is "simply the doing of new things or the doing of things that are already being done in new ways" (Schumpeter, 1947: 151). The concept of innovation and its impact on firm performance and economic growth has been studied in many different fields and, therefore, many definitions have been offered. However, one common characteristic underlying all definitions is the element of *newness* (i.e., creation and adoption of something new) (Gopalakrishnan & Damanpour, 1997). Accordingly, the innovation construct encompasses the generation, development, and implementation of new ideas and behaviors (e.g., Damanpour, 1991). Covin and Miles (1999) noted that innovations are critical for a firm's ability to gain competitive advantage because they enable firms (1) to regenerate (by frequently introducing new products and services and entering new markets), (2) to rejuvenate (by significantly changing their organizational processes, structure, and capabilities), (3) to renew their strategies and the way they compete in the marketplace, and (4) to shape their product market domain and attain first mover status (Covin & Miles, 1999). Firms can purposefully instigate innovation by developing an organizational culture and an entrepreneurial mindset that promotes experimentation and creativity and by intensively spending on research and development for maintaining technological leadership (MacGrath & MacMillan, 2000; Lumpkin & Dess, 1996).

Researchers have distinguished between different types of innovation: administrative and technical, product and process innovation, or radical and incremental innovation (Gopalakrishnan & Damanpour, 1997). In this study, I focus on technical and radical innovations. Accordingly, in this dissertation i*nnovativeness* refers to *a firm's tendency to pursue technological leadership*. I assume that a firm with the capability to frequently discover radically new technologies is better able to create new competitive advantages than a firm without such capability (Ahuja, 2001). Hence, innovativeness captures the firm's tendency to discover new technologies, whereas proactiveness refers to the firm's tendency to be first to introduce (or commercialize) new products, services, and technologies on the market.

Defining advantage-enhancing tendencies

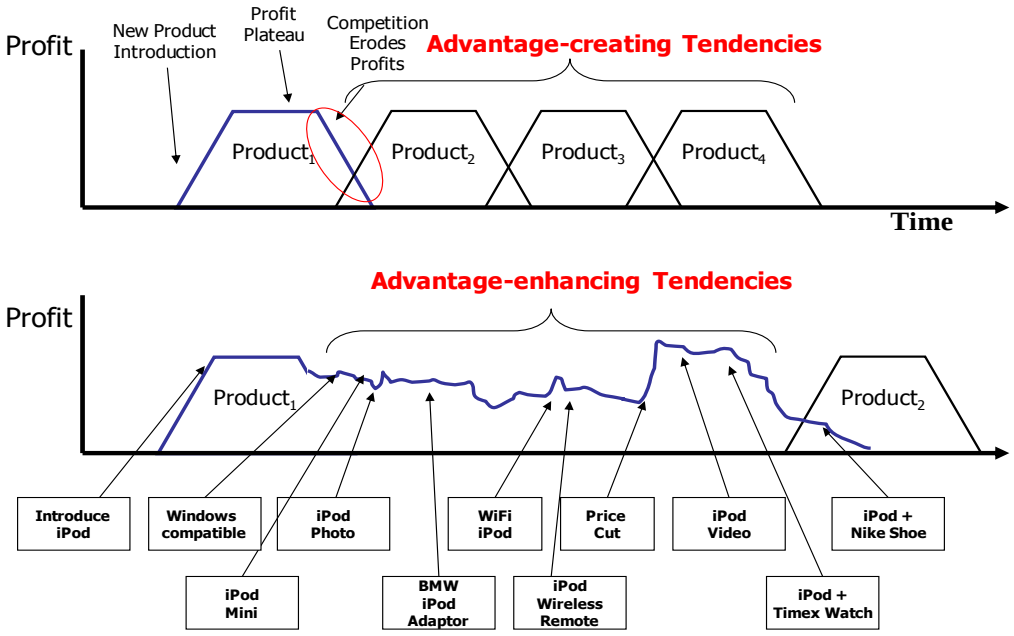
The proponents of the "entrepreneurial" strategies, discussed above, implicitly or explicitly assume that competitive advantages of firms are not persistent. Competitive advantages (unique resources or market positions) in hypercompetitive environments are quickly eroded either by imitative efforts of other firms or by developing more innovative products and technologies that make the existing products obsolete; therefore, firms need to frequently create new advantages and disrupt the status quo (D'Aveni, 1994). In contrast, some researchers have emphasized that even in the most volatile environments, some firms can sustain their advantages for a prolonged period (e.g., Makadok, 1998). Lieberman and Montgomery (1988) emphasized several mechanisms that firms can strategically use to protect and enhance the durability of their superior competitive position. For example, firms with superior learning capabilities can quickly accumulate experience and move down the learning curve, which in turn enables them to cut prices and thus prevent market entry. They can also have the ability to quickly develop a variety of product versions and preemptively occupy attractive market niches (e.g., spatial preemption of locations in geographic and product characteristics space). Additionally, firms may have marketing competences to develop recognizable brand name or ability to add intensively new product features and updates to increase customers' switching costs. Porter (1985) noted a wide variety of strategic and tactical moves that firms use to protect their competitive position, such as building extra capacity, preempting shelf space, and cutting prices. Finally, in highly competitive environments, it is crucial that firms have the ability to intensively update and improve their existing products and thus keep ahead of competitors (Brown & Eisenhardt, 1998; Porter, 1991). This competitive activity can be depicted by the intensity with which a firm introduces actions such as price cuts, sale incentives, advertising, promotions, product improvements, new product versions, new capacity, or market expansions. Because this competitive tendency is likely to enhance and further develop the firm's existing competitive advantages, I refer to this tendency as an *advantage-enhancing* strategy.

Figure 8 illustrates the distinction between advantage-creating and advantage-enhancing tendencies. The top portion of Figure 8 illustrates D'Aveni's (1994) view of

how firms with strong advantage-creating tendencies gain superior performance. Because it is assumed that advantages are short lived in hypercompetitive environments, firms must create a series of new competitive advantages. By the time rivals imitate the existing advantage, the firm has created a new short-term competitive advantage and thus will remain ahead of its competition.

The lower portion of Figure 8 depicts the role of firms' advantage-enhancing capabilities in maintaining competitive advantage over rivals. Despite operating in a hypercompetitive environment, Apple introduced the iPod in 2001 and has managed to sustain its competitive advantage for more than seven years. Apple managed this despite the market entry of several powerful competitors (e.g., Creative, Dell, and Gateway) within one year of iPod's first introduction. The competitors offered close substitutes to the iPod: similar quality levels and lower prices. Despite its rivals' quick reaction, Apple has sustained the iPod's competitive advantage by introducing actions that continuously enhanced the iPod's value. For example, Apple intensively introduced updated versions of the iPod, such as the iPod shuffle, the iPod movie, the iPod nano, and the iPod Photo, offered complementary software (iTunes) and expanded memory, launched new creative advertising campaigns frequently, introduced many sales incentives and price cuts, teamed with Nike, Disney, Motorola, and Timex to introduce product bundles, and entered new international markets (more detailed information about iPod's advantage-enhancing activity is shown in Table 17 in the appendix). The intensity of these value-enhancing actions enabled Apple to stay ahead of competitors and sustain its advantage.

Figure 8: Advantage-creating and Advantage-enhancing Strategic Tendencies



During any period, a firm may have a number of new product introductions and new technological inventions; or it can undertake many advantage-enhancing actions for several existing products. Across all firms in the industry, some firms show superior advantage-creating tendencies while others have superior advantage-enhancing tendencies. Some of these firms might possess superior capabilities in both types of strategic tendencies simultaneously, while others may be inferior in both tendencies. Note that a firm with strong advantage-enhancing tendencies may not be frequently first to introduce new products and still gain sustainable advantage and earn profits. A firm that is an early follower or even a late entrant, but which has superior advantage-enhancing capabilities, can quickly supersede the first mover and become market share leader.

Theory and Hypotheses

Advantage-creating tendencies, advantage-enhancing tendencies, and firm performance

As argued above, although all firms may exhibit some degree of advantage-creating and advantage enhancing tendencies, firms vary in their abilities to pursue each type of tendency. Some firms may focus on developing superior entrepreneurial abilities

to frequently create innovative products and technologies and thus earn above average profits. Other firms may be able to create only a few new advantages but may possess a strong ability to continuously enhance and expand their existing advantages and thus outperform rivals. Indeed, previous research has shown that pioneers and firms with entrepreneurial strategies possess a different set of skills, practices, and competences than firms that focus on protecting and enhancing their existing advantages and are often followers or late entrants (e.g., Kerin, Varadarajan, & Peterson, 1992; Miles & Snow, 1978; Covin & Slevin, 1989). The underlying cause of the differences in firms' skills and competences to pursue both strategies is based on the assumption that all firms face resource constraints. Firms have limited resources and thus they must make choices in allocating their attention and resources either toward continuously exploring new products, markets, and technologies or toward exploiting and enhancing their existing advantages (Levinthal & March, 1993; March, 1991). Prior research has suggested that firms with superior advantage-creating or superior advantage-enhancing capability can outperform rivals.

On one hand, firms that show innovative and proactive tendencies (i.e., advantage-creating tendencies) frequently create and act on first-mover opportunities. These entrepreneurial actions disrupt the status quo on the market and often render the existing products and technologies of rivals obsolete (D'Aveni, 1994). These groundbreaking entrepreneurial actions are complex and difficult for rivals to imitate (Smith & Di Gregorio, 2002), which causes delayed rivals' responses. This in turn can enable the first mover firms to gain (at least temporarily) above-average profits. First mover advantage literature has suggested that the late entrants gain substantially less market share than early entrants do (see Kalyanaram, Robinson, & Urban, 1995). Robinson (1988) and Robinson and Fornell (1985) showed that the order of market entry alone can explain from 9% to 18% of the variation in market share and Makadok (1998) found that first movers (in the money market mutual fund industry) were able to sustainably charge higher expense ratios (higher fees for operating the fund). Hence, we can expect that firms that are frequently first to introduce new products and technologies on the market will earn greater profits than will the less innovative and proactive firms. Indeed, research in corporate entrepreneurship has shown that firms can pursue an

entrepreneurial strategy regardless of their size and that this entrepreneurial strategy (or posture) has a positive effect on firm performance especially in highly volatile environments (Covin & Slevin, 1989). In addition, several researchers have shown that firms with entrepreneurial orientation (measured by its degree of proactiveness, innovativeness, and risk taking) exhibit superior performance (e.g., Wiklund, 1999; Wiklund and Shepherd, 2003; Zahra, 1991). Hence,

Hypothesis 1: Firms' advantage-creating tendencies will be positively related to firm performance.

On the other hand, firms with strong advantage-enhancing tendencies can gain superior performance either by adopting a "wait-and-see" strategy and entering the market once the uncertainty is resolved or by being able to successfully protect a few well-established competitive advantages. These firms may possess superior marketing and promotional capabilities, reputation and recognizable brand name, economies of scale and learning experience advantages, or ability to continuously update and improve the value of the existing products and services. These capabilities enable them to catch up quickly with first movers even if they enter the market as later entrants and gain profits. This is because later entrants have opportunity to learn from pioneers' mistakes, to collect more comprehensive information about the probability of success of the new product/technology, and benefit from lower imitation costs and free riding (Lieberman & Montgomery, 1988). Prior research has provided empirical evidence for this argument. For example, the research in competitive dynamics has shown that firms that compete aggressively with a wide variety of competitive actions (such as series of price cuts, advertising, and product versions) can dethrone industry leaders and gain greater market share and profits (Ferrier, Smith, & Grimm, 1999). In addition, Boyd and Bresser (2008) provided evidence that moderately late entrants (firms that enter markets neither too fast nor too late) enjoyed performance advantages. This finding also suggests that firms with advantage-enhancing strategies can outperform rivals. On one hand, firms with advantage-enhancing tendencies are less likely to enter markets as early movers (second or third) because of their predominant focus on extending the existing advantages. On the other hand, they are also less likely to wait too long to enter the new markets, as they possess superior advantage-enhancing capabilities to quickly mobilize resources and

imitate the first movers' products and technologies. This capability enables them to offer a wide variety of new product versions at lower prices than those offered by first movers.

This suggests that both advantage-creating and advantage-enhancing capabilities can enable firms to gain superior performance. For example, Abegglen and Stalk (1985) noted that Sony and Matsushita have developed different types of capabilities and use different strategies to outcompete rivals. Sony regularly develops technological innovations and introduces pioneering products, whereas Matsushita is often a follower in an established market who quickly overtakes rivals and becomes market share leader because of its strong advantage-enhancing capabilities (e.g., manufacturing and marketing expertise).

Hence, I expect that advantage-enhancing strategic tendencies will also be positively related to firm performance in the future.

Hypothesis 2: Firms' advantage-enhancing tendencies will be positively related to firm performance.

Strategic entrepreneurship and firm performance

Thus far, I have argued that a firm can gain profits either by being a frequent first mover or by being a capable follower. Strong advantage-creating capabilities enable a firm to frequently discover new technologies and be first to introduce new products on the market. On the other hand, strong advantage-enhancing capabilities enable a firm to enter markets as a later entrant, quickly surpassing industry leaders and gaining profits. But, what are the performance implications for firms that are able to develop both types of capabilities?

Ireland et al. (2001) and Hitt et al (2002) argued that firms that are able to develop both capabilities will exhibit superior profits. The authors referred to this simultaneous pursuit of advantage-creating and advantage-enhancing strategies as *strategic entrepreneurship*. Firms that pursue strategic entrepreneurship can outperform rivals in two ways. First, these firms are capable of not only frequently creating new competitive advantages but also sustaining those advantages longer and thus fully capitalizing on the first mover opportunities. More specifically, strong advantage-creating capabilities will lead to frequent discovery of new first mover opportunities and at the same time, strong

advantage-enhancing capabilities will enable them to quickly build entry barriers or intensively improve the value of the new products and thus stay ahead of competitors (as Apple did with iPod, see Figure 8). Second, firms pursuing strategic entrepreneurship can outperform rivals (1) by quickly eroding rivals' competitive advantages and (2) by capitalizing on rivals' newly created advantages. In the former case, advantage-creating capabilities lead to formation of new product categories and discoveries of radically new technologies; this innovative and proactive activity can make rivals' technology obsolete and can erode rivals' well-established monopolistic position on the market (because the new product category may offer superior value to that offered by the rival's established products). In the latter case, advantage-enhancing capabilities will enable them to effectively imitate rivals' newly created products and technologies and capitalize on pioneers' expenses in research and development of new products and technologies (e.g., costs of obtaining regulatory approvals, educating customers, developing infrastructure, learning from pioneers' experiences, and lower imitation costs through reverse engineering) (Porter, 1980; Lieberman & Montgomery, 1988). This suggests that a firm with both types of capabilities will be better able (1) to discover and fully capitalize on the first mover opportunities and (2) either to eliminate rivals' advantages or capitalize on their investment in research and development of new products and technologies. Consequently, the firms that possess both advantage-creating and advantage-enhancing capabilities will earn higher profits compared with firms that have either capability (but not both).

> *Hypothesis 3: Firms pursuing strategic entrepreneurship (high advantage-creating and high advantage-enhancing) will exhibit highest performance.*

CHAPTER III: COMPETITIVE STRATEGY AND ALLIANCE NETWORK FORMATION

Introduction

In the previous chapter, I argued that firms could develop superior internal capabilities that enable them to pursue intensively advantage-creating and advantage-enhancing strategies. However, the differences in the firms' internally controlled resources and capabilities can only partially explain performance differentials across firms. Firms' ability to persistently outperform rivals depends also on the advantageous access to external information and resources uniquely held by other market participants (Dyer & Singh, 1998). The increased competitive pressure and the unprecedented pace of technological change in most industries today (Bettis & Hitt, 1995; D'Aveni, 1994) have made collaboration with other firms a necessary condition for sustained success in the marketplace. This increased collaborative activity, strategically initiated by firms in their efforts to outcompete rivals, leads to formation of a network of interfirm relationships (in the form of strategic alliances, joint ventures, and long-term agreements) at the system level. Each firm in the alliance network maintains a distinct portfolio of alliances and has a distinct pattern of alliance ties with other network members, which in turn provide different potential for gaining access to network resources (Gulati, 1998; Gulati, Nohria, & Zaheer, 2000). Applying social network theories, researchers have shown empirically that several network positions (e.g., brokerage position, ego network density, centrality) and configurations (e.g., diversity of ties, proportion of strong/weak ties) provide firms with advantageous access to network resources, which in turn is positively related to firms' performance (e.g., Zaheer & Bell, 2005; Ahuja, 2000a; Rowley, Behrens, & Krackhardt, 2000; Baum, Calabrese & Silverman, 2000; Powell, Koput, & Smith-Doerr, 1996).

In this dissertation, I argue that the effect of network structure on firm performance is contingent on the type of competitive strategy the firm is pursuing. However, before I examine which type of network structure is optimal for a given type of strategy, it is important to understand how firms with different strategies become embedded in different network structures. Firms purposefully form alliances to support

their competitive strategies. The degree to which a firm has the ability to pursue advantage-creating or advantage-enhancing tendencies leads to different managerial choices and motivations about (1) the intensity of interorganizational collaborative activity, (2) the type of alliance partners, and/or (3) the type of alliance governance form (equity vs. non-equity). Thus, it is likely that the network structure is also a function of firms' strategies, because different strategies produce different needs and motivations for collaboration with other market participants. Hence, in this chapter, I examine how firms actually construct their network structures (i.e., how different strategies lead to different types of network structure).

The prevailing preoccupation in the networks literature has been in understanding how the firm's network position leads to certain outcomes; less emphasis has been placed on how the firm arrives in that network position. A few studies that have tried to explain the origins of network positions have mainly focused on how previous network positions provide opportunities for alliance formation and how these tendencies lead to formation of certain network positions (e.g., Gulati & Garguilo, 1999; Gulati, 1999; Powell, Koput, & Smith-Doerr, 1996). Although these studies have increased our understanding of network structure formation, we still have "very little systematic knowledge of how *strategic actors* construct their networks" (Stuart & Sorensen, 2007: 219, emphasis added). As Stuart and Sorensen (2007) noted, firms are not randomly assigned to network positions. Firms strategically and purposefully engage in collaborative activity in an effort to enhance their ability to gain or sustain competitive advantage. Different firms exhibit different strategies and these strategies create different needs, motivations, and incentives for collaborative activity. Thus, it is reasonable to expect that particular regularities in the strategic behavior of firms may lead to recognizable patterns of networking behavior, which in turn may result in being located in predictable network positions.

This study adopts a resource-based view of alliance formation (Eisenghardt & Schoonhoven, 1996). It assumes that alliances and the resulting network structure are driven by the firms' needs for resources or capabilities that are controlled by other firms. Firms have different strategic needs because they pursue different types of strategies and therefore certain strategies are associated with certain types of network structure. This is

not to say that firms are purposefully constructing their alliance network structure. Firms form alliances to satisfy their strategic needs, and these individual decisions aggregate to certain types of alliance network structure that may be the unintended outcome of this networking activity. Firms purposefully create alliances, but they may unintentionally become embedded in a certain network structure. I will argue that different firms exhibit recurrent patterns of strategic behavior and hence have different needs for external resources; therefore, they are consistently embedded in certain network structures. Thus, although the overall alliance network is constantly changing, firms with particular strategic tendencies tend to maintain stable network positions.

Theoretical Background

Previous research has identified two general sets of factors that affect firms' likelihood to form alliances: resource needs and social opportunities (Eisenhardt & Schoonhoven, 1996). The first set of factors assumes that firms act strategically to outcompete rivals and earn profits. Therefore, firms form alliances to gain access to resources needed to accomplish certain strategic goals. For example, firms may use alliances to reduce the transaction costs and increase their operational efficiency. According to transaction cost economics, firms purposefully form joint ventures when the costs of writing and executing contracts are too high (because of a small number of bidders, asset specificity and hold up issues, a high degree of uncertainty, or significant incentives for partners to act opportunistically) and, at the same time, it is inefficient to internalize the production process (because the firm lacks such competences) (Williamson, 1975). Another explanation for alliance formation is based on resource dependence theory (Pfeffer & Salancik, 1978). This theory suggests that firms strategically form alliances to effectively manage symbiotic interdependencies (interdependencies between supplier and buyer) and competitive interdependencies (interdependencies between competitors). Furthermore, strategy researchers have focused on various characteristics of the firm such as top management team characteristics, employing an innovative strategy (Eisenhardt et al., 1996), and the availability of technical and commercial capital (Ahuja, 2000b) to explain the likelihood of firms to form alliances. Another research stream builds on exchange theory (Emerson, 1962) and

emphasizes the need for collectively achieving strategic goals through enhanced coordination, reciprocity, and mutual support (Oliver, 1990). Thus, according to this research, the motivation to form alliances is found in the achievement of collective goals. Finally, research based on institutional theory (DiMaggio & Powell, 1983; Tolbert & Zucker, 1983) has highlighted the need for organizational legitimacy as an important motive for forming alliances (Baum & Oliver, 1991). This research argues that firms form alliances to improve their reputation and image, to signal creditworthiness, to gain government approval, to increase their attractiveness as worthy alliance partners, or to increase investors' confidence in their business activities (Dacin, Oliver, & Roy, 2007).

The other set of factors focuses on the social opportunities for forming new alliance ties. Firms may have needs for external resources but may not have many opportunities for accessing the needed resources. Firms differ in the amount of information they have about which partners have complementary resources, which potential partners are actually interested in collaborative activity, and which firms might be reliable and valuable partners. Gulati (1999) showed that firms' awareness of potential partners is a function of their prior alliance experience and their favorable position in the network structure. Ahuja (2000a; 2000b) found that a focal firm is considered an attractive partner when it possesses a high degree of technical (innovative) and commercial capital. Prior alliance experience also provides information (often through third-party referrals) about the complementarity of the resources held by the potential partners, as well as the partners' trustworthiness and the likelihood of opportunistic behavior (Gulati, 1998; Gulati & Garguilo, 1999).

In this chapter, I argue that firms vary in both their *strategic needs* for resources and their *access to social opportunities* for alliance activity as a function of their competitive strategy. Different strategies create different needs and opportunities for firms to obtain network resources. In particular, I focus on how two types of strategic tendencies – advantage-creating and advantage enhancing – lead to firms forming either dense or sparse network structures. *Network density* refers to a network structure in which a large proportion of a firm's network partners are connected with one another. Thus, a firm is embedded in a dense network when all of its alliance partners are connected with each other. Coleman (1988) argued that actors (individuals or firms) can benefit from

being embedded in a dense network because it creates norms, obligations, and reciprocity; promotes the development of trust; and ease the transfer of information and resources. In contrast, other firms might be embedded in a sparse network structure, which provides opportunities for them to bridge structural holes. *Structural holes* are the disconnections between two clusters of actors; brokers are the firms that bridge between the two disconnected clusters of actors. Burt (1992) argued that actors embedded in networks with many structural holes enjoy competitive advantage because (1) they have faster access to diverse and nonredundant information because they bridge different knowledge and information pools, which tend to be homogeneous within the same cluster and heterogeneous across different clusters, and (2) they have the power to control the flow of information and resources from one to another part of the network.

I will argue that firms with advantage-creating strategic tendencies will tend to be embedded in sparse networks with many structural holes, whereas firms with an advantage-enhancing strategy will be embedded in dense network structures. In addition, because a sparse network structure is often associated with weak ties (Granovetter, 1973), whereas strong ties enhance the stability of dense network structures, I also examine how advantage-creating and advantage-enhancing strategies affect firms' tendencies to form weak and strong ties. In this study, *weak ties* refer to non-equity alliances (e.g., licensing, long-term supply contracts, marketing and distribution agreements), whereas *strong ties* refer to equity alliances (e.g., joint ventures and other strategic alliances in which partners exchange equity). Strategic alliances refer to "any voluntarily initiated interfirm cooperative agreement that involves exchange sharing, or co-development, and it can include contributions by partners of capital, technology or firm-specific assets" (Gulati, 1995:621).

Theory and Hypotheses

Advantage-creating tendencies and network structure

An *advantage-creating tendency* refers to the tendency of a firm to develop radically new products and technologies (innovativeness) and to frequently be first on the market to introduce new products and services (proactiveness). I argue that firms with

advantage-creating tendencies are more likely to form new alliances with partners outside their current network. This behavior in turn will lead to forming sparse network structures with many structural holes.

First, proactive firms, by definition, tend to frequently introduce new products ahead of competitors (Lumpkin & Dess, 1996). This frequent discovery of new products creates a greater need for acquiring or developing new and different resources and capabilities. For example, when a firm introduces a pioneering product it often needs to form new relationships with suppliers, distributors, manufacturers, customers, or other firms with complementary products, technologies, or services. Although some of the existing partners may provide adequate resources and capabilities, it is likely that the introduction of radically new products will require new sets of partners with more compatible and sophisticated resources. As a result, proactive firms will frequently bring new partners into their networks and thus are less likely to be locked in dense networks. In support of this argument, Eisenhardt and Schoonhoven (1996) found that firms in emergent-stage markets have a higher rate of new alliance formation than firms in other market stages (e.g., in growth stage or mature stage markets).

Firms with proactive tendencies also continuously search for new partners to explore new opportunities to offer superior value to customers. Sarkar, Echambadi, and Harrison (2001: 702) argued that proactive firms exhibit greater "efforts to identify potentially valuable partnering opportunities and to initiate preemptive actions in response to identified opportunities." These exploratory tendencies lead to frequent discoveries of unique ways for creating product bundles that provide greater value to customers (e.g., Apple collaborated with Disney, Nike, and GM to create product bundles with iPod). This continuous recognition of partners with complementary resources or products from a wide range of indsutries leads to formation of new structural holes.

Proactive firms are not only first to introduce innovative products, but are also more likely to enter new markets with new or existing products. Proactive firms actively seek for opportunities where their newly created products provide superior value (i.e., better quality for similar price, or similar quality for significantly lower price, or both) to customers in different markets and market segments (Kirzner, 1973). For example, firms increasingly use alliances and joint ventures to accelerate entry into international markets

by gaining access to local market knowledge, sharing investment risk and resources (Garcia-Canal, Duarte, Criado, & Llaneza, 2002). This again leads to formation of network structures with many structural holes – in this case by forming alliances with partners across geographical regions and countries.

Firms that pursue advantage-creating tendencies are also more innovative than their rivals. The discovery of new technologies increases both (1) the potential of the innovative firm to discover new resource combinations through forming alliances with firms with complementary resources and (2) the likelihood that other firms will approach the innovative firm with new ideas for collaborative activity. Shane (2000), for example, observed that the discovery of three-dimensional printing (3DP) technology generated opportunities for many firms from technologically distant industries (e.g., pharmaceuticals, orthopedics, surgical models, retail consumer goods) to combine their own resources and competencies with the newly developed technology. This suggests that when a firm discovers a radically new technology it increases the range of opportunities for discovering more productive resource combinations with diverse partners. Ahuja (2000a) argued that innovative firms are considered attractive partners and are often approached by other firms with ideas for combining their complementary resources. This further suggests that innovative firms will be more likely to form new alliance ties and thus bring new partners into their networks. Eisenhardt and Schoonhoven (1996) provided empirical evidence that innovative firms are more likely to form new alliances than their less innovative rivals do.

Finally, firms with a history of innovative activity are attractive alliance partners for gaining legitimacy. Allying with innovative partners often provides assurance that the new entrepreneurial venture is highly likely to succeed. As Dacin, Oliver, and Roy (2007: 177) noted, "investor confidence in a novel or seemingly risky initiative may be secured by entering into a strategic alliance with a partner who exhibits strong support, experience, and confidence for the uncertain business activity by its willingness to share risk in the investment." Because new industry players will have greater need to legitimize their entrepreneurial activity (Baum & Oliver, 1991), they are more likely to seek to form an alliance with a firm having a reputation for successful innovating. This again suggests

that innovative firms will have more opportunities to establish alliances with new partners and therefore will tend to form more structural holes.

> *Hypothesis 4: Firms exhibiting higher advantage-creating tendencies (proactiveness and innovativeness) will have more structural holes in their alliance network structure in subsequent periods.*

Advantage-creating tendencies and weak ties

Firms exhibiting high levels of advantage-creating tendencies will also be more likely to form non-equity alliances rather than equity alliances as compared with firms that are less proactive and innovative, because non-equity alliances provide more *flexibility* for entrepreneurial firms both to form new alliances and to dissolve the old ones.

As argued above, proactive firms are continuously first to develop and introduce new products. This tendency creates a greater need to form new alliances because the new products and technologies are likely to be incompatible with the competencies of the current set of alliance partners. As firms move from one product to another (or as they introduce radically new technologies), the old collaborative relationships may no longer be effective and/or productive. Proactive firms will therefore not only create many new alliances but also will *terminate* their alliances sooner and at a higher rate than firms that are not proactive. This is not to say that all types of alliances will become unproductive or ineffective. For example, a distributor or a manufacturer may successfully adjust operations to serve the newly developed product, which may lead them to renew and extend the alliance contract. On average, though, it is more likely that firms with greater advantage-creating tendencies will have greater need to restructure their alliance portfolio than firms that rarely introduce radically new products and technologies. This tendency requires greater flexibility to exit the old alliances, given that all firms face limitations about the number of alliances they can enter and reasonably maintain.

This flexibility can be more efficiently achieved by forming non-equity alliances. Non-equity alliances do not involve exchange of equity between partners and typically do not entail hierarchical controlling mechanisms and joined ownership structure (Gulati, 1995; Gulati & Singh, 1998). As a result, non-equity alliances are less costly and require

less time to terminate (Harrigan, 1988). Equity alliances, on the other hand, involve shared equity and more formal organizing mechanisms such as authority and command systems, incentive systems, or standard operating procedures (Gulati & Singh, 1998). As such they provide less strategic flexibility because they are "normally considered more difficult than a contractual agreement[s] to establish, terminate, and fundamentally change" (Osborn & Baughn, 1990: 505). Because proactive and innovative firms continuously generate new opportunities for collaborative activity and therefore exhibit greater rate of alliance turnover, the non-equity alliances would be more suitable for pursuing an advantage-creating strategy, as compared with equity alliances. Therefore,

> *Hypothesis 5: Firms exhibiting higher advantage-creating tendencies (proactiveness and innovativeness) will have more non-equity alliances in their alliance network in subsequent periods.*

Advantage-enhancing tendencies and network structure

Firms exhibiting advantage-enhancing tendencies intensively and continuously enhance the value of *existing* products and services. In highly competitive environments, this advantage-enhancing tendency is highly dependent on close collaboration and coordination of activities among several firms. Baldwin and Clark (2003) noted that firms in industries such as personal computers or consumer electronics have adopted modular system designs to cope with the high pace of technological change. "A modular system is composed of units (or modules) that are designed independently but still function as an integrated whole" (p. 151). *Modules* thus refer to a group of interrelated components or subsystems (e.g., peripherals, processors, software applications, displays) that, combined with other modules and components, form a complex product (such as a computer or an iPhone). To deal with this enormous product complexity, firms in these industries specialize in developing one or few modules (or components). This greater flexibility by the module providers permits greater experimentation and innovation, which in turn leads to frequent improvements and upgrades of different components of the whole product.

However, because each component/module is continuously modified by independent firms, the module providers must communicate and interact intensively. A complex product comprises components and modules that are highly interrelated; any

change in one component requires appropriate adjustments of other components. Garud and Kumaraswamy (2003) noted that the improvements of different components (or modules) cannot be effectively integrated into the whole product through arm-length relationships. Instead, integration requires formation of alliances and joint ventures that facilitate the exchange of fine-grained information about each module's functions: how a particular module interacts with other modules, and how all components and modules fit together in the whole product. Alliances help coordination among module suppliers and thus ensure that the improvements and upgrades in the performances in one module will be compatible with other components. For clarity, it is useful to distinguish between a *firm architect* and a *firm module-designer* (Baldwin & Clark, 2003). A firm architect is responsible for the design of the whole product (e.g., Apple is an architect of iPod); while a firm module-designer is responsible for manufacturing and designing particular modules and components. I argue that both firm architects and firm module-designers that exhibit strong advantage-enhancing tendencies will tend to form a dense network structure.

The firm architect is likely to encourage its network partners to collaborate with one another for at least two reasons. First, as Garud and Kumaraswamy (2003) noted, standardization can be achieved through close collaboration among component providers. *Standardization* refers to "the use of the same component in multiple products…" (p. 132). Standardized components involve lower costs: a standard component can be used in several versions of the product, thus providing greater economy of scale and scope and higher performance. Another reason for firms with advantage-enhancing strategy to develop dense network structure is the increased need for ensuring greater compatibility among various components of the complex product. As argued above, when independent firms are continuously improving a complex product (e.g., 90% of iPod's components are outsourced), the process requires intensive communication to assure compatibility (1) between the firms' architects and module (components) designers, and (2) among all firms component-designers. Dense alliance networks enhance information exchange among network partners and prevent information spillover outside the network by imposing strong norms, expectations, and sanctions for network members (Coleman, 1988). Hence, it is reasonable to expect that the firm-architect (in an attempt to enhance

the market position of their existing modular products), will work hard to encourage partners to collaborate with one another and create dense network structures.

However, this cannot be accomplished unless network partners (module designers) also have strong incentives to collaborate. For a firm module-designer, information exchange about specific characteristics of the other components/modules as well as updates and improvements of the other components are crucial for achieving greater alignment and compatibility. Greater compatibility in turn provides greater operational efficiency and avoids unnecessary delays and product malfunctioning. Because the success of a complex product in the marketplace affects the profitability of all participating firms, module designers also have strong incentives to closely collaborate.

This suggests that both firm architects and firm module designers will seek to closely collaborate with one another to continuously improve the *existing* modular product and thus create a dense network structure.

Hypothesis 6: Firms exhibiting higher advantage-enhancing tendencies will have higher degree of network density in the subsequent periods.

Advantage-enhancing tendencies and strong ties

While advantage-creating tendencies require greater flexibility in restructuring the alliance portfolio, advantage-enhancing tendencies require a more stable network in which partners develop trustful relationships and intensively collaborate to develop compatible components. Network stability can be enhanced when firms form equity alliances. One characteristic of equity alliances is that they are more difficult and costly to dissolve (Das & Teng, 2000; Gulati, 1995). This characteristic reduces high alliance turnover rate, and thus strengthens the current network structure.

As argued above, advantage-enhancing tendencies in the context of modular product design require intensive exchange of information for effective coordination among all partners responsible for manufacturing various components. *Equity alliances* in this respect are more effective in managing such interdependencies than are non-equity alliances. Equity alliances typically involve some form of governance structure and hierarchical elements such as authority and incentive systems, standard operating

procedures, dispute resolution procedures, and nonmarket pricing systems that enable coordination between partners (Gulati & Singh, 1998). Gulati and Singh (1998) showed empirically that firms are more likely to form equity alliances when they face a higher degree of interdependency.

In addition, equity alliances promote trust development and deter opportunistic behavior (Gulati, 1995). Trust between partners is critical if they are to share confidential information and knowledge. Reduced concerns that partners will act opportunistically encourage firms to invest in transaction-specific assets and be more willing to share knowledge and resources and thus jointly develop new competences. This mutual commitment toward achieving a common goal is an essential precondition for continuous improvement and enhancement of the value of an existing modular product.

Hypothesis 7: Firms exhibiting higher advantage-enhancing tendencies will have more equity alliances in subsequent periods.

Strategic entrepreneurship and network structure

Although advantage-creating and advantage-enhancing strategies are distinct, it is also possible that some firms are able to pursue both simultaneously. These firms have been identified as following a strategy of "strategic entrepreneurship." Following Ireland, Hitt, and Sirmon (2003), *strategic entrepreneurship* is defined here as the simultaneous pursuit of advantage-creating and advantage-enhancing strategies at high levels relative to other industry participants. As argued above, however, advantage-creating and advantage-enhancing tendencies lead to different types of network structures.

On the one hand, *proactive* advantage-creating tendencies create a greater need for restructuring the alliance portfolio and seeking out new partners with complementary resources and capabilities, because being first in the market to introduce a new product often requires a new set of partners. Similarly, *innovative* advantage-creating tendencies create more opportunities for forming alliances with new partners because (1) innovative firms are attractive partners and (2) innovative technologies generate new entrepreneurial opportunities. This leads to forming sparse network structures. On the other hand, firms that pursue strategic entrepreneurship also have strong advantage-enhancing abilities that stimulate the formation of dense network structures. They are likely to subsequently

encourage the new firms to closely collaborate with their other network partners because network coordination is critical for continuously enhancing the current competitive advantages. Their new partners will also have incentive to collaborate because it is to their benefit to become valued partners within the innovative firm's network.

So, within what type of network structure will "strategically entrepreneurial" firms be embedded? Firms that pursue strategic entrepreneurship will exhibit dynamic network structures with moderate levels of network density and structural holes. Advantage-creating tendencies will continuously create new alliances and bring new partners into the network and thus form new structural holes, whereas advantage-enhancing tendencies will encourage those new partners to form ties with the other network partners and thus close up the structural holes. This dynamic cycle of creating and closing structural holes will change the level of density and structural holes in the firm's network. Thus, we can expect that the relative degree to which a firm pursues advantage-creating and advantage-enhancing tendencies at any given time will determine the type of their network structure. Specifically, an increase in advantage-creating tendencies will increase the number of structural holes, whereas an increase in advantage-enhancing tendencies will decrease the number of structural holes. Alternatively, an increase in advantage-creating tendencies will decrease network density, whereas an increase in advantage-enhancing tendency will increase network density. Hence,

> *Hypothesis 8a: There will be a negative interaction between advantage-creating and advantage-enhancing tendencies of firms in explaining the future degree of network density.*

> *Hypothesis 8b: There will be a negative interaction between advantage-creating and advantage-enhancing tendencies of firms in explaining the future number of structural holes in the alliance network structure.*

CHAPTER IV: COMPETITIVE STRATEGY, ALLIANCE NETWORK STRUCTURE AND FIRM PERFORMANCE

Introduction

In Chapter 2, I argue that firms vary in their capabilities to pursue advantage-creating and advantage-enhancing tendencies. In Chapter 3, I show that each type of strategic tendency tends to lead a firm to be embedded in a different type of network structure. This chapter explores how these combinations of strategic and networking tendencies affect firm performance. More specifically, I address the following questions: If advantage-creating tendencies lead to sparse network structures, whereas advantage-enhancing tendencies lead to dense network structures, are these combinations of strategy and network structure the most beneficial for the firm's performance? If not, what is the optimal network position for a given strategic tendency that enhances a firm's performance? Answers to these questions are important both (1) for gaining greater understanding of how firms *should* construct their networks and (2) for providing a more complete explanation of the causes for conflicting findings about the relationship between network structure and performance (e.g., Ahuja, 2000a; Zaheer & Bell, 2005). First, providing empirical support for the optimal fit between different strategies and network positions can provide basis for developing normative propositions; that is, how should managers construct their networks to enhance the effect of their strategy on firm performance? Second, the empirical research on social networks has demonstrated conflicting findings about which type of network structure (sparse vs. dense network) is more beneficial for the firm. This study tries to reconcile these opposing perspectives by arguing that the effect of the network structure on firm performance is contingent on the type of strategy the firm is pursuing.

Theoretical Background

Previous research has mainly examined how the firm's position in the network structure directly affects firm performance. The main argument is that certain positions in the network structure provide firms with unique resources and strategic information (controlled by other network members) that is not available to other firms. Because some

firms consistently occupy such advantageous network positions (and thus preferential access to network resources), they are able to gain a sustainable competitive advantage over rivals (Gulati, Nohria, & Zaheer, 2000).

Two basic arguments exist about which type of alliance network structure is the most beneficial for an actor. The first argument is that dense network structures (network structures in which all actors are highly interconnected with one another) are conducive to developing strong norms, reciprocity, and trust. These collective network properties on one hand encourage efficient exchange of information, resources, and ideas and on the other hand, curb partners' opportunistic behavior by enforcing sanctions (Coleman, 1988). The second argument is that sparse network structures with many brokerage opportunities provide benefits for actors. Brokerage opportunities exist when a focal actor links other disconnected members of its network. The absence of ties between disconnected others is called a structural hole (Burt, 1992). When an actor spans many structural holes in its network, the actor enjoys two types of benefits: (1) preferential access to nonredundant information, and (2) the power to control the information flow between disconnected parties.

The mechanisms through which these network structures provide benefits for network members are quite different. Network density (also called network closure) primarily works through solidarity, coordination, and collective action; whereas network brokerage works through providing opportunities for entrepreneurial action. To some extent, network density and network brokerage offer alternative ways for actors to gain benefits. For example, network density eases coordination among network members, whereas sparse networks may hinder the cooperative exchange of information among members. In operational terms, the two types of network structure more clearly appear to be mutually exclusive. A sparse network structure with many brokerage opportunities implies that the network structure is not dense. When a focal firm's partners are disconnected, it has a maximum number of structural holes, whereas when all of its partners are connected, the focal firm has a maximum density score of one.

Empirical research at the firm level of analysis (i.e., when actors are firms, not individuals) has also produced conflicting findings. Uzzi (1997) documented that firms embedded in a dense network have access to fine-grained information and knowledge

from network partners and exhibit a higher likelihood of surviving. Ahuja (2000a) also found that network density is more beneficial for firms' innovative performance. In contrast, research has also found that firms embedded in a sparse network structure exhibit greater revenue growth (Baum, Calabrese & Silverman, 2000) and enjoy greater market share (Zaheer & Bell, 2005).

In general, research has taken two approaches in reconciling these opposing arguments. On one hand, Burt (2000) and Reagans and Zuckerman (2001) posited that network density and brokerage are complementary arguments and thus an actor can simultaneously gain benefits from brokerage and closure. For example, actor A may benefit from its membership in two dense clusters X and Y, whose members are disconnected. Thus, actor A can enjoy the benefits from its membership in X and Y, and, at the same time, enjoy brokerage position between the members of X and members of Y.

On the other hand, some researchers propose a contingency perspective in explaining how network structure provides benefits for network members. Rowley et al. (2000) argued that whether a firm will benefit from a dense or sparse network structure depends on the type of competitive environment it faces. They argued that in stable environments (e.g., the steel industry), network density increases firms' performances, whereas in dynamic environments (e.g., the semiconductor industry) sparse network structures will be more beneficial. Their empirical findings showed that the effect of network density on firm performance was stronger in stable environments. Zahra and George's (2002) work suggested that whether a firm will exploit the resources embedded in the network structure will depend on their internally developed absorptive capacity (i.e., their ability to recognize, assimilate, and exploit external knowledge and information). Building on this argument, Zaheer and Bell (2005) showed that more innovative firms have a greater ability to extract value from a sparse network structure, and thus exhibit better performance. Finally, discussing the conflicting findings in the literature, Ahuja (2000a) also speculated that which type of network structure (sparse versus dense) would be more beneficial for a firm may depend on what it seeks to achieve through the network structure.

Theory and Hypotheses

This dissertation also adopts a contingency perspective. I posit that whether a firm will benefit from a sparse or dense network structure depends on the type of competitive strategy it exhibits. Each type of network structure provides distinct benefits that are differentially relevant for each type of strategy. I develop two theoretical explanations for the interplay between network position and firm strategy in explaining firm performance: (1) network as *complementor* of firms' capabilities and (2) network as *substitutor* of firms' capabilities.

*Network-as-complementor***.** The first potential role of a network involves having the resources provided by a particular network position that complements and enhances a given type of strategy. Specifically, a firm with strong advantage-creating tendencies can better exploit the diverse and unique information provided through a sparse network structure than a firm with low emphasis on such a strategy. Similarly, a high level of advantage-enhancing capabilities enables firms to better realize the resource potential provided by a dense network.

*Network-as-substitutor***.** The second potential role of network refers to the use of network position as a substitute for capabilities that a firm is lacking. The rationale for the beneficial impact of this role builds on the strategic entrepreneurship argument that firms need to have both high advantage-creating and advantage-enhancing capabilities. Thus, a firm with strong advantage-creating capabilities may use the capabilities of a dense network of collaborators to enhance its advantage-enhancing capabilities. Likewise, a firm with strong advantage-enhancing capabilities may use a network structure rich with structural holes to gain access to innovative partners outside of their cluster, and thus substitute for their lack of internal advantage-creating capabilities. I next discuss how each combination of strategy and structure might positively affect firm performance.

Advantage-creating tendencies and firm performance

A complementary role of a sparse network structure

Firms that span structural holes are more at "risk" of discovering profit opportunities (Burt, 1992). I refer to profit opportunity as a situation in which a firm becomes aware of a unique combination of resources (internal, external, or both) that could produce superior value for customers. Network positions create such situations by providing unique access to information, resources, or technologies that could be used to create a product or service that is superior to those hitherto offered by competitors. A firm embedded in a network structure rich with structural holes has greater awareness of and access to a diverse set of resources and competences uniquely held by firms in different industries and industry segments. However, the *access* to resources and the *ability* (and motivation) to exploit those resources are distinct processes (Portes, 1998). The network position only provides the potential for gaining valuable and advantageous information and resources. A mere exposure to diverse network resources is insufficient for creating new competitive advantages. A firm needs the capability to create unique resource configurations by combining its internal resources with those available through network ties. Zahra and George (2002) noted that firms can utilize the external resources and information if they have developed routines and processes to analyze, interpret, and make sense of new information, if they possess the capability to re-combine the externally acquired resources with their own internally developed resource potential, and they have the ability to utilize the newly created resource base in developing pioneering products.

A firm with strong advantage-creating tendencies (innovative and proactive) will be better able to utilize the diverse resource potential available through network ties. These innovative and proactive firms are recognized by their ability to continuously experiment with new products and technologies and stay alert to the changes in their environments. They also have greater experience in developing new resource configurations than less innovative and proactive firms (Ireland, Covin, & Kuratko, 2009). Building on this argument, Zaheer and Bell (2005) tested the interaction between innovative capabilities and sparse network structure in explaining firm performance and

found that highly innovative firms with access to many structural holes outperform rivals. This suggests that more innovative and proactive firms will be better able to utilize the access to diverse information provided by sparse network structures, and will thus perform better in the future. Thus, in this case, the network rich with structural holes *complements* and enhances the firm's advantage-creating tendencies.

Hypothesis 9: The number of structural holes in the alliance network structure will strengthen the relationship between advantage-creating tendency and firm performance.

A substitutive role of a dense network structure

Alternatively, a firm with strong advantage-creating tendencies can use a dense network structure to *substitute* for the lack of advantage-enhancing capabilities. This combination of strategy and network structure would be especially beneficial for firm designers that develop strong capabilities for frequently creating innovative product designs. Once the new complex product is designed, the responsibility for its continuous enhancement can be shifted to network partners. A dense network structure facilitates information flow and encourages an intensive exchange of ideas and resources that can lead to frequent improvements and updates of existing products. Thus, instead of building its own advantage-enhancing capabilities, a firm can focus on developing superior advantage-creating capabilities and maintain a dense alliance network structure as a way of substituting for lacking the internal advantage-enhancing capabilities. For example, Apple's superior advantage-creating capabilities led to discovering the iPod, but the continuous enhancement and improvement of the iPod (i.e., advantage-enhancing activity) is mainly carried out in close collaboration with the other component providers in its network. This combination of an advantage-creating strategy and a dense network structure enables Apple to sustain its advantages over rivals. In addition, Linden, Kraemer, and Dedrick (2007) showed that Apple captured a far larger portion of the iPod's gross profit margin than did any of the other component providers, retailers, and distributors. This further suggests that firms with advantage-creating tendencies can enhance their performance when they are embedded in a dense network structure and thus use partners' capabilities to substitute for advantage-enhancing capability.

Hypothesis 10: The degree of density in the alliance network structure will strengthen the positive effect of advantage-creating tendency on firm performance.

Advantage-enhancing tendencies and firm performance

A complementary role of dense network structure

As argued in Chapter 3, firms are increasingly becoming specialized in manufacturing one or a few components of a complex product. No single firm can have all the capabilities needed to continuously enhance and upgrade the value of an existing complex product. Therefore, it is crucial for a firm to collaborate with other component providers and encourage the other component providers to collaborate. I argue that firms with advantage-enhancing tendencies embedded in a dense network will be more successful in inducing partners (component providers) to commit their time and resources to continuously improve an existing product. Thus, in this case, dense network structure will play a complementary role to the firm's advantage-enhancing capabilities.

A firm with a strong commitment to advantage-enhancing activity is more likely to generate reciprocal expectations from network partners to match its inputs by investing extra time and resources in the joined project. A dense network enhances this process because it encourages the development of norms, solidarity, and obligations and leads to the development of shared behavioral expectations (Rowley, 1997). In addition, when all firms are interconnected, the information about an actor's behavior deviating from the established norms is quickly disseminated throughout the network, and is immediately sanctioned (Walker, Kogut, & Shan, 1997). In addition, a dense network eases the exchange of ideas, information, and resources among network members, which creates system-level benefits for all participating firms. The increased input of all network partners creates synergy at the network level and thus enables each individual partner to gain greater benefit for their input. The intensive information-exchange also reduces the possibilities of product malfunctioning, which can adversely affect product sales and firm performance. This suggests that a firm with a strong focus on an advantage-enhancing strategy will be better able to extend its existing competitive advantages when it is

embedded in a dense network. Hence, it is reasonable to expect that the network density will augment the effect of advantage-enhancing strategy on firm performance.

Hypothesis 11: The degree of density in the alliance network structure will strengthen the positive effect of advantage-enhancing tendencies on firm performance.

A substitutive role of a sparse network structure

A firm with strong advantage-enhancing tendencies may use a network with high degree of structural holes to substitute for its advantage-creating capabilities. Because a sparse network provides preferential access to information and technologies from a wide range of geographical and technological clusters, a firm can substitute for its lack of advantage-creating capabilities in at least two ways. First, a firm that maintains alliances with firms from different clusters (industries or regions) can recognize more opportunities for entering new product markets. Second, because brokerage ties provide timely information about technological advances from distant network clusters, these firms have greater awareness of collaborative opportunities with inventors. This suggests that a firm with strong advantage-enhancing capabilities, embedded in a network with many (global) structural holes, is in a better position to identify innovative firms and offer collaborative activity to these firms. At the same time, because of their strong advantage-enhancing capability, they are attractive partners for innovative firms. Innovative firms have also a need to identify firms with strong advantage-enhancing capabilities to successfully commercialize their new products and technologies (Rothaermel & Deeds, 2004).

Furthermore, a sparse network structure also provides quick access to information about new industries and technological trends. This can increase a firm's ability to more accurately anticipate the introduction of pioneering products and technologies. The timely information provided through the network can enable a firm to begin developing capabilities to enter the newly created product market as an early follower. Early entry into new markets is especially crucial for firms with strong advantage-enhancing capabilities. Huff and Robinson (1994) showed that the ability of later entrants to catch up with the pioneering firm increases as the time decreases between market entry of

pioneering firm and the market entry of later entrants. Similarly, Lilien and Yoon (1990) found that early followers that enter the market in the early stages of the product life-cycle (e.g., introductory or growth stages rather than late-growth or maturity stages) have higher product success rates. Thus, firms can fully capitalize on their superior advantage-enhancing capabilities when they are embedded in a sparse network structure, and thus network structure again plays a substitutive role for the firm's advantage-creating capabilities.

Hypothesis 12: The number of structural holes in the alliance network structure will strengthen the relationship between advantage-enhancing tendencies and firm performance.

CHAPTER V: RESEARCH METHODOLOGY

Sample Selection

I draw a sample of firms from the computer and electronics industries to test the theoretical propositions. These industries are characterized by intense alliance activity, short product life cycles, frequent updates of products and services, and intense rivalry (Mendelson & Pillai, 1999). For example, the computer industry's share of the total number of granted patents across all industries increased from 5% in 1960s to 20% in the late 1990s, and the patent activity in the electronics segment remained at about 18% of the total number of patents granted in all industries (Hall, Jaffe, & Trajtenberg, 2001). Furthermore, the frequency of new product introductions by the firms in these broad industry segments has substantially increased to almost one new product introduction per year (Nadkarni & Narayanan, 2007).

The computer and electronics industries are a very broad segment and include a number of four-digit SIC codes. However, one commonality that all firms in this industry share is the use of the *integrated circuit chip* as a core technology; thus, they are close competitors and collaborators across a wide range of product markets. For example, the integrated circuit chip is used as a base for producing a wide variety of products such as computers (e.g., laptops, desktops, workstations), computer peripherals (e.g., printers, fax machines, scanners), consumer electronics (e.g., camcorders, digital cameras, TVs), and other electronic products (Mendelson & Pillai, 1999).

Firms were selected from the following four three-digit SICs: 357 (computer and office equipment), 365 (household audio and video equipment and audio recordings), 367 (electronic components and accessories), and 386 (photographic equipment). Additionally, I included the computer software industry (SIC 7372 – prepackaged software and 7373 – integrated systems design), as firms in this industry are often both collaborators and competitors to the firms in the computer hardware and consumer electronics industry. From the population of 598 firms for which COMPUSTAT had available financial data, I selected firms based on the following criteria: total revenues > = $1 billion and number of employees > = 1,000. These criteria yielded a sample of 103 firms. I chose to sample large and publicly more prominent firms to reduce the concerns

of the so-called *newspaper bias* (Earl, Martin, McCarthy, & Soule, 2004). One of the main sources of data collection in this study is content analysis of published new articles, which sometimes can be susceptible to bias toward more prominent firms (see below for more detail about my content analysis approach).

It is possible, however, that some smaller companies are major competitors in these industries and draw substantial attention from the media, despite not reaching the criteria of at least 1,000 employees and at least $1 billion in sales. To identify these firms, I conducted an additional search for announcements of firms' competitive activities in nearly 8,000 newspapers and magazine articles available through *Factiva* (see below for more information). I searched for general news (i.e., media coverage) using the following key word criteria: company name in the headline, time period (1993 to 1999), and *Factiva* code (in = i3302) for the "computer and electronics" industry. The total number of news articles that were generated was used to rank all firms that did not satisfy the initial selection criteria (i.e., >1,000 employees and >$1,000 million sales). All firms with a news count greater than the news count of the lowest ranked firm in my initial sample were added back to the sample. This procedure yielded an additional 22 firms. The final sample included 125 major competitors in the computer (hardware and software) and electronics industries (because of missing data, this number varied in the regression analysis over time). The distribution of firms by 3-digit SICs are as follows: 47 firms in SIC 357 (computer and office equipment), 54 firms in SIC 367 (electronic components and accessories), 16 firms in SIC 737 (prepackaged software and integrated systems design), 4 firms in SIC 386 (photographic equipment) and 4 firms in SIC 365 (audio and video equipment).

Alliance Network: Data and Measures

Data

I used the SDC database (a product of Thomson Financial) as a main source for collecting alliance data. I used "Joint Ventures/Strategic Alliances" section of SDC database to access data on newly formed alliances. Compared with other similar data sources (e.g., MERIT-CATI, CORE, RECAP, or Bioscan), the SDC database is the most

comprehensive. It includes the widest range of industries and sectors, alliances with both public and private firms, and an extensive searchability across a large number of items coded with high accuracy (e.g., current status of the alliance, date of announcement and termination of the alliance, equity vs. non-equity alliances, nation, SIC code of partners, type of alliance across different business functions, parent company identification number - CUSIP) (Schilling, 2009). I searched alliances for each firm using its unique CUSIP number. The CUSIP numbers are unique for each firm and allow for reliable merging of the data across all three databases used in this study: COMPUSTAT, NBER Patent Citations Database, and SDC Joint Ventures and Strategic Alliances. To adequately compute my network measures (e.g., network density) I collected *complete network data,* including the alliances formed both by my sample firms and by the partners of my sample firms. More specifically, I first searched for all alliances established by the 125 firms in my sample (by CUSIP number) between 1990 and 2003. This search identified 4,561 alliances among 2,502 unique firms. To construct a full network, I then searched for alliances that these 2,502 firms have formed over the same period. This search generated 36,766 alliances. Table 18 in the appendix reports detailed summary statistics on the alliances.

I created matrixes for each year. These matrixes were of different sizes for each year. The number of unique firms varied from a minimum of 1,806 in 1990 to a maximum of 3,934 in 1995. The SDC database provides data for alliance termination date for many of the alliances. I used these data to remove the alliance ties in the year when the alliance was dissolved. However, several researchers have suggested that alliance termination data are not as reliable (or reported) as alliance formation data, which can cause overrepresentation of the alliances for some firms (e.g., Gulati, 1995). To reduce these concerns, I followed the prior research and used "moving-window" approach. The prior research has used three- or five-year moving windows (e.g., Stuart, 2000; Lavie, 2007). I chose the more conservative three-year moving window (i.e., I considered only the alliances formed in the past three years).

Because matrixes were sized differently in each year (i.e., a different number of firms appeared in the network in each year), I used the "time stack" function available in UCINET VI (Borgatti, Everett, & Freeman, 2002) to generate even matrixes for each

subsequent three-year period (including all firms that had established alliances in a given three-year period). Then, I added the matrixes at time t-1 and t-2 to the matrix of time t. For example, the alliance matrix in year 1999 was formed by adding the matrixes for years 1997, 1998, and 1999; similarly, the alliance matrix in year 1998 was the sum of the matrixes in years 1996, 1997, and 1998. The number of unique firms in each of the three-year stacked matrixes varied from 5,156 to 8,307 firms. The network structure measures for each firm were computed from each three-year matrix.[2]

Measures

Structural holes

I measured structural holes using Freeman's (1979) betweenness centrality index, which can be formulated as follows:

$$b_k = \sum_{i,j} \frac{g_{ikj}}{g_{ij}}$$

,where g_{ij} is the number of shortest paths from node i to node j, and g_{ijk} is the number of times those paths pass through k. I used UCINET VI (Borgatti et al., 2002) to compute the normalized betweenness centrality score (normalized score is computed as betweenness centrality score divided by the maximum betweenness centrality score) for each of the focal firms in the sample. Betweenness centrality ranged from a minimum of 0 to a maximum of 1.

Betweenness centrality indicates the extent to which a given actor "lies" between many other points in the network. I chose the measure of betweenness centrality over Burt's (1992) measure of constraint (whose inverse is used frequently as a measure of structural holes) because betweenness centrality takes into account both *local* structural holes (i.e., whether an actor's direct partners are disconnected) and *global* structural holes (whether an actor's structural holes span two disconnected clusters of firms). Figure 9 illustrates the distinction between betweenness centrality and network constraint. Table 1 below shows the scores of betweenness centrality and the inverse of network constraint

[2] Because licensing agreements may not provide a substantial flow of resources between firms, I also computed all network measures excluding these types of alliances. For a robustness check, I ran all models using non-licensing matrixes. The results were equivalent to those using all types of alliances.

(local number of structural holes) for actors: 21, 20, 1, 4, and 12. Actor 21 has the greatest score on betweenness centrality (135), but the lowest score on the inverse of network constraint (.59). This is because actor 21 spans only 3 structural holes, but these structural holes separate distant network clusters. Thus, the structural position of actor 21 provides the greatest potential to access diverse and unique resources from distant network clusters, although it does not broker between disconnected firms as much as do other actors. On the other hand, actors 20, 1, 4, and 12 span more structural holes, but these structural holes separate firms located within a single cluster of firms. This indicates that the inverse measure of constraint increases proportionally with the number of structural holes regardless of the "significance" of the structural hole within the network as a whole. For example, actor 4 is much more embedded in a network of interrelated firms than actor 21, and still has a higher inverse constraint score than actor 21. This suggests that betweenness centrality captures not only the extent to which a firm spans structural holes, but also the degree to which the structural hole separates clusters of firms.

One additional reason for using betweenness centrality is that both network density and constraint are ego network measures and are highly correlated (i.e., the more ties between an actor's partners the greater the constraint). Betweenness centrality, on the other hand, is based on the whole network. This provides greater confidence of the regression results as all relationships are tested on both ego network measures (network density) and global network measures (betweenness centrality). Note also that these two measures are, as expected, negatively correlated, although very low correlation exists between the two measures. This reduces the potential for multicollinearity problems in the regression analysis.

Table 1: Scores of Network Constraint and Betweenness Centrality

	Actors				
	21	20	1	4	12
Degree Centrality	5	5	5	5	5
Betweenness	135	112	112	42.83	42.83
Constraint (reversed)	0.59	0.80	0.80	0.62	0.62

Figure 9: Network Constraint versus Betweenness Centrality

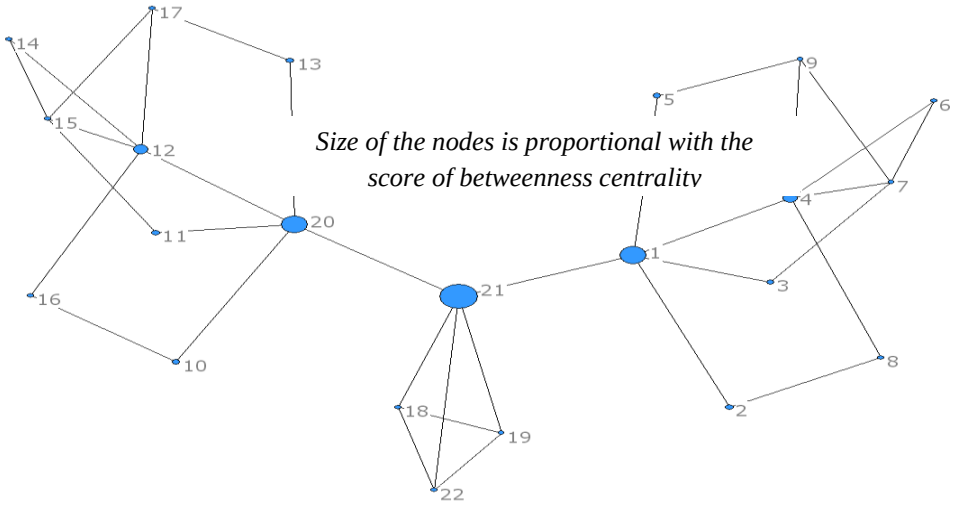
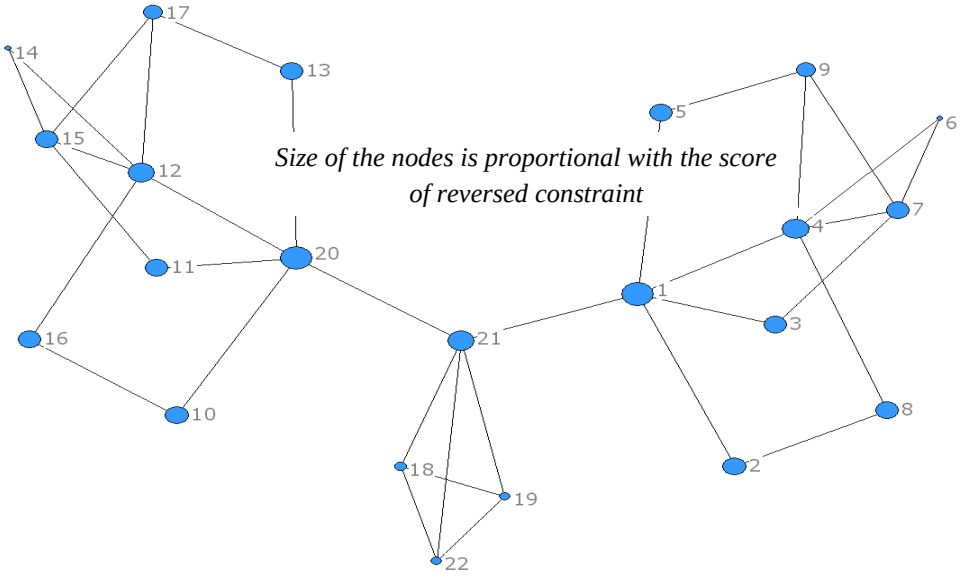


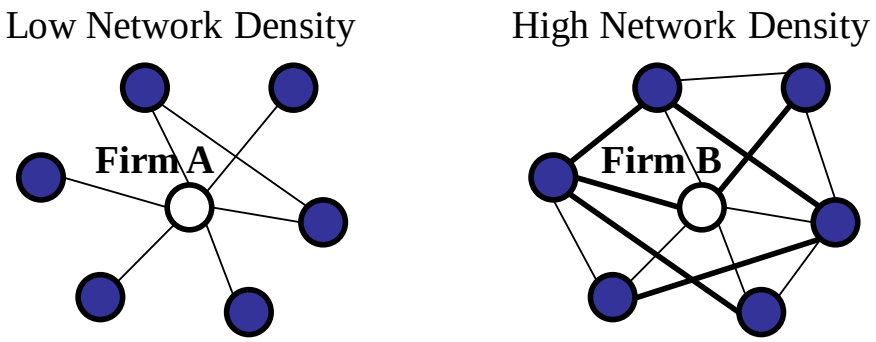
Figure 10: Network Constraint versus Betweenness Centrality



Network density

I also used UCINET to compute the firms' density scores. Network density is computed as the proportion of actual ties in the focal firm's network divided by the total number of possible ties in the firm's network, multiplied by 100. Following Rowley et al. (2000), I included both strong and weak ties to compute ego network density. This measure indicates the extent to which a firm's partners are interconnected (Scott, 1991; Wasserman & Faust, 1994). For example, Firm A in Figure 10 has a low network density and Firm B has a high degree of network density. The density score can vary from 0 (all partners are disconnected) to 100 (all partners are connected with one another).

Figure 11: Network Density



Proportion of strong ties

Strong ties refer to equity-based alliances, whereas weak ties are called non-equity alliances. The proportion of strong ties was computed as the ratio of the number of strong ties to the total number of ties in the focal firm's alliance portfolio.

Advantage-enhancing Strategic Tendencies: Data and Measures

Data

Advantage-enhancing strategic tendencies refer to the firm's tendency to aggressively introduce competitive actions that protect or enhance the competitive position of its existing products and services. Competitive action is defined as any

externally directed, specific, and observable competitive move initiated by the firm to enhance the firm's competitive position (Ferrier et al, 1999; Smith, Grimm, Gannon, & Chen, 1991). The data collection method used in this study was structured content analysis (Jauch, Osborn, & Martin, 1980). Content analysis is a technique for reducing a text into manageable content categories, which are meaningful units of information that can be analyzed and interpreted. This technique enables a researcher to generate a unit-by-variable matrix suitable for quantitatively testing hypotheses (Denzin & Lincoln, 2000). Following the research in competitive dynamics, I used content analysis to identify publically announced competitive moves of firms. The primary source of data for measuring firms' advantage-enhancing tendencies was *Factiva*, an electronic online data base. *Factiva* is one of the most comprehensive databases for business news and information covering more than 2,100 newspapers (including the *Wall Street Journal*, the *Financial Times*), 3,500 magazines (e.g., the *Economist* and *Computerworld*), 500 newswires (including Dow Jones, Reuters, and the Associated Press), transcripts from 280 media programs (e.g., BBC, CNN, NBC, ABC, Fox) and 12,000 of the world's top news and business Web sites. *Factiva* is used extensively by firms such as Microsoft, Ford, Seiko Epson, De Beers and Ernst & Young for competitive intelligence and knowledge management purposes (www.factiva.com). *Factiva* provides full articles in electronic form, which enhances the researchers' ability to reliably code the competitive activity of firms. In addition, because of its global scope, the use of *Factiva* as a news source provides greater confidence that the published news articles are not biased toward covering only the competitive actions of the firms that predominantly sell in the North American market.

Measures

To identify advantage-enhancing competitive actions, I followed the coding procedure developed in previous research in competitive dynamics (e.g., Ferrier, Smith, & Grimm, 1999; Boyd & Bresser, 2008; Smith et al., 1991; Gnyawali & Madhavan, 2006). I first randomly selected five firms from each of the six industry segments (described in the sample selection section above). For each of these firms, I downloaded news articles using a general key word searching criteria available in *Factiva*: company

name (e.g., Sony/f30/ – the company name in the first 30 words of the article), year = 1999, and *Factiva*-specific industry code (in = i3302 – for computers and electronics industry). I then tried to identify inductively all possible advantage-enhancing actions these firms carried out in 1999. I focused on market-based and externally oriented actions that indicated a firm's attempt to enhance and improve its market position. After consulting with two experts with extensive prior experience in the consumer electronics and computer industries, I identified the following four advantage-enhancing competitive actions: *marketing* (advertising and promotions), *improvements* (product improvements and new versions of an existing product), *price cuts* (price cuts and sales incentives), and *market expansions* (new capacity, new distribution channels, expansion of dealership network, and winning of new supply contracts).[3] Table 2 below shows examples of the news announcements for each action category.

I developed key word searching criteria using a combination of *Factiva*'s intelligent indexing and Boolean search operators. Table 21 in the appendix shows the key-word criteria used in *Factiva* search engine to retrieve relevant articles. I also provide more detail about the process of developing key word queries. Using these queries, the search generated 42,481 news articles. The articles were exported into an Excel spreadsheet. The data were carefully screened for duplicates and irrelevant news (e.g., news about stock prices, analyst commentaries, legal actions). Only the earliest news announcement of each action was retained. After cleaning and coding all articles, I identified 11,075 competitive actions initiated by the 125 firms between 01/01/1993 and 12/31/1999. To estimate the reliability of the coding, two coders independently coded a randomly selected subsample of 1% of the total number of news items (110 news articles). To estimate inter-rater reliability of the coding process, I used Perreault and Leigh's (1989) index, which is formulated as follows:

$$Ir=\{[(Fo/N) - (1/k)][k/(k-1)]\}^{.5}.$$

where, *Fo* is number of correct choices (agreement), *N* is total number of choices, and *k* is number of action categories. The estimated interrater reliability was .85, which exceeds the convention of 0.70 (Denzin & Lincoln, 2000). On average, firms introduced about 3.3

[3] New products are excluded from this list and are used exclusively for measuring proactiveness (see below).

marketing actions (range from 0 to 86), 7.7 improvements (min 0 to max 153), 1.1 price cuts (min 0 to max 32), and 1.84 market expansions (min 0 to max 35). The average number of competitive actions per firm/year (i.e., the average advantage-enhancing activity) was 19 (min 0 to max 250). The confirmatory factor analysis (discussed below) provided evidence for treating advantage-enhancing tendency as a distinctive construct. The estimated factor scores were used in the regression analysis.

Table 2: Selected News Reports on Advantage-enhancing Actions

Product Improvements	Dec. 10, 1997 SUNNYVALE, Calif., (Reuters) - Advanced Micro Devices Inc. Wednesday unveiled an **upgrade to** its flash memory chip family which will extend battery life in hand-held portable devices such as cellular telephones and pagers.
Product Improvements	Feb. 28, 1995. PRINCETON, N.J.--(BUSINESS WIRE)-- --Dataram Corp., a leading developer, manufacturer, and marketer of memory and storage products, today announced the immediate availability of **memory upgrades** for Digitals' AlphaServer 1000 4/200. Dataram's DR70 memory upgrade is available in 16, 32, 64, and 128 MB capacities.
New Product Version	1/16/1998 Tewksbury, Massachusetts based Avid Technology Inc has unveiled **an upgraded version** of its video production system Avid Xpress version 2.0 with enhanced graphics, titling and audio features. The system will begin shipping next month in four new configurations with prices beginning at $9,995.
New Product Version	6/12/1998 -Oracle Corp has **released Version 3.0** of its Video Server product, **boasting numerous enhancements** and new features to the software that was first introduced in 1993 for interactive TV video-on-demand. Video Server 3.0 is designed to, along with Oracle8 database server, offer the central components for interactive applications.
Price cuts	4/17/1995-CUPERTINO, Calif. (Reuter) - Apple Computer Inc. said Monday it was **cutting prices** on its entry-level PowerBook 150 notebook computers by 27%. Under the new pricing, the PowerBook 150 with 4 megabytes RAM and a 120 megabyte hard drive will cost $1,069, down from $1,469 previously.
Price cuts	2/13/1997-Bracknell-based Dell Computer **has slashed up to 16% off the price** of its Optiplex business desktop computers in a bid to put pressure on its main rivals Compaq and Gateway.
Market expansion:	1/14/1999-Apple Computer, Inc. **has expanded its online store** into France, Germany, Italy, Spain, Holland and Belgium, following the launch of the UK store last May. European customers can now take advantage of Apple's build-to-order capabilities for G3 systems.
Market Expansion:	11/30/1998-MILPITAS, CALIF.--Solectron has **purchased 40 acres** of land in Timisoara, Romania and has started **building a new manufacturing campus**. The move, the firm said, brings to Europe an expanded, full-service, high-volume, low-cost manufacturing hub for Solectron's growing regional customer base.
Marketing: Promotion	May 8, 1995--SANTA CLARA, Calif. – (BUSINESS WIRE) – Intel Corporation today announced it is **donating $1 million to Smart Valley**, Inc. to support the Smart Schools Project. The donation will include cash, expertise, and equipment such as Intel's ProShare Video Systems and Pentium Processor Systems.
Marketing: Advertising	8/17/1995-SEATTLE, Aug 17 (Reuter) - Microsoft Corp. has bought rights to use the Rolling Stones song "Start Me Up" as the theme to **its advertising campaign** for the new Windows 95 operating system, a spokeswoman for the software giant said Thursday.
Marketing: Advertising	April 26 ,1996-ROCHESTER, N.Y., (Reuter) - Eastman Kodak Co said Friday it **has introduced a new television advertising campaign** to strengthen its brand this week under the theme "Take Pictures."

Advantage-creating Strategic Tendencies: Data and Measures

An advantage-creating strategic tendency is defined as a firm's tendency to frequently create new competitive advantages by discovering radically new technologies (i.e., innovativeness) and introducing new products, services, or technologies on the market ahead of competitors (i.e., proactiveness). Thus, advantage-creating strategy comprises two dimensions: proactiveness and innovativeness. In an operational sense, I consider these two dimensions as formative rather than reflective. Formative measures are viewed as *causes* of the latent construct, whereas reflective measures are viewed as reflections (or manifestations) of the latent construct, and thus they are *caused by* the latent factor (Diamantopoulos & Siguaw, 2006; Edwards & Bagozzi, 2000). The advantage-creating tendency is behavioral, higher-order construct that is *caused* by firms' innovative and proactive activity. This implies that firms can exhibit advantage-creating tendency by pursuing different degrees of innovative and proactive activity. Thus, a firm may create new competitive advantages either by discovering new technologies or by creating new product categories or both. Therefore, although these two dimensions can be related, they can also vary independently (Lumpkin & Dess, 1996). Previous research suggests a positive relationship between innovativenses and proactiveness (e.g., Comanor & Scherer, 1969; Hagadoorn & Clodt, 2003) and that this relationship may be sequential (Lumpkin & Dess, 2001). For example, high innovativeness may increase the firm's potential to introduce new products. However, the firm can also introduce new products (proactively) without possessing radically new technology. I, therefore, consider proactiveness and innovativeness related but independent dimensions (i.e., they can differentially explain other outcome variables) that capture a distinctive portion of the advantage-creating tendency construct.

Proactiveness: Data and Measures

I also used the content analysis approach described above to measure proactiveness. The announcements of new product introductions were identified using the criteria shown in Table 21 in the appendix (also used for identifying product versions and improvements). I identified 3,488 news articles with announcements of new products and

versions. Then, I read each article to identify key words that indicate the firms' proactiveness. To capture the proactive tendency of firms, I searched for key words in the news reports that indicated the "pioneering" nature of the new product. Some examples of the identified key words of proactive tendency are "first company to offer," "industry first," "industry's only," "world's first," "set industry standards," "revolutionary," "breakthrough," "pioneering," "the only device on the market," and "new world standard" (the full list of identified phrases is shown in Table 19 in the Appendix). Using these words and phrases as a guideline, two raters independently coded all 3,488 news articles with new-product announcements. The two coders identified 587 announcements of new products that indicated the firm's proactiveness. Table 3 below shows examples of news reports that indicated the "pioneering" nature of the products. Firms' proactiveness was measured as the number of pioneering products that a firm initiated in a given year. To capture the firm's tendency to be proactive, I averaged this count over the past three years for each firm. On average, firms initiated about 0.73 pioneering products a year, ranging from minimum 0 to maximum 7.

Table 3: Selected News Reports on "Proactive" New Products

Proactiveness	3/3/1995 PALO ALTO, Calif. (Reuter) - Hewlett-Packard Co., aiming to exploit the rapid growth of the mobile computing market, will announce Monday **the industry's first** wireless printers. The printers use infrared technology that allows them to take orders from laptops and other mobile computers.
Proactiveness	Tokyo, Nov. 6, 1996- (Jiji Press)-Fujitsu Ltd. said Wednesday it will launch the **world's first** personal computer equipped with a DVD-ROM drive, a computer peripheral device that reads information on digital videodiscs, in Japan in mid-December. The FMV Deskpower T20D, powered by Intel Corp's 200-megahertz Pentium microprocessor, will allow users to enjoy high-quality video on DVDs, a new large-scale digital storage. They can also use CD-ROMs and DVD-ROMs as well as music CDs.
Proactiveness	3/3/1995 PALO ALTO, Calif. (Reuter) - Hewlett-Packard Co., aiming to exploit the rapid growth of the mobile computing market, will announce Monday **the industry's first** wireless printers. The printers use infrared technology that allows them to take orders from laptops and other mobile computers.
Proactiveness	Tokyo, Nov. 6, 1996- (Jiji Press)-Fujitsu Ltd. said Wednesday it will launch the **world's first** personal computer equipped with a DVD-ROM drive, a computer peripheral device that reads information on digital videodiscs, in Japan in mid-December. The FMV Deskpower T20D, powered by Intel Corp's 200-megahertz Pentium microprocessor, will allow users to enjoy high-quality video on DVDs, a new large-scale digital storage. They can also use CD-ROMs and DVD-ROMs as well as music CDs.
Proactiveness	Oct 1, 1999. Adobe launches "revolutionary" design software. KUALA LUMPUR: Adobe Systems Inc has launched the Adobe InDesign, touted to be **a revolutionary product** designed to change the way professionals view layout applications.
Proactiveness	SANTA CLARA, Calif.–(BUSINESS WIRE)–Oct. 15, 1997–3Com Corp. (NASDAQ:COMS), a leader in providing networking solutions for the retail industry, today launched its Point of Sale (POS) Partners Program to deliver the **industry's first** complete enterprise-wide, standards-based networked POS solution. The **first-of-its-kind** in the networking industry, the 3Com POS Partners Program brings a new level of functionality, performance, and investment protection to the point of sale.
Proactiveness	SUNNYVALE, Calif.–(BUSINESS WIRE)–Nov. 4, 1998–SanDisk Corporation (Nasdaq:SNDK) today introduced the **world's first** solid-state flash memory card in the new CompactFlash Type II form factor approved by the CompactFlash Association (CFA) last March. The new card can store 160 megabytes (MB) of data, audio and images. SanDisk, inventor of CompactFlash(TM) (CF(TM)), is a founding member and technical chairman of the CFA.
Proactiveness	SAN JOSE, Calif.–(BUSINESS WIRE)–May 11, 1999–Sony Tuesday announced a **breakthrough in tape recording density**, by demonstrating the ability to store one billion bits of data on a square inch of tape. This achievement was made possible by incorporating the first use of magneto-resistive (MR) heads in a helical scan tape mechanism. This achievement demonstrates the viability of Sony's next generation of AIT (AIT-3), which will provide 100GB of uncompressed data in a compact media cartridge and 3.5 inch drive form factor.

To provide greater confidence in the content validity of the news reports, I also searched for at least two additional independent news sources for each announcement of a "proactive" new product. To illustrate, Table 4 below shows several news reports from various newspapers, magazines and newswires that announced the introduction of the

Hewlett-Packard's new wireless printer. The reliability of the proactive tendency is likely to be higher when several independent media sources clearly indicate that the new product is the first of its kind on the market.

Table 4: Example of Multiple News Sources

Date	News source	Short Description
Oct 9, 1995	InformationWeek	Hewlett-Packard is rolling out the market's first mobile wireless printer. The five-pound DeskJet 340 relies on the increasingly popular infrared technology for its wireless capabilities. An infrared adapter that plugs into the printer's parallel port enables wireless printing from up to three feet away…
Sep 19, 1995	M2 Presswire	HEWLETT-PACKARD: HP announces industry's first mobile printer that supports wireless printing…
Mar 6, 1995	ComputerWorld	HP sparks interest in infrared New LaserJets will become wireless…Red hot market Infrared ``will be hot," predicted Randal Giusto, an analyst at BIS Strategic Decisions in Norwell…

To test the reliability of the coding, I asked two PhD students in Business Administration to code 1% (35) randomly selected articles from the 3,488 news articles with new product announcements. The students were asked to identify new product announcements that indicate the firm's proactive tendency. The Perreault and Leigh's (1989) interrater reliability index was .78.

Innovativeness: Data and measures

I used patent and patent citations data to approximate a firm's tendency to innovate. The patent data were obtained from NBER Patent Citations Database. This database provides detailed information on patents applied for and granted by the U.S. Patent and Trademark Office (USPTO) over the period 1963 to 2002. This database includes both the application date (the date on which the inventor filed for the patent) and the grant date (the date when the patent was actually granted). Because the timing of the application date is closer to the date of the actual discovery of the invention, I used the

application date to identify the number of patents that each firm was involved with in a given year[4] (Hall, Jaffe, & Trajtenberg, 2001).

NBER database also includes information about citations *received* and citations *made* for each patent. *Citations made* refer to the number of previous patents that are cited in a given patent's application document, whereas *citations received* refer to the number of subsequent patents that have cited a given patent. Citing any prior knowledge is a legal duty and is critical information for clearly specifying the patent's property rights (Hall, Jaffe, & Trajtenberg, 2001). Research has shown that high patent citation counts are important indicators of the path-breaking nature of an invention. An invention that is cited by many subsequent patents is likely to provide the basis for many future technological discoveries (Ahuja & Lampert, 2001; Trajtenberg, 1990). I used citations *received* to approximate the impact or "radicality" of each patent (see below for more detail).

Previous research using patent citations data have highlighted several issues that need to be adequately addressed. First, not all patents have the same citation "window." More recent patents have shorter time periods in which to be cited. To avoid this problem, all patents were compared only with the patents in the same year. In addition, as recommended by Hall et al. (2001), I use time fixed effects to eliminate any systematic time-related effects that might affect the citation rate over time. Second, there is a lag between the invention time and the time when the patent is actually granted by USPTO. To deal with this problem, I followed Hall et al.'s (2001) recommendation to use the *application date* of the granted patents, because the application date is closest to the actual timing of the invention. Finally, following prior research, I used U.S. Patent and Trade Office data for all firms including non-U.S. firms. This approach reduces the inconsistencies and incompatibilities between the patent systems across different nations (Ahuja & Lampert, 2001). In addition, because the United States is the largest technology

[4] "Inventors have a strong incentive to apply for a patent as soon as possible following the completion of the innovation, whereas the grant date depends upon the review process at the Patent Office, which takes on average about 2 years, with significant variance…Indeed, the mode of operation of the patent Office underwent significant changes in the past decades, thereby introducing a great deal of randomness (that have noting to do with the actual timing of the inventions (into any patent time series dated by grant year" (Hall, Jaffe, & Trajtenberg, 2001: 10)

market, most of the major non-U.S. headquartered firms submit their patent applications in the United States (Stuart & Podolny, 1996).

I measured firms' innovativeness using three items: innovation intensity, innovation radicality, and innovation generality. The first item captures the total quantity of innovative activity, whereas the other two items capture the technological significance of the inventions (Morris & Sexton, 1996).

Innovation intensity

Innovation intensity is simply a count of the total number of patents a firm has applied for in a given year. Although this measure does not directly capture the radicality of the inventions, I included this measure for two reasons. First, entrepreneurship research suggests that firms' entrepreneurial activity can be more closely depicted using measures of both the amount and the magnitude of innovativeness (Moris & Sexton, 1996). Second, it is possible that a firm has strong entrepreneurial (advantage-creating) tendency, but in a given period has not discovered radically new technology. Because I use patent activity of firms to depict firms' innovative strategy (tendency), a more reliable measurement would include both firms' entrepreneurial intent and entrepreneurial outcome. To approximate the innovative tendency of firms, I averaged the number of patents for each firm over the past three years. Thus, innovation intensity refers to the average number of patents that a firm has applied for (and was subsequently granted) in the past three years. On average, firms applied for 43 patents per year.

Innovation radicality

This item captures the tendency of firms to discover radical (breakthrough) innovations. I used "citations received" to approximate the impact of a given patent on the subsequent innovations in the industry. More specifically, when patent B cites patent A, it means that patent B builds on the knowledge previously created by patent A. The more subsequent patents that cite patent A, the greater the technological significance of patent A (Hall, Jaffe, & Trajtenberg, 2001).

I first ranked all patents in a given year by the number of "citations received." Then, I identified the top 1% most cited patents in the industry for that year. Innovation radicality is the total number of patents that each firm has in the top 1% most cited patents in the industry in a given year (Ahuja & Lampert, 2001, refer to these patents as breakthrough patents). To approximate the firms' strategic *tendency* to generate radical innovation, I averaged this measure over the past three years. On average firms issued 0.43 patents per year in the top 1% most cited patents in the industry (min 0 – max 17).

Innovation generality

Innovation generality refers to the tendency of firms to discover innovations that have broad impact on subsequent technologies in wide range of industries. I measured innovation generality as the firm's number of patents in the top 1% most cited patents across different technological domains in a given year. Similar to innovation radicality measure, I first ranked all patents in the industry in a given year. This time, however, the ranking was based on each patent's generality score. The generality score is computed using Blau's (1977) heterogeneity index:

$$\text{Generality}_i = 1-\sum p_{ij}^2$$

where p_{ij} is the proportion of citations received by patent i in technological category j.[5] "High generality score suggests that the patent presumably had a widespread impact, in that it influenced subsequent innovations in a variety of fields" (Hall et al., 2001:21).

Innovation generality for each firm/year was computed as the number of patents in the top 1% most "general" patents in the industry in a given year. I averaged this number over the past three years to approximate a firm's *tendency* to generate innovations with a broad impact across wide range of industries. On average, firms issued

[5] I used two patent classification systems: (1) USPTO classification system based on 428 technological categories (j = 428) and (2) 36 higher-order technological categories (j = 36) developed by Hall et al. (2001). The two measures were highly correlated and the results were similar for both measures. The innovation generality item based on 36 technological categories was used in the factor analysis.

0.42 patents in the top 1% most cited patents across different technological categories (min 0 – max 11).

Performance

I measured firms' financial performance using the two most frequently used measures of firm and industry profitability: return on equity (ROE - net income divided by total equity) and return on assets (ROA - net income divided by total assets) (Schmalensee, 1989). To estimate the long-term impact of the network structure and competitive strategy, I used averages of these measures over the next three years. This approach reduces short-run fluctuations of firms' profitability and is more likely to capture the full effect of previous entrepreneurial and collaborative activity that may have both immediate and lagged effects. Both one-year and three-year averages of ROA and ROE produce similar pattern of regression results. The regression results in all tables are based on three-year average ROA.

Control Variables

Firm size was measured using the accounting value of firms' total assets as proxy. Firms with larger stocks of assets may systematically differ from smaller firms in their strategic behavior, their propensity to form alliances, and their performance.

Performance was approximated using return on assets. Past performance can affect a firm's propensity to engage in innovative activity and undertake major investment activities. Organizational learning theory suggests that firms adjust their aspiration targets according to their present and past performance (Cyert & March, 1963; Nelson & Winter, 1982). Therefore, future performance is also a function of the firm's prior performance (e.g., a firm that is underperforming may try to reduce the operational costs and thus increase its financial performance in the next years).

Financial slack was measured using the quick ratio. I computed the quick ratio as a firm's current assets minus its current liabilities divided by its current liabilities. The availability of slack resources can affect the decision to enter new alliances and to invest in and introduce new products and services.

Betweenness centrality and Network Density were also included as control variables because previous research has found that past networking behavior can affect the future likelihood to form alliances (Gulati, 1999) by facilitating or constraining the set of available partnering opportunities (Ahuja, 2000b).

Market Share. A firm's profitability can be affected by its monopolistic position in the market. I approximated this measure by the firm's market share. I computed *market share* as total sales divided by total industry sales in the firm's primary three-digit SIC code.

Financial Leverage. I measured financial leverage as the firm's debt-to-equity ratio (total long-term debt divided by total shareholder equity). This measure controls for the firm's propensity to use debt to finance its major capital investments, which can affect the firm's performance in the next period.

I also included *firm and time fixed effects*. Firm fixed effects controlled for all firm-specific factors that were invariant over time, such as industry segment, corporate level diversification, firms' reputation, firms' country of origin, top management team (TMT) experience and skills or other unobserved and idiosyncratic characteristics of firms. Time fixed effects controlled for time-related exogenous factors such as changes in tax policy, technological changes, financial crises, or wars and other conflicts. In addition, time fixed effects absorb the effect of variables with constant change such as firm age and TMT tenure.

Construct Validity

To establish the convergent and discriminant validity of advantage-creating and advantage-enhancing tendencies, I applied confirmatory factor analysis. I chose common factor analysis over principal component analysis (PCA) for two reasons: (1) the constructs above and the measures are theoretically driven, which renders confirmatory factor analysis more appropriate than the exploratory nature of PCA, and (2) my focus is predominantly on the common or shared variance (or underlying structure – latent constructs) and thus the unique variance or the error variance (which are both considered in PCA) is not of primary interest in deriving the underlying latent factors.

Table 5 shows the results of the factor analysis. Only the eigenvalues of the first three factors are greater than 1. Figure 11 plots Eigen values against the number of factors. This scree test criterion shows that the eigenvalues drop sharply after the third factor. For more accurate interpretation of the factors, I performed factor rotation using an oblique rotational procedure. Oblique rotation allows correlated factors in contrast to orthogonal rotation, which assumes that factors are not correlated. The oblique procedure is more appropriate for this study because value-creating tendencies and value-enhancing tendencies are likely to be closely related, although firms may differ in their emphasis on each tendency. I used the PROMAX rotation method available in STATA to perform the oblique factor rotation.

Table 5: Eigenvalues

Factor	Eigenvalue	Difference	Proportion
Factor1	4.88005	2.24999	0.5461
Factor2	2.63006	1.20314	0.2943
Factor3	1.42692	1.33179	0.1597
Factor4	0.09513	0.04459	0.0106
Factor5	0.05054	0.06106	0.0057

Figure 12: Scree Plot

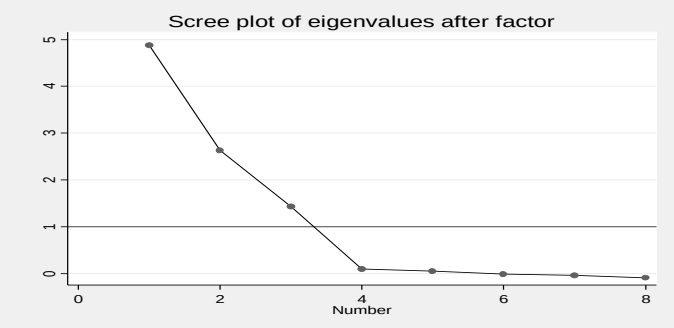


Table 6 also shows the factor loadings for all items. The number of marketing actions, product improvements, price reductions, and market expansions represent the construct of advantage-enhancing tendency (AET). The number of patents, the radicality of those patents, and the generality of those patents are all measures of innovativeness

(the first dimension of advantage-creating tendency – ACT). The factor analysis results indicated that proactiveness is a distinctive dimension of advantage-creating tendency (ACT). All factor loadings are statistically significant at the .001 level.

Table 6: Factor Loadings

Variable	Factor1	Factor2	Factor3
Advertising (AET)	**0.757**	-0.0244	0.1367
Improvements/Versions (AET)	**0.7699**	-0.0334	0.2776
Pricing (AET)	**0.8491**	0.1409	-0.2098
Market expansions (AET)	**0.7029**	-0.0005	0.1044
Patent radicality (Innovativeness - ACT)	0.1678	**0.5872**	-0.0604
Patent intensity (Innovativeness - ACT)	-0.0378	**0.9856**	0.0241
Patent generality (Innovativeness - ACT)	-0.0363	**0.9524**	0.0688
Proactiveness (ACT)	0.2614	0.0445	**0.5977**

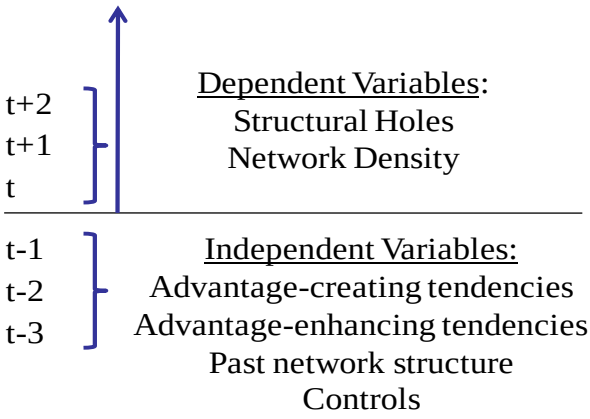
To provide additional support for convergent validity, I also computed variance extracted. Variance extracted (VE) refers to the variance explained by the factor and is computed as the average of the squared standardized factors loadings. VE for factor 1 is .5935 and for factor 2 is .7395, which are both greater than the rule of .5. I also conducted two tests for providing evidence for discriminant validity. A comparison of three-factor solution, with two and one factor models, showed that the model fit of three factor structure is significantly better than either the one- or two-factor model. Second, variance extracted for both constructs is greater than the square of the correlation estimates between the three constructs (.15, .09, and .38). This implies that each factor explains its items better than it explains another construct.

Research Design

This study's research design is shown in Figure 12. The independent variables and control variables are computed as average values over the past three years (t-1, t-2, and t-3) and the dependent variables are measured over the next three years (t, t+1, and t+2). To illustrate, I use network structure as the dependent variable, which is measured on the basis of the alliance formed in the next three years. The measures of the

independent variables (including prior network position) and control variables are averaged over the past three years.

Figure 13: Research Design



Model Specification

I considered several potential issues that may affect the interpretation of the empirical findings. First, I addressed endogeneity issues that arise from the effect of unobservable factors that may affect the observed relationships. According to resource-based theory of the firm, firms gain sustainable competitive advantage because they possess unique resources that are inimitable and non-substitutable by rivals. As such, these strategic resources are often unobservable and difficult to identify, or observable but difficult to adequately measure. This can cause serious statistical problems because firms' unique resources and capabilities can affect both the independent and dependent variables. Not controlling for this endogeneity can bias the regression estimates. Assuming that these *firm-specific* factors (e.g., unique resources) are relatively stable over time, fixed effects (FE) or random effects (RE) panel data models can adequately account for this unobserved heterogeneity. Fixed effects model uses time-demeaned data (subtracting each variable from its average value over time), which eliminates any invariant unobserved effect from the model. Random effects model uses quasi-demeaned data by subtracting only a fraction of each variable from the time average. Both models have some advantages and disadvantages. Random effects model can account for unobserved effects that change over time. It also allows for examining the effect of

invariant independent variables. In addition, a random effects model is preferable to a fixed effects model because fixed effects lead to a large loss of degrees of freedom, especially in large cross-sectional panels. Finally, random effects produce more efficient estimates for samples with large *N* (number of firms) and small *T* (number of time periods). However, the random effects model must satisfy one additional assumption: the unobserved individual effects should be uncorrelated with the other independent variables $Cov(x_{itj}, a_i) = 0$, where x_{itj} denotes all independent variables and a_i is the unobserved effect. Violation of this assumption produces inconsistent estimates. I used Hausman's (1978) specification test to detect violation of this assumption. When this assumption was not violated I used random effects model (see below).

Furthermore, the relationship between a firm's strategy and network formation or its strategy and performance can also be affected by *time-specific* factors, such as abrupt changes in oil prices, government interventions, or economic downturn and recession. One way to control for these time-related factors is to include dummy variables for each time period. One last consideration in selecting an appropriate model and estimation technique was the use of lagged dependent variables. Because both firm performance and the firm's position in the network structure can be affected by the value of these variables in the previous period, it is important to control for this possibility. Inclusion of lagged values of the dependent variables was also important for providing more confidence for the direction of causality. Given all these considerations, all models in this dissertation account for both firm- and time-specific effects and include lagged dependent variables.

Finally, I computed variance inflation factors (VIFs) to test for any possible multicollinearity problem. Multicollinearity can be especially present in the models that use fixed effects and interaction terms. The VIFs for all variables in the analysis (including the interaction terms) was lower than 3 (which is below the critical value of 10), ruling out any potentially major multicollinearity problems.

Modeling performance

I applied a random effects model with time fixed effects to test the hypotheses predicting performance. One reason for selecting random effects over fixed effects model was that the Hausman test was insignificant (Chi2 = 3.37; prob>Chi2 = .91). A rejection

of the Hausman test means that the assumption that the unobservable effects are not correlated with the independent variables Cov(x_{itj}, a_i) = 0 is violated. Failure to reject the Hausman test implies that the estimates of RE and FE models are very similar. Another reason for selecting RE model is that the estimates of RE model are consistent and more efficient than those estimated by FE model for panels with a large *N* and small *T*. Given that the panel examined in this study has a large *N* (112 firms after listwise deletion) and small *T* (5 years), the random effects model was preferable. In addition, because I also control for the past values of the dependent variables (in this case firm's past performance), the presence of a lagged dependent variable is a source of serial correlation (i.e., the lagged dependent variable and the error term are correlated). Indeed, Wooldridge's test for autocorrelation in panel data showed the presence of serial correlation in all models. To correct for serial correlation, I used a random-effects model with an autoregressive error term—AR(1). The random effects model can be formulated as follows:

$$Yit = \acute{a}i + \ddot{a}Yit\text{-}1 + \hat{a}'Xit\text{-}1 + \mathring{a}it$$

where subscripts i and t represent firms (*i* = 1 to 8) and years (*t* = 1 to 5) respectively. $\beta' x_{it}$ is the coefficient (slope) of the independent variables that is assumed to be constant across firms. ε_{it} represents the two-way error component disturbances ($\varepsilon_{it}=\mu_i+\lambda_t+\nu_{it}$), where μ_i denotes the unobservable individual effect, λt denotes the time-specific effect and ν_{it} represents the remaining stochastic disturbance term (Baltagi, 2008). It is assumed that X_{it} is independent of μ_i, λ_t, and ν_{it} for all i and t, and that $\mu_i \sim$ IID $(0, \sigma_\mu^2)$, $\lambda_t \sim$ IID$(0, \sigma_\lambda^2)$; $\nu_{it} \sim$ IID $(0, \sigma_\nu^2)$ are independent of each other. I also included an autoregressive AR(1) parameter ρ with zero mean, homoskedastic and serially uncorrelated: $\varepsilon_{it} = \rho\varepsilon_{it-1} + z_{i,t}$ and $-1<\rho<1$. The coefficients are estimated using generalized least squares method (GLS).

Previous research suggests that firms adjust their competitive activity and aspiration targets as a function of their previous performance (Ferrier, MacFhionnlaoich, Smith, & Grimm, 2002; Cyert & March, 1963). In addition, including past values of dependent variables provides more confidence about the causality of the relationships between the IVs and DVs. Finally, in panel data with short *T* (time periods) and large *N* (number of firms), the coefficient of the lagged dependent variable may be biased in both

FE and RE models with AR(1). This is because the presence of a lagged dependent variable is correlated with the error term, which produces biased estimates (Baum, 2006). Hence, to deal with this problem, Arellano and Bond (1991) recommended a two-step approach: (1) following Anderson and Hsiao (1981), the model is first-differenced to remove the firm-specific effects (which eliminates any endogeneity because of the correlation between the unobserved *firm-specific effects* and the other independent variables), and (2) a generalized method of moments (GMM) procedure is used to produce consistent and efficient estimates of the parameters. In the first step, Arelano and Bond's (1991) approach takes the first difference to remove the constant term and any unobserved and invariant individual (firm) effect. Because this transformation does not eliminate the correlation between the change in the lagged dependent variable and the change in the error term, they proposed using the other lags (the second or third lags) as instruments for the dependent variable. These lagged values Δy_{it-2} and Δy_{it-3} are instruments that are correlated with Δy_{it-1} and uncorrelated with the error term (ε_{t-1}) (Baum, 2006). The Arellano and Bond (1991) GMM estimator assumes that the original disturbances are serially uncorrelated and that the differenced error is MA(1) with unit root (Baltagi, 2008).This procedure was developed further by Blundell and Bond (1998), who proposed the extended system of GMM estimator, which uses extra moment conditions. This approach produces unbiased and consistent estimates and, in the GMM context, the most efficient estimates. Hence, I also estimated the coefficients using this system GMM technique.

Modeling network structure

For network structure variables (network density and betweenness centrality), the Hausman test was statistically significant (Chi2 = 401; prob>Chi2 = .0000), rejecting the assumption that the unobserved effects are uncorrelated with independent variables. I, therefore, used the firm and time effects model (Greene, 2003), which can be formulated as follows:

$$Yit = \acute{a}i + \ddot{a}Yit\text{-}1 + \hat{a}'Xit\text{-}1 + \mathring{a}it$$

where subscripts i and t represent firms (i = 1 to 8) and years (t = 1 to 5) respectively. ε_{it} represents two-way error component disturbances ($\varepsilon_{it}=\mu_i+\lambda_t+\nu_{it}$), where μ_i denotes the

unobservable individual effect, λ_t denotes the time-specific effect and ν_{it} represents the remaining stochastic disturbance term (Baltagi, 2008). Here, μ_i and λ_t are assumed to be fixed parameters to be estimated and the remaining disturbances are stochastic with ν_{it}~ IID $(0, \sigma_\nu^2)$. X_{it} is assumed to be independent only from the ν_{it} for all *i* and *t*. Because I also controlled for the firm's previous network position, the inclusion of a lagged dependent variable can cause serial correlation. The Wooldridge test for autocorrelation available within STATA (Wooldridge, 2002) did not provide support to reject the null hypothesis (H0: no first-order autocorrelation) for all models. To correct for serial correlation, I used fixed effects model with a first order autoregressive disturbance term - AR (1), using Durbin–Watson estimator of rho (the autocorrelation coefficient).

I estimated Poisson regression coefficients for the network density variable because of the distribution of that variable. Many of the firms in my sample (almost 40%) had a zero score on network density. This is because there were many cases where a focal firm's partners had not formed alliances with one another within a three-year period. Hausman, Hall, and Grilliches (1984) suggested that panel data Poisson regression model might be a more appropriate model when the dependent variable is a count variable containing many zeros and non-negative integers. The Poisson panel regression can be formulated as follows:

$$\Pr\left(Y_{it} = \frac{y_{it}}{x_{it}}\right) = \frac{e^{-\lambda it}\ {\lambda_{it}}^{y_{it}}}{y_{it}!}$$

where $y_{it} = 0, 1, 2, \ldots$; *i* denoting firms, and *t* denoting time. Because the computed network density measure also included some non-integer values, I rounded the decimals to the closest integer. This transformation did not change the distribution of this variable as the correlation coefficient between transformed variables and the original ones was .99. As a robustness check on the regression results, I also report the estimated coefficients and standard errors using a panel data Poisson regression model with firm and time fixed effects. The coefficients of this model were estimated using a maximum likelihood algorithm.

CHAPTER VI: RESULTS

Summary Statistics and Correlation Matrix

Table 7 below shows the summary statistics and correlations among all variables. The correlation coefficients are bivariate and based on pooled data across all firms and years. Larger firms have greater market share, use more debt to finance their capital investments (financial leverage), have less slack resources, are more likely to be embedded in a sparse network structure, form more ties (strong/equity or weak/non-equity), and exhibit greater advantage-creating (proactivenes and innovativeness) and advantage-enhancing strategic tendencies than smaller firms. Firms' performance (ROA) is not related to firm size, but is positively related to their betweenness centrality, their number of weak (non-equity) ties, their advantage-creating tendencies (specifically, proactiveness), and their advantage-enhancing tendencies. Betweenness centrality is negatively related to the proportion of strong ties in the firm's alliance portfolio (i.e., a sparse network is associated with more weak/non-equity ties than strong/equity ties), and positively related to firm size, market share, performance (ROA), and both advantage-creating and advantage-enhancing tendencies. Network density, on the other hand, is positively related to the proportion of strong ties in the firms' alliance portfolio (at 10% level), but not related to advantage-creating and advantage-enhancing tendencies.

Table 7: Summary Statistics and Correlation Matrix

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Firm size (total assets)	4682.44	11917.82	1												
2 Market share	0.01	0.02	0.5174*	1											
3 Financial Leverage	0.28	1.16	0.0914*	0.0974*	1										
4 Financial Slack	2.10	1.85	-0.1350*	-0.1825*	-0.0748*	1									
5 Performance	0.04	0.11	0.0707	0.0717*	0.0409	0.0317	1								
6 Network Density	3.55	9.55	0.0245	-0.008	-0.0141	0.0517	0.0201	1							
7 Betweenness Centrality	0.11	0.09	0.5000*	0.3143*	0.027	-0.0507	0.1221*	-0.0429	1						
8 Strong ties to total ties	0.52	0.12	-0.0674	-0.0271	-0.0067	-0.0523	-0.1865*	0.1189	-0.2231*	1					
9 Strong ties	24.07	22.33	0.5797*	0.4082*	-0.0132	-0.0392	0.1321	-0.2041*	0.7749*	-0.1812*	1				
10 Weak ties	25.84	26.95	0.3672*	0.2768*	-0.0563	0.1208	0.1971*	-0.2062*	0.7640*	-0.3997*	0.8963*	1			
11 Advantage-creating tendency - Proactiveness	0.00	0.81	0.4837*	0.2411*	-0.0061	0.0194	0.0967*	-0.0195	0.4415*	-0.3079*	0.5955*	0.6667*	1		
12 Advantage-creating tendency - Innovativeness	0.00	0.98	0.5185*	0.1940*	0.0448	-0.0982*	0.0753	0.0162	0.4108*	-0.2390*	0.2156*	0.2093*	0.3464*	1	
13 Advantage-enhancing tendency	0.00	0.95	0.3799*	0.2022*	-0.0191	-0.0377	0.1219*	0.0616	0.5264*	-0.2382*	0.6449*	0.7187*	0.5217*	0.3949*	1

* significant at 5% level

N=415 to 545

Competitive Strategy and Firm Performance

Table 8 shows the GLS estimates with AR (1), and Table 9 shows the system GMM estimates. All models in Tables 8 and 9 account for time and firm-specific unobserved heterogeneity. Model 1 presents the coefficients for all control variables. The coefficients for past performance and market power are statistically significant. Firms with greater performance and a possibly monopolistic position in the previous period perform better in the next three years. The coefficients for year dummies are jointly significant (Chi2 (4) = 12.32; Prob>Chi2 = .0151) indicating influential macroeconomic factors affecting firms' performances.

Hypothesis 1

Hypothesis 1 predicts that high advantage-creating strategic tendencies (ACT) will have a positive effect on firm performance. Model 2 in Table 8 shows the coefficients of the two dimensions of ACT. Both proactiveness and innovativeness are positively related to performance. The coefficient for proactiveness is positive and statistically significant at the 5% level (b = .0199; p <.017) and the coefficient for innovativeness is statistically significant at the 10% level (b = .0086; p <.082). Table 9 (Model 2) shows the GMM estimates for proactiveness and innovativeness. The GMM estimates of the coefficients for proactiveness and innovativeness in Table 9 (Model 2) are also positive and statistically significant at the 10% level (b = .0268; p <.074 and b = .017; p <.064). Given that I use the more conservative two-tailed significance test (even though the direction of the effects is predicted), these results suggest some support for Hypothesis 1. Firms with higher advantage-creating strategic tendencies exhibit better performance than do other firms.

Hypothesis 2

Hypothesis 2 states that advantage-enhancing strategic tendencies (AET) will be positively related to firm performance. Model 3 in Table 8 shows the results for the relationship between advantage-enhancing tendencies and firm performance. The

coefficient for AET is positive and statistically significant at the 1% level (b = .0334; p <.003), which provides support for Hypothesis 2. The GMM estimates of the coefficient of AET in Table 9 (Model 2), are also positive and statistically significant at the 5% level (b = .053; p <.018). These findings provide support for Hypothesis 2. Firms with higher advantage-enhancing strategic tendencies exhibit better financial performance than do firms with lower level of advantage-enhancing strategic tendencies.

Post-hoc analysis

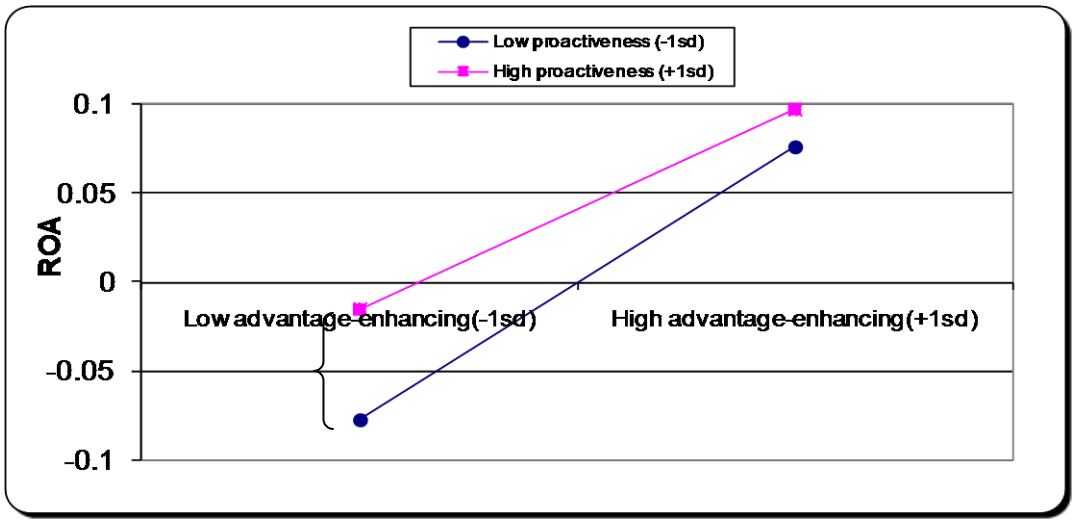
Model 4 in Tables 8 and 9 includes both AET and ACT (proactiveness and innovativeness) simultaneously. The coefficients for AET and one dimension of ACT (proactiveness) remain statistically significant at the 5 % level (b = .022; p <.038, and b = .016; p <.043 respectively). The coefficient for innovativeness, however, becomes insignificant (b = .0029; p <.678). These results suggest a potential mediating effect of advantage-enhancing on the relationship between innovativeness and firm performance. For example, firms that have had greater innovative abilities in the past period may have a greater ability to intensively introduce advantage-enhancing actions going forward. Therefore, I also tested whether innovativeness in the previous period affects proactiveness and AET in the future period. Table 10 shows the results of this post-hoc analysis. Model 1 shows that the coefficient of innovativeness is positive and significant (b = .136; p <.04) in predicting future degree of proactiveness (controlling for past innovativeness). In Model 2, the coefficient of innovativeness is also marginally significant in predicting future advantage-enhancing tendency (b = .053; p <.09). These results suggest that innovativeness has a positive effect on the future ability of the firms to be proactive and to compete intensively using advantage-enhancing actions. Controlling for the lagged dependent variable and using lagged values of the independent variables suggests support for the causality of these relationships. To further investigate the causal direction of these relationships, I tested whether there is a reciprocal relationship (that is, whether proactivenses and AET in the previous period also affect innovativeness in the future period). Model 3 shows that the effect of AET on innovativeness is negative and nonsignificant (b = - .069; p <.32). Model 4 shows that the effect of proactiveness on innovativeness is negative and nonsigificant (b = - .64; p <.19).

The coefficients remain nonsignificant when both are included in predicting future innovativeness (Model 5). Hence, these results suggest that past innovativeness positively affects the firm's future ability to proactively introduce new products and intensively initiate advantage-enhancing actions such as new product versions, product improvements, or market expansions.

Hypothesis 3

Hypothesis 3 predicts that firms that are high in both ACT and AET will exhibit the best performance. The GLS estimates in Table 8 Model 5 do not provide support for the interaction effect between ACT and AET. The coefficient of PROXAET is *negative* and significant at 5% level (b = -.0104; p <.024), whereas INNXAET is not significant. GMM estimates in Table 9 are also consistent with GLS estimates. The coefficient of PRO x AET is negative and significant at 5% level (b = -.0155; p <.041). In addition, the coefficient of INN x AET is negative and marginally significant at 10% level (b = -.0087; p <.075). Thus, Hypothesis 3 is not supported. Figure 13 illustrates the form of the interaction.

Figure 14: Interaction between ACT (Proactiveness) and AET in Explaining Firm Performance



Although firms with high levels of proactiveness and high levels of advantage-enhancing tendencies exhibit the best performance, this effect is not significantly higher

than firms with low levels of proactiveness and high levels of advantage-enhancing tendencies. The chart in Figure 13 also shows that when firms exhibit low levels of both proactiveness and advantage-enhancing tendencies, they are least profitable. In addition, the positive relationship between advantage-enhancing tendencies and firm performance is stronger for firms that exhibit low levels of proactiveness. Alternatively, the effect of proactiveness on firm performance is stronger at low levels of advantage-enhancing tendencies.

Table 8: ACT, AET and Performance
Random Effects Model – GLS estimator

	DV: Performance (average ROA over the next three years)				
	Model 1	Model 2	Model 3	Model 4	Model 5
Performance (past ROA)	0.2385*	0.2314*	0.2289*	0.2251*	0.2186*
	(0.095)	(0.094)	(0.094)	(0.094)	(0.094)
Firm size (total assets)	-8.27e-07	-7.80e-07	-2.31e-07	-4.19e-07	-4.33e-07
	(5.61e-07)	(5.74e-07)	(3.85e-07)	(7.39e-07)	(7.39e-07)
Market Power	0.8029+	0.8398+	0.7645+	0.7919+	0.7808+
	(0.456)	(0.459)	(0.440)	(0.448)	(0.441)
Financial Leverage	0.006	0.0068	0.0069	0.0071	0.0073
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Financial Slack	0.0132	0.012	0.0131	0.0125	0.0124
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Year dummy 1996	-0.0474*	-0.0540*	-0.0494*	-0.0523*	-0.0533*
	(0.024)	(0.025)	(0.024)	(0.025)	(0.025)
Year dummy 1997	-0.036	-0.0507+	-0.0429+	-0.0489+	-0.0518*
	(0.025)	(0.026)	(0.025)	(0.026)	(0.026)
Year dummy 1998	-0.0808*	-0.0959*	-0.0928*	-0.0978*	-0.1016*
	(0.035)	(0.039)	(0.037)	(0.039)	(0.040)
Year dummy 1999	-0.0805*	-0.0955*	-0.0921*	-0.0974*	-0.1040*
	(0.035)	(0.039)	(0.037)	(0.039)	(0.042)
ACT - Proactivenes (PRO)		0.0199*		0.0157*	0.0207*
		(0.008)		(0.008)	(0.009)
ACT - Innovativeness (INN)		0.0086+		0.0029	0.0013
		(0.005)		(0.007)	(0.007)
AET			0.0334**	0.0221*	0.0666*
			(0.011)	(0.011)	(0.028)
Interaction (PRO X AET)					-0.0104*
					(0.005)
Interaction (INN X AET)					-0.0032
					(0.003)
Constant	-0.0063	0.0047	0.0055	0.0084	0.0201
	(0.027)	(0.025)	(0.025)	(0.025)	(0.023)
R-squared	0.500	0.520	0.530	0.550	0.600
Observations	521	521	521	521	521
Number of i	113	113	113	113	113

Robust standard errors in parentheses
* significant at 5%; ** significant at 1%; + significant at 10%
ACT - advantage-creating strategy
AET - advantage-enhancing strategy

Table 9: ACT, AET and Performance
Dynamic Panel Data Model - System GMM Estimator

	DV: Performance (average ROA over the next three years)				
	Model 1	Model 2	Model 3	Model 4	Model 5
Performance (past ROA)	0.0601	0.3463**	0.3437**	0.3448**	0.3422**
	(0.049)	(0.119)	(0.121)	(0.120)	(0.119)
Firm size (total assets)	-1.61e-06	-4.53e-06	-5.62e-08	-8.00e-07	-1.01e-06
	(1.11e-06)	(1.53e-07)	(1.07e-06)	(1.29e-06)	(1.31e-06)
Market Power	1.0205	1.8357	1.6592	1.7427	1.6585
	(0.804)	(1.206)	(1.102)	(1.162)	(1.081)
Financial Leverage	0.0032	0.0043	0.0044	0.0047	0.0055
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
Financial Slack	0.0074	0.0072	0.0079	0.0076	0.0073
	(0.005)	(0.007)	(0.007)	(0.007)	(0.007)
Year dummy 1996	0.0304*	0.1417**	0.1403**	0.1441**	0.1520**
	(0.012)	(0.045)	(0.041)	(0.045)	(0.048)
Year dummy 1997	0.0573**	0.1318**	0.1361**	0.1364**	0.1430**
	(0.017)	(0.041)	(0.039)	(0.041)	(0.043)
Year dummy 1998	0.0273	0.0847**	0.0927**	0.0898**	0.0952**
	(0.023)	(0.014)	(0.014)	(0.015)	(0.016)
Year dummy 1999	0.0148	0.0287**	0.0277**	0.0273*	0.0322**
	(0.019)	(0.011)	(0.011)	(0.011)	(0.011)
ACT - Proactivenes (PRO)		0.0268+		0.0123	0.0158
		(0.015)		(0.015)	(0.015)
ACT - Innovativeness (INN)		0.0171+		0.009	0.0083
		(0.009)		(0.009)	(0.008)
AET			0.0533*	0.0439*	0.1131**
			(0.023)	(0.021)	(0.042)
Interaction (PRO X AET)					-0.0155*
					(0.008)
Interaction (INN X AET)					-0.0087+
					(0.005)
Constant	-0.0095*	-0.0163*	-0.0155*	-0.0157*	-0.0144*
	(0.004)	(0.007)	(0.006)	(0.007)	(0.006)
Observations	535	535	535	535	535
Number of i	113	113	113	113	113

Robust standard errors in parentheses

* significant at 5%; ** significant at 1%; + significant at 10%

ACT - advantage-creating strategy

AET - advantage-enhancing strategy

Table 10: The Effect of Innovativeness on AET and Proactiveness
Dynamic Panel Data Model - System GMM Estimator

	ACT-Proactiveness[1] Model 1	AET Model 2	ACT-Innovativeness Model 3	ACT-Innovativeness Model 4	ACT-Innovativeness Model 5
Firm size					
(total assets)	-1.09e-05**	6.56e-05	-1.12e-05	-1.88e-05	-1.20e-05
	(4.14e-06)	(6.72-e06)	(7.44-e06)	(1.41e-05)	(9.20-e06)
Market Power	1.7967	1.5982	1.556	1.8973	1.5095
	(1.199)	(1.782)	(1.149)	(1.551)	(1.247)
Financial Leverage	-0.0133	-0.0221	0.0058*	-0.0026	-0.0029
	(0.015)	(0.058)	(0.003)	(0.005)	(0.005)
Financial Slack	0.0043	0.0059	0.0048	0.0101	0.0082+
	(0.007)	(0.006)	(0.004)	(0.006)	(0.005)
Year dummy 1997	0.6764**	0.0653	0.1396**	-0.0429+	-0.0441+
	(0.108)	(0.101)	(0.043)	(0.023)	(0.023)
Year dummy 1998	0.4417**	0.0714	0.0279	-0.1300**	-0.1369**
	(0.075)	(0.067)	(0.017)	(0.042)	(0.043)
Year dummy 1999	0.4578**	-0.0975*	0.0879	-0.1252**	-0.1370**
	(0.077)	(0.040)	(0.077)	(0.043)	(0.042)
AET		0.7592**	-0.0689		-0.1004
		(0.075)	(0.069)		(0.088)
ACT -Proactiveness	0.9216**			-0.064	-0.0268
	(0.047)			(0.049)	(0.057)
ACT -Innovativeness	0.1359*	0.1290+	0.9450**	1.1985**	1.0975**
	(0.066)	(0.078)	(0.134)	(0.213)	(0.127)
Constant	-0.2761**	0.0297	-0.1172**	0.0774+	0.0498
	(0.052)	(0.051)	(0.039)	(0.044)	(0.034)
Observations	552	552	552	552	552
Number of i	112	112	112	112	112

Robust standard errors in parentheses
* significant at 5%; ** significant at 1%; + significant at 10%
AET - advantage-enhancing strategy
1 - DV's are based on the next three years (t, t+1 and t+2), whereas IV's on the past three years (t-3, t-2, and t-1)

Competitive Strategy and Alliance Network Formation

Hypothesis 4

Hypothesis 4 proposes that advantage-creating tendencies will be positively associated with betweenness centrality. The regression results for this hypothesis are shown in Table 11. Models 1, 2, and 3 show the result for betweenness centrality, while Models 4 through 7 show the results for network density. Model 2 in Table 11 shows that the coefficient for proactiveness is positive but not significant (b = .003; p <.69), whereas the coefficient for innovativeness is positive and significant at the 5% level (b = .013; p <.037). Thus, Hypothesis 4 is supported only for one dimension of ACT – innovativeness (i.e., the tendency of firms to pursue technological leadership). Additional support for this hypothesis provides the negative and statistically significant coefficients for proactiveness in Model 7 (b = -.361; p <.0001) in predicting network density. Thus, the overall pattern of these results provides support for Hypothesis 4. Firms with a greater emphasis on advantage-creating tendencies are more likely to be embedded in a network with many structural holes and are less likely to be locked in a dense network compared with firms that are low on advantage-creating tendencies.

Hypothesis 5

Hypothesis 5 predicts that firms with a high level of advantage-creating tendencies will form more non-equity alliances. The results for this hypothesis are shown in Table 12. The dependent variable is expressed as a proportion of strong ties to the total number of ties. As predicted, the coefficients for proactiveness (b = -.033; p <.008) and innovativeness (b = -.022; p <.047) are negative and statistically significant, providing support for Hypothesis 5. Thus, firms with high advantage-creating tendencies are more likely to form weak ties (i.e., non-equity alliances) than strong ties (i.e., equity alliances).

Hypothesis 6

Hypothesis 6 states that firms with a high level of advantage-enhancing strategic tendencies will become embedded in a dense network of alliances in the future period. The coefficients for advantage-enhancing tendencies (ACT) in Models 5 and 7 (Table 11) are positive and significant (b = 1.382; p <.007 and b = .368; p <.001, respectively) in predicting future network density. In addition, Model 2 in Table 11 shows that the coefficient of AET is negative and significant (b = -.027; p <.001) in predicting betweenness centrality. These results provide support for Hypothesis 6. Firms with a high level of advantage-enhancing tendencies are more likely to form dense network structures and less likely to span many structural holes.

Hypothesis 7

Hypothesis 7 states that firms with high advantage-enhancing tendencies will form more equity alliances in the future period. The coefficient for AET in Table 12's Model 2 is positive (as predicted) but nonsignificant (b = .0003; p <.997). Thus, Hypothesis 7 is not supported. This was surprising because a dense network is likely to provide incentives for firms to establish more stable ties and further enhance the exchange of fine-grained information and know-how. To further examine this proposition, I conducted additional (post hoc) analyses. Instead of the ratio of strong ties to total ties, I estimated two additional models where the dependent variables were the "number of strong ties" and the "number of weak ties." This approach would estimate the effect of ACT and AET on the propensity of firms to form strong or weak ties. Model 5 in Table 12 shows that the coefficient of AET is positive and statistically significant in predicting the number of strong ties formed over the subsequent in the next three years (b = 3.96; p <.009). At the same time, the coefficients of ACT dimensions (proactiveness and innovativeness) are negative (as predicted), though not statistically significant. However, the coefficient of AET in Model 6 in Table 12 is, contrary to the prediction, positive and not significant in predicting weak ties. Thus, these results provide somewhat mixed results for Hypothesis 7.

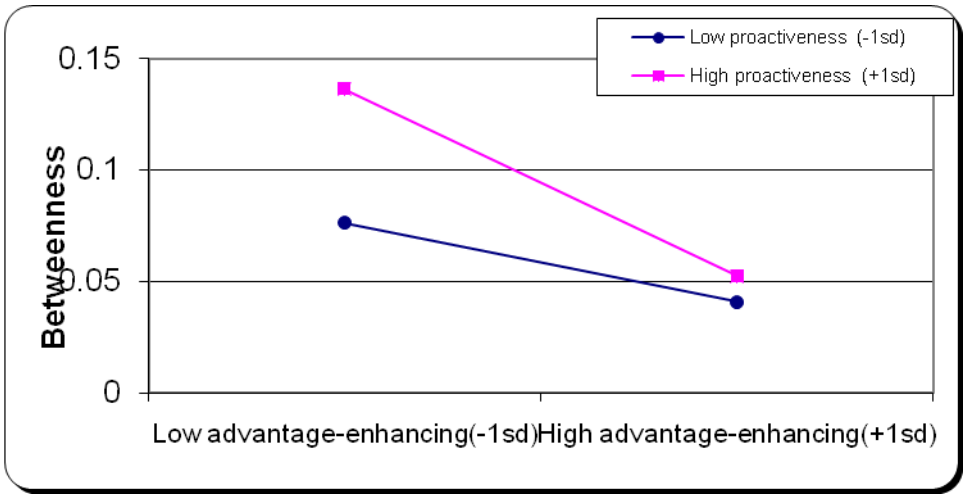
The overall pattern of these results suggest that firms with high advantage-creating strategic tendencies are more likely to be embedded in sparse network structures with a greater proportion of weak/non-equity alliances, whereas firms with high levels of advantage-enhancing strategic tendencies are more likely to be embedded in dense networks with a large proportion of strong/equity ties.

Hypotheses 8a and 8b

Hypotheses 8a and 8b tested the effect of strategically entrepreneurial firms on network formation. These hypotheses predict a negative interaction between AET and ACT in predicting the type of network structure (betweenness centrality and network density). The results of the tests of these moderating hypotheses are shown in Table 11. The interaction between proactiveness and advantage-enhancing tendency in predicting betweenness centrality in Model 3 is negative and statistically significant (b = -.005; p <.002), providing some support for Hypothesis 8a. The same interaction effects in Models 6 and 8, when network density is dependent variable, are positive and statistically significant (b = .402; p <.057, and b = .105; p <.001), providing support for Hypothesis 8b. I did not find support for the interaction effect between innovativeness and advantage-enhancing tendencies in predicting either betweenness centrality or network density. The coefficient for the interaction between innovativeness and AET is negative and nonsignificant (b = -.0001; p <.885) in Model 3 and positive and nonsignificant in Models 6 and 7 (b = .067; p <.743, and b = .011; p <.724).

Taken together, these findings provide some support for moderating effects. Figure 14 below displays the form of the moderating effect of AET on the relationship between proactiveness and betweenness centrality. Betweenness centrality is highest when a firm is pursuing highly proactive advantage-creating tendencies and very low advantage-enhancing tendencies. However, as the firm is increasing its level of AET, betweenness centrality also decreases. Advantage-enhancing tendencies stimulate greater collaboration among a firm's partners, which leads to the closure of the firm's structural holes. Therefore, the rate of decrease in the betweenness score is higher for firms with a high level of proactiveness than for firms with a low level of proactiveness. There is no effect of AET on betweenness centrality at low levels of proactiveness.

Figure 15: Interaction between ACT (proactiveness) and AET in Explaining Future Betweenness Centrality



The results for the interaction effects between ACT and AET in predicting network density depicted in Figure 15 below show a similar pattern. Initially, firms with low levels of proactiveness are embedded in a highly dense network. However, as proactiveness increases, network density rapidly decreases to moderate-to-low levels. The negative slope is steeper for firms that have low levels of advantage-enhancing tendencies. For firms with high levels of AET, the increase in proactiveness decreases the density of the alliance network, but at a slower rate than that of the firms with low levels of AET.

Figure 16: Interaction between ACT (proactiveness) and AET in Explaining Future Network Density

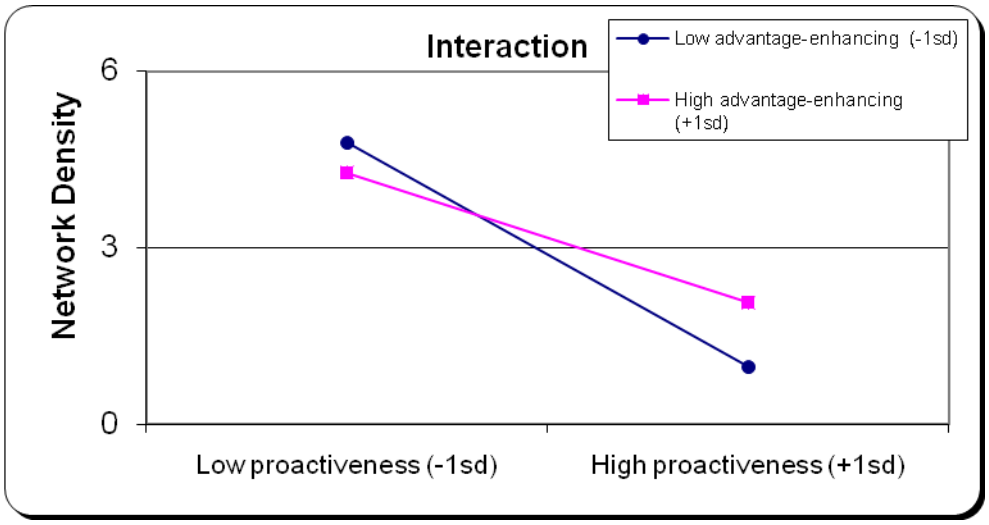


Table 11: ACT, AET and Network Structure
Fixed Effects Model – OLS Estimator

	DV: Betweenness Centrality			DV: Network Density				
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7[p]	Model 8[p]
Betweenness Centrality	-0.638**	-0.666**	-0.582**	-	-	-	-	-
	(0.116)	(0.112)	(0.086)	-	-	-	-	-
Network Density	-	-	-	-0.289+	-0.244+	-0.246+	-0.025**	-0.026**
	-	-	-	(0.164)	(0.148)	(0.149)	(0.003)	(0.003)
Financial Slack	0.003	0.003	0.002	-0.181	1.837	1.895	-0.018	-0.005
	(0.005)	(0.005)	(0.004)	(0.497)	(1.468)	(1.477)	(0.036)	(0.036)
Performance	-0.001	-0.001	-0.005	0.127	-0.688	-0.699	0.219*	0.241*
	(0.008)	(0.007)	(0.006)	(0.147)	(0.419)	(0.424)	(0.092)	(0.094)
Firm size (assets)	-1.71e-05**	-1.30e-05**	-1.08e-05**	-5.48e-05	-1.54e-04	-2.51e-04*	-1.45e-05	-3.56e-05+
	(2.90e-06)	(2.66e-06)	(1.17e-06)	(6.55e-05)	(1.15e-04)	(1.17e-04)	(1.76e-05)	(1.85e-05)
Advantage-creating tendency (proactiveness)	-	0.003	0.017**	-	-1.000	-1.501+	-0.361**	-0.525**
	-	(0.007)	(0.006)	-	(0.698)	(0.784)	(0.089)	(0.102)
Advantage-creating tendency (innovativeness)	-	0.013*	0.001	-	0.429	0.666	0.079	0.149+
	-	(0.006)	(0.005)	-	(0.528)	(0.563)	(0.075)	(0.080)
Advantage-enhancing tendency - AET	-	-0.027**	-0.015	-	1.382+	0.146	0.368**	0.142
	-	(0.007)	(0.009)	-	(0.764)	(1.337)	(0.102)	(0.135)
Proactiveness X AET	-	-	-0.005**	-	-	0.402+	-	0.105**
	-	-	(0.002)	-	-	(0.211)	-	(0.026)
Innovativeness X AET	-	-	-0.0003	-	-	0.067	-	0.011
	-	-	(0.002)	-	-	(0.205)	-	(0.030)
Constant	0.127**	0.137**	0.120*	6.431**	2.804	2.671	-	-
	(0.046)	(0.049)	(0.049)	(1.604)	(3.027)	(3.080)	-	-
R-squared	0.380	0.440	0.450	0.180	0.270	0.310	-	-
Observations	514	514	514	514	514	514	284	284
Number of i	112	112	112	112	112	112	74	74

Robust standard errors in parentheses ; Time dummies included

* significant at 5%; ** significant at 1%; + significant at 10%

[p] - Poisson regression estimates

Table 12: ACT, AET and Strength of Ties
Firm and Time Fixed Effects Model

	DV: Strong ties / total ties			Number of strong ties		Number of weak ties	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Strong ties / total ties	-0.210+	-0.448**	-0.427**	-	-	-	-
	(0.11)	(0.11)	(0.11)	-	-	-	-
Number of strong ties	-	-	-	0.603**	0.126	-	-
	-	-	-	(0.08)	(0.17)	-	-
Number of weak ties	-	-	-	-	-	0.610*	0.572*
	-	-	-	-	-	(0.25)	(0.26)
Financial Slack	-0.023	-0.03	-0.036	7.725*	1.123	-5.763	-3.643
	-0.018	-0.026	-0.025	-3.655	-3.611	-4.789	-4.521
Performance	-0.033**	-0.022**	-0.023**	-4.630**	-2.383+	-1.455	-1.448
	(0.01)	(0.01)	(0.01)	(1.03)	(1.23)	(1.34)	(1.42)
Firm size (assets)	-6.55e-07+	-3.32e-06+	-2.47e-06	-2.55e-04	-2.61e-04	-2.64e-04	-1.47e-04
	(5.39e-07)	(1.72e-06)	(1.75e-06)	(1.33e-04)	(3.45e-04)	(2.82e-04)	(4.13e-04)
Advantage-creating tendency (proactiveness)	-	-0.033**	-0.023	-	-1.112	-	3.744*
	-	(0.01)	(0.02)	-	(1.72)	-	(1.74)
Advantage-creating tendency (innovativeness)	-	-0.022*	-0.027*	-	-0.641	-	1.196
	-	(0.01)	(0.01)	-	(2.23)	-	(2.15)
Advantage-enhancing tendency - AET	-	0.000	0.003	-	3.960**	-	2.548
	-	(0.01)	(0.02)	-	(1.48)	-	(1.84)
Proactiveness X AET	-	-	-0.003	-	-	-	-
	-	-	(0.00)	-	-	-	-
Innovativeness X AET	-	-	0.002	-	-	-	-
	-	-	(0.00)	-	-	-	-
Constant	0.656**	0.867**	0.851**	-11.255+	25.887*	10.674	12.884
	(0.07)	(0.11)	(0.11)	(6.50)	(11.52)	(11.37)	(11.23)
R-squared	0.13	0.39	0.43	0.18	0.27	0.31	0.57
Observations	456	456	456	456	456	456	456
Number of i	112	112	112	112	112	112	74

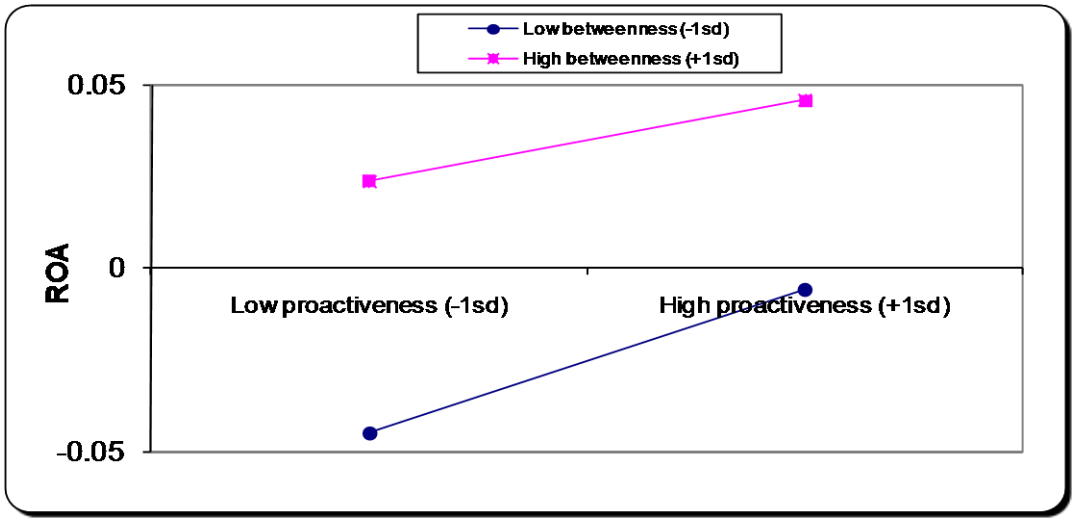
Standard errors in parentheses ; Time dummies included
* significant at 5%; ** significant at 1%; + significant at 10%

Competitive Strategy, Alliance Network Structure and Firm Performance

Hypothesis 9

Hypothesis 9 predicts that the positive effect of advantage-creating strategic tendencies on firm performance will be stronger when the firm is embedded in a sparse network structure. Table 13 shows the GLS estimators and Table 14 shows system GMM estimators. Model 1 in Table 13 regresses firm performance on all control variables and the two dimensions of advantage-creating strategic tendencies: proactiveness and innovativeness. Model 2 adds betweenness centrality. The coefficient for betweenness centrality is positive and statistically significant (b = .129; p <.015). Model 3 introduces the two interaction terms. Only the coefficient for the interaction between proactiveness and betweenness centrality is negative and significant (b =. -047; p <. 009). The GMM estimates in Table 14 exhibit a similar pattern. The coefficient for betweenness centrality is significant at the 10% level (p <.059); the interaction between proactiveness and betweenness centrality is negative and significant (b = - .067; p <. 029). The interaction between innovativeness and betweenness centrality is not significant (b = -.064; p <.127). Thus, Hypothesis 9 is supported only for proactiveness. Figure 16 below illustrates this moderating effect. Highly proactive firms embedded in a network with many structural holes exhibit the highest level of performance. The chart below also shows that firms that span structural holes across distant clusters exhibit better performance than highly proactive firms that do not span structural holes. However, this chart also suggests that firms with low advantage-creating capabilities (proactiveness) benefit more from sparse network structures than do firms with high advantage-creating capabilities. These findings confirm the complementary role of sparse network structure and further suggest that firms that lack advantage-creating capabilities benefit more from sparse network structure.

Figure 17: Moderating role of Betweenness Centrality on the Relationship Between ACT (proactivenes) and Performance



Hypothesis 10

Hypothesis 10 proposes that firms with high advantage-creating capabilities can use network density as a substitute for advantage-enhancing capabilities. More specifically, it predicts that network density will strengthen the positive effect of advantage-creating strategic tendencies (being highly proactive and innovative) on firm performance. Models 4 and 5 in Tables 13 and 14 show the results for Hypothesis 10. The main effect for network density in Model 4 is not significant (b = -.0007; p <.26). Model 5 shows that the coefficient for the interaction term between innovativeness and network density is positive and significant (b = .0017; p <.004), whereas the interaction between proactiveness and network density is not significant (b = .0005; p <.32). GMM estimates in Table 14 show a similar pattern. The interaction between innovativeness and density is marginally significant at the 10% level (b = .0014; p <. 054), whereas the interaction between proactiveness and density is not significant. Thus, Hypothesis 10 is supported only for innovativeness. Figure 17 below shows the form of the interaction between innovativeness and network density in explaining firm performance. Firms with strong innovative capabilities (advantage-creating strategic tendencies) that are embedded in highly dense networks exhibit better performance than other firms. The positive effect

of innovativeness on firm performance becomes stronger as the firm becomes more densely embedded in the alliance network. Note also that at low levels of network density, innovativeness has no effect on firm performance. Thus, firms with high advantage-creating tendencies can increase their performance when they use dense network structures to substitute for advantage-enhancing tendencies.

Figure 18: Moderating role of Network Density on the Relationship between ACT (Innovativeness) and Performance

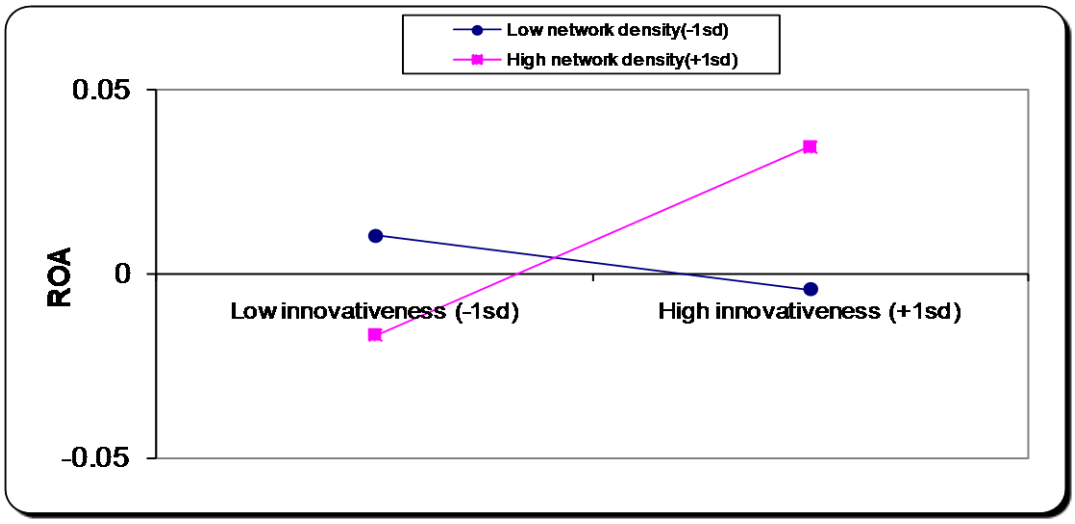


Table 13: ACT, Network Structure and Performance
Random Effects Model – GLS estimator

	DV: Performance (average ROA over the next three years)				
	Model 1	Model 2	Model 3	Model 4	Model 5
Performance (past ROA)	0.2314*	0.2395*	0.2341+	0.2294*	0.2295+
	(0.0944)	(0.1209)	(0.1211)	(0.0941)	(0.1231)
Firm size (total assets)	-7.80e-07	-8.07e-07	-5.51e-07	-7.88e-08	-7.16e-07
	(5.74e-07)	(-5.69e-07)	(6.77e-07)	(1.15e-06)	(9.97e-07)
Market Power	0.8398+	0.909	0.8805	0.8653+	0.8868
	(0.4586)	(0.7147)	(0.6928)	(0.4497)	(0.6571)
Financial Leverage	0.0068	0.006	0.0058	0.0069	0.0069
	(0.0080)	(0.0063)	(0.0064)	(0.0080)	(0.0096)
Financial Slack	0.012	0.0338*	0.0339*	0.012	0.0119
	(0.0096)	(0.0150)	(0.0150)	(0.0097)	(0.0081)
Year dummy 1996	-0.0540*	-0.0623+	-0.0616+	-0.0545*	-0.0543*
	(0.0247)	(0.0339)	(0.0342)	(0.0246)	(0.0239)
Year dummy 1997	-0.0507+	-0.0736*	-0.0724*	-0.0512*	-0.0522*
	(0.0259)	(0.0326)	(0.0325)	(0.0257)	(0.0217)
Year dummy 1998	-0.0959*	-0.0573*	-0.0558*	-0.0971*	-0.0976*
	(0.0388)	(0.0263)	(0.0266)	(0.0386)	(0.0454)
Year dummy 1999	-0.0955*	-0.0542**	-0.0543**	-0.0962*	-0.0960*
	(0.0390)	(0.0166)	(0.0172)	(0.0388)	(0.0459)
ACT - Proactivenes (PRO)	0.0199*	0.0089+	0.0167**	0.0202*	0.0208
	(0.0083)	(0.0049)	(0.0049)	(0.0083)	(0.0148)
ACT - Innovativeness (INN)	0.0086+	0.0137	0.0026	0.0088+	0.0041
	(0.0049)	(0.0084)	(0.0069)	(0.0049)	(0.0064)
Betweenness Centrality		0.1291*	0.3335*		
		(0.0530)	(0.1602)		
Interaction (PRO X Betweenness)			-0.0470**		
			(0.0180)		
Interaction (INN X Betweenness)			-0.0205		
			(0.0345)		
Network Density				-0.0007	0.0003
				(0.0006)	(0.0006)
Interaction (PRO X Density)					0.0005
					(0.0005)
Interaction (INN X Density)					0.0017**
					(0.0006)
Constant	0.0047	-0.0052	-0.0054	0.0074	0.0051
	(0.0251)	(0.0309)	(0.0302)	(0.0257)	(0.0255)
R-squared	0.44	0.58	0.62	0.45	0.52
Observations	521	523	523	521	523
Number of i	113	113	113	113	113

Robust standard errors in parentheses

* significant at 5%; ** significant at 1%; + significant at 10%

ACT - advantage-creating strategy

Table 14: Advantage-creating strategy, Network Structure and Performance
Dynamic Panel Data Model - System GMM Estimator

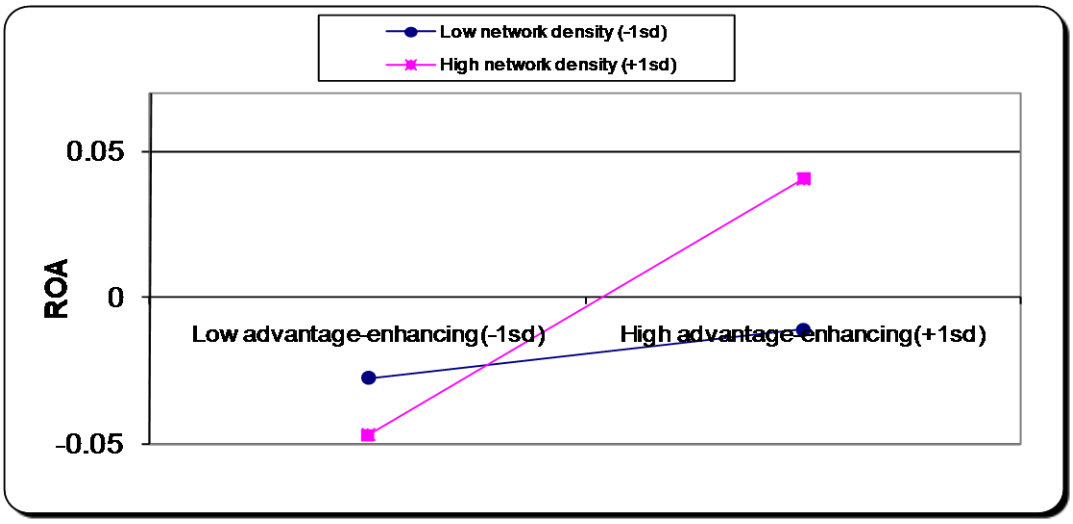
	DV: Performance (average ROA over the next three years)				
	Model 1	Model 2	Model 3	Model 4	Model 5
Performance (past ROA)	0.3463**	0.3441**	0.3189*	0.3446**	0.3058*
	(0.1192)	(0.1172)	(0.1385)	(0.1202)	(0.1244)
Firm size (total assets)	-4.54e-07	-4.32e-07	-2.54e-07	-7.42e-07	-5.84e-07
	(1.53e-06)	(1.52e-06)	(9.80e-07)	(6.98e-07)	(7.55e-07)
Market Power	1.8357	1.3111*	1.0584	1.8178	1.3030+
	(1.2062)	(0.6540)	(0.6494)	(1.1892)	(0.7738)
Financial Leverage	0.0043	0.0046	0.0028	0.0045	0.0021
	(0.0038)	(0.0031)	(0.0020)	(0.0038)	(0.0020)
Financial Slack	0.0072	0.0154+	0.0144+	0.0072	0.0113+
	(0.0072)	(0.0080)	(0.0076)	(0.0072)	(0.0069)
Year dummy 1996	0.1417**	0.0522	0.0595	0.1413**	0.1150*
	(0.0453)	(0.0372)	(0.0404)	(0.0452)	(0.0477)
Year dummy 1997	0.1318**	0.0514	0.0577	0.1318**	0.1040*
	(0.0407)	(0.0325)	(0.0367)	(0.0408)	(0.0435)
Year dummy 1998	0.0847**	0.0444+	0.0466+	0.0847**	0.0603**
	(0.0143)	(0.0233)	(0.0261)	(0.0143)	(0.0172)
Year dummy 1999	0.0287**	0.0388**	0.0397*	0.0295**	0.0307**
	(0.0108)	(0.0134)	(0.0161)	(0.0108)	(0.0112)
ACT - Proactivenes (PRO)	0.0268+	0.0086	0.0139	0.0265+	0.016
	(0.0150)	(0.0082)	(0.0089)	(0.0148)	(0.0142)
ACT - Innovativeness (INN)	0.0171+	0.0131+	0.0169*	0.0170+	0.0045
	(0.0094)	(0.0071)	(0.0083)	(0.0092)	(0.0066)
Betweenness Centrality		0.1538+	0.4591*		
		(0.0816)	(0.1793)		
Interaction (PRO X Betweenness)			-0.0674*		
			(0.0309)		
Interaction (INN X Betweenness)			-0.0636		
			(0.0417)		
Network Density				0.0005	0.0007
				(0.0007)	(0.0005)
Interaction (PRO X Density)					0.0005
					(0.0005)
Interaction (INN X Density)					0.0014+
					(0.0007)
Constant	-0.0163*	-0.0136**	-0.0138**	-0.0165*	-0.0158**
	(0.0066)	(0.0045)	(0.0044)	(0.0067)	(0.0060)
Observations	520	520	520	520	520
Number of i	112	112	112	112	112

Robust standard errors in parentheses
* significant at 5%; ** significant at 1%; + significant at 10%
ACT - advantage-creating strategy

Hypothesis 11

Hypothesis 11 proposes that being embedded in a dense network structure will strengthen the positive effect of advantage-enhancing strategic tendencies on firm performance (and thus network will play a complementary role). Model 5 in Table 15 shows that the coefficient for AET and network density is positive and statistically significant (b = .0033; p >.01). The GMM estimates are also consistent (b = .0028; p <.01). Figure 19 shows the form of this interaction. The positive effect of advantage-enhancing strategic tendencies on firm performance is stronger when a firm is embedded in a dense network structure. Firms with high levels of advantage-enhancing strategic tendencies that are highly embedded in a dense network exhibit the best performance. Thus, Hypothesis 12 is supported. Firms with high levels of advantage-enhancing tendency can extract greater value from dense network structures than firms with low levels of advantage-enhancing tendencies. In addition, no effect is seen for advantage-enhancing tendencies when firms are not embedded in a dense network structure.

Figure 19: Moderating Role of Network Density on the Relationship Between AET and Performance



Hypothesis 12

Hypothesis 12 predicts that being embedded in a network structure with many structural holes can increase the positive effects of advantage-enhancing strategic tendencies on firm performance. Model 3 in Table 15 shows that the coefficient for the interaction between AET and betweenness centrality is negative and statistically significant at the 5% level (b = - .088; p <.02). The system GMM estimates in Table 16 confirm the GLS results (b = - .093; p <.03). Figure 18 illustrates this moderating effect. Firms exhibit the highest performance at high levels of betweennness centrality and high levels of advantage-enhancing strategic tendencies. Thus, Hypothesis 11 is supported. Firms with low levels of betweenness centrality and high levels of AET, or vice versa, exhibit lower performance than firms with high level of AET that are embedded in sparse network structures. However, Figure 18 also shows that at low levels of advantage-enhancing tendency, the increase in the degree of structural holes is greater than that at high level of advantage-enhancing tendencies. This suggests that firms with low advantage-enhancing capabilities benefit more from highly sparse networks than firms with low level of advantage-enhancing capabilities do.

Figure 20: Moderating role of Betweenness Centrality on the Relationship Between AET and Performance

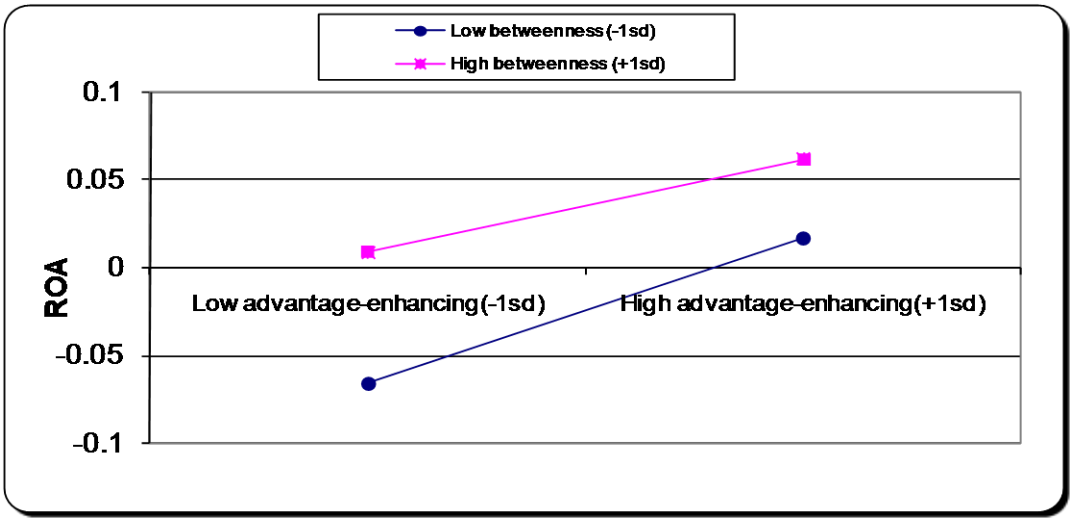


Table 15: Advantage-enhancing strategy, Network Structure and Performance
Random Effects Model – GLS Estimator

	DV: Performance (average ROA over the next three years)				
	Model 1	Model 2	Model 3	Model 4	Model 5
Performance (past ROA)	0.2289*	0.2395*	0.2350*	0.2269*	0.2245*
	(0.0943)	(0.0971)	(0.0968)	(0.0939)	(0.0933)
Firm size (total assets)	-2.31e-07	-3.68e-07	-5.30e-07	-3.68e-07	-5.30e-07
	(3.85e-07)	(5.29e-07)	(7.83e-07)	(5.29e-07)	(7.83e-07)
Market Power	0.7645+	0.8561+	0.8547+	0.7865+	0.7891+
	(0.4401)	(0.4764)	(0.4771)	(0.4311)	(0.4267)
Financial Leverage	0.0069	0.006	0.0062	0.007	0.007
	(0.0081)	(0.0075)	(0.0074)	(0.0081)	(0.0081)
Financial Slack	0.0131	0.0344*	0.0349*	0.0131	0.013
	(0.0098)	(0.0151)	(0.0152)	(0.0099)	(0.0098)
Year dummy 1996	-0.0494*	-0.0598*	-0.0609*	-0.0498*	-0.0514*
	(0.0241)	(0.0290)	(0.0290)	(0.0240)	(0.0240)
Year dummy 1997	-0.0429+	-0.0703+	-0.0728*	-0.0432+	-0.0434+
	(0.0249)	(0.0364)	(0.0369)	(0.0248)	(0.0247)
Year dummy 1998	-0.0928*	-0.0616*	-0.0612*	-0.0938*	-0.0947**
	(0.0369)	(0.0257)	(0.0255)	(0.0368)	(0.0367)
Year dummy 1999	-0.0921*	-0.0580**	-0.0589**	-0.0926*	-0.0937*
	(0.0368)	(0.0179)	(0.0179)	(0.0367)	(0.0366)
AET	0.0334**	0.0239*	0.0388**	0.0337**	0.0224+
	(0.0111)	(0.0100)	(0.0136)	(0.0112)	(0.0118)
Betweenness Centrality		0.0133	0.3332*		
		(0.0846)	(0.1403)		
Interaction (AET X Betweenness)			-0.0883*		
			(0.0378)		
Network Density				-0.0006	0.0001
				(0.0006)	(0.0006)
Interaction (AET X Density)					0.0033**
					(0.0011)
Constant	0.0055	-0.0048	-0.0049	0.0079	0.0043
	(0.0250)	(0.0037)	(0.0038)	(0.0256)	(0.0254)
R-squared	0.51	0.64	0.68	0.51	0.54
Observations	521	521	521	521	521
Number of i	113	113	113	113	113

Robust standard errors in parentheses
* significant at 5%; ** significant at 1%; + significant at 10%
AET - advantage-enhancing strategy

Table 16: AET, Network Structure and Performance
Dynamic Panel Data Model - System GMM Estimator

	DV: Performance (average ROA over the next three years)				
	Model 1	Model 2	Model 3	Model 4	Model 5
Performance (past ROA)	0.3437**	0.3428**	0.3177*	0.3419**	0.3047*
	(0.1205)	(0.1170)	(0.1381)	(0.1216)	(0.1250)
Firm size (total assets)	-5.62e-08	-6.20e-08	-3.33e-07	-3.01e-07	-4.94e-07
	(1.07e-06)	(1.07e-06)	(6.43e-07)	(7.16e-07)	(7.78e-07)
Market Power	1.6592	1.1979*	1.0016	1.6428	1.1637+
	(1.1016)	(0.5895)	(0.6120)	(1.0852)	(0.6970)
Financial Leverage	0.0044	0.0045	0.003	0.0045	0.002
	(0.0036)	(0.0031)	(0.0021)	(0.0036)	(0.0021)
Financial Slack	0.0079	0.0156+	0.0144+	0.0079	0.0119+
	(0.0072)	(0.0083)	(0.0078)	(0.0072)	(0.0070)
Year dummy 1996	0.1403**	0.0562	0.0618	0.1400**	0.1116*
	(0.0408)	(0.0350)	(0.0384)	(0.0407)	(0.0434)
Year dummy 1997	0.1361**	0.0581+	0.0610+	0.1362**	0.1042*
	(0.0388)	(0.0306)	(0.0353)	(0.0388)	(0.0418)
Year dummy 1998	0.0927**	0.0523*	0.0498*	0.0927**	0.0647**
	(0.0143)	(0.0208)	(0.0247)	(0.0144)	(0.0165)
Year dummy 1999	0.0277**	0.0382**	0.0381*	0.0285**	0.0299**
	(0.0105)	(0.0131)	(0.0156)	(0.0106)	(0.0112)
AET	0.0533*	0.0202	0.0387*	0.0530*	0.0194
	(0.0226)	(0.0134)	(0.0174)	(0.0224)	(0.0150)
Betweenness Centrality		0.0154	0.3361*		
		(0.1354)	(0.1434)		
Interaction (AET X Betweenness)			-0.0933*		
			(0.0451)		
Network Density				0.0005	0.0012*
				(0.0007)	(0.0005)
Interaction (AET X Density)					0.0028**
					(0.0011)
Constant	-0.0155*	-0.0135**	-0.0132**	-0.0157*	-0.0155**
	(0.0063)	(0.0045)	(0.0043)	(0.0064)	(0.0057)
Observations	520	520	520	520	520
Number of i	112	112	112	112	112

Robust standard errors in parentheses

* significant at 5%; ** significant at 1%; + significant at 10%

AET - advantage-enhancing strategy

Robustness check

Advantage creating (proactiveness and innovativeness) and advantage-enhancing strategic tendencies are measured as the observable and realized strategic activity of firms over time. This activity, however, may reflect not only firms' internal advantage-creating and advantage-enhancing capabilities; it may also capture firms' access to network resources in the previous period. This effect can be removed by partialling out the explained variance in competitive strategy due to the network structure effect in the previous period. Therefore, I first regressed each strategy variable (i.e., proactiveness, innovativeness, and AET) on each type of network structure (betweenness centrality and network density). Then, I used the residuals from this regression as a measure of firm strategy. For example, to remove the effect of prior network density on advantage-enhancing tendency (AET), I regressed AET on network density and used the residuals from this regression as a measure of AET. This procedure partials out the variance in AET that is explained by past network density. Thus, the interaction between AET and network density is a product of the current period AET (without the effect from past network density) and the current period network density. I ran all models using these modified measures of AET and ACT. The results were consistent with those shown below, which used the original measures.

In addition, all measures of the network structure are based on all types of alliances, including licensing alliances. Although licensing agreements also facilitate transfer of knowledge and information, they are different from other types of alliances because the transfer of knowledge mostly goes one-way: from a licensor to a licensee. Because firms that have many licensing agreements are more likely to have many structural holes (partners are less likely to collaborate with one another) for reasons other than their competitive strategy, I also computed alliance network measures excluding licensing agreements. The pattern of the results remained unchanged.

Finally, my sample included the largest companies in computers and electronics industry. However, because some of the smaller firms may be important rivals in these industries, I also included those firms that were more newsworthy than some of the largest firms in the sample (selected by number of employees and the total revenues). The

inclusion of these firms can introduce some bias in the sample, because these additional firms added to the sample of the largest firms are not a random draw from the population of smaller firms in these industries. Therefore, I also tested the propositions excluding these firms. The results again remained consistent with those shown above.

CHAPTER VII: DISCUSSION AND CONCLUSION

Overview

In this dissertation, I explore the interplay between alliance networks and firms' strategies in explaining firm performance. In hypercompetitive environments, in which firms compete with complex modular products, a firm's ability to systematically outperform rivals depends not only on its internally developed capabilities but also on the advantageous access to information, assets, and expertise controlled by the other firms. Recent research suggests that the sources of performance differences across firms reside in the firm's favorable pattern of alliance ties (Gulati, Nohria & Zaheer, 2000). For example, Dyer and Nobeoka (2000) qualitative research has shown that Toyota's productivity advantages over rivals can be, at least partially, attributed to its dense network of interconnected suppliers. Dense network stimulates knowledge sharing among network partners, discourages free riding and reduces the cost of accessing and mobilizing valuable external resources. On the other hand, Burt (1992) work suggests that firms can gain from sparse network structure in which a focal firm is connected with firms from disconnected clusters. This network structure provides access to diverse knowledge and resources, which increases firms' potential for discovering entrepreneurial opportunities and developing radical innovation. However, although this research has increased our understanding of how the structure of alliance network affect firm performance, we still have incomplete understanding of two fundamental questions for strategy researchers: 1) Why some firms (and not others) develop such advantageous positions in the alliance network structure, and 2) Why some firms benefit from dense network structure, whereas others benefit from sparse network structure?

In this dissertation, I argue that firms develop and benefit from different alliance network structures because they pursue different competitive strategies. Different strategies create different needs, motivations, and opportunities for collaboration with other market participants. Because different network resources are needed for different types of strategies, the effect of network position on firm performance is contingent on the type of strategy a firm is pursuing. I find that firms with superior advantage-creating strategies tend to create sparse network structures with many non-equity alliances,

whereas those with superior advantage-enhancing strategies become embedded in dense network structures with many equity alliances. However, this tendency is not universally beneficial for all firms. Firms with *superior* advantage-creating or advantage-enhancing capabilities can benefit more from creating dense network structures, whereas firms that *lack such capabilities* will benefit more from network structures with many brokerage opportunities between disconnected clusters. Thus, network structure plays both supplementary and complementary role to the firm's advantage-creating and advantage-enhancing capabilities. I discuss this point in more detail in Section 7.4. Here, I first start with discussion of the major findings in Chapter 1 (the relationship between competitive strategy and firm performance).

Competitive Strategy and Firm Performance

This dissertation extends the research in corporate entrepreneurship by showing that superior performance in hypercompetitive environments can be achieved not only through proactiveness and innovativeness (advantage-creating tendencies) but also through intensive advantage-enhancing activity. I find that advantage-creating and advantage-enhancing strategies have independent positive effects on firm performance. Firms with advantage-creating strategy are frequently first to introduce new products and technologies on the market and thus create series of short-term monopolistic market positions. Firms with strong advantage-enhancing capabilities, on the other hand, are better able to protect and extend a few well-established market positions and to quickly imitate the new products and technologies of first movers. In addition, I find that firms cannot pursue strategic entrepreneurship (frequent creation of new competitive advantages and ability to protect and sustain those advantages) relying solely on its internal capabilities; this study's results suggest, however, that firms can achieve strategic entrepreneurship through developing an optimal alliance network structure that can substitute for the capabilities that a firm is lacking. As such, this research study is among the few that has empirically examined some important aspects of the emergent "strategic entrepreneurship" paradigm (I discuss this point in more detail below).

This study advances the research in corporate entrepreneurship also by examining the relationship between the changes in entrepreneurial strategies and firm performance

over time. Using a longitudinal time-series research design, this study empirically examines the causal relationship between different dimensions of entrepreneurial strategies (proactiveness and innovativeness), advantage-enhancing strategies, and firm performance. For example, the post-hoc analyses reveal that the past level of firms' innovativeness affects the future ability of firms both to proactively introduce new products (proactiveness) and to intensively enhance the value of their existing products (advantage-enhancing tendencies). The confidence in the direction of the causality of this relationship is increased (1) by including lagged dependent variables, (2) by using lagged independent variables, (3) by controlling for unobserved heterogeneity, and (4) by showing that the reverse effect is not statistically significant, none of which could have been possible using cross-sectional data. This additional analysis corroborates Covin and Miles's (1999) argument that innovativeness is a central characteristic of entrepreneurial firms and that the dimensions of entrepreneurial orientation may be sequentially related (Lumpkin & Dess, 2001). It is possible, however, that the magnitude of the effect of each of these dimensions on firm performance may vary for different firm performance measures. For example, a firm's innovativeness and proactiveness may be more strongly related to measures of firm performances such as market share change or sales growth rate. Thus, future research may examine how advantage-creating and advantage-enhancing tendencies are interrelated in explaining different measures of firm performance.

Competitive Strategy and Network Formation

This study also contributes to a better understanding of how strategic actors find their way into certain network positions. Firms are embedded in different network structures, because they pursue different strategies. Because firms exhibit recurring and stable strategic behavior over time, they also show consistent patterns of networking behavior. Thus, although the overall alliance network is changing dynamically, firms exhibit stable patterns of network ties, which in turn result in their being in a stable position in the alliance network structure over time.

I find that firms with strong advantage-creating tendencies in the previous period exhibit enduring propensity to become embedded in sparse network structures and to

form more non-equity alliances in the future. These firms have a greater need and motivation to frequently bring new partners into their networks, often from distant network clusters; therefore, they constantly maintain sparse network structures. Because this frequent formation of new alliances requires greater flexibility (both to form new alliances and dissolve old alliances that are no longer useful), they are also more likely to form non-equity alliances. Non-equity alliances provide this flexibility because they involve less formal organizing mechanisms and are less costly to dissolve. On the other hand, firms with an emphasis on advantage-enhancing strategies are more likely to become embedded in a dense network with many equity-based alliances. Because the products are complex systems involving components supplied by independent firms, the component providers need to closely collaborate with one another. A dense network structure facilitates the flow of information and resources and decreases the incentives of network members to behave opportunistically. This increased exchange of information ensures greater fit among components and modules, which leads to a reduced risk of product malfunctioning. Thus, it is reasonable to expect that firms with advantage-enhancing strategies will intensively form alliances with the other firms as well as encouraging greater collaboration among the other network members. Because equity alliances are more effective in managing interdependencies among firms, we would expect that these firms will be more likely to form equity rather than non-equity alliances.

This research provides new insights into how firms that try to pursue strategic entrepreneurship use their alliances to outperform rivals. Because these firms are able to simultaneously pursue advantage-creating and advantage-enhancing strategies, they dynamically change their network positions. They form new ties with firms from distant network clusters and at the same time encourage their partners to collaborate with one another. Thus, their network structure is changing from dense to sparse and back again as a function of their relative needs and motivations to pursue advantage-enhancing and advantage-creating strategic tendencies.

This study also addresses Stuart and Sorenson's (2007) concerns with the endogeneity problems in current network research. Firms' competitive strategies may affect both their position in the network structure and their performance. The results of this study suggest that future studies should account for firms' competitive strategies

when they investigate the relationship between network structure (and portfolio configuration) and firm performance.

It is important to note that in this chapter, I examine how individual decisions of firms to form alliances leads to recognizable network structure at the interfirm level of analysis. I did not initially assume that firms are aware of their network structure and they purposefully shape their position in the network structure. Adopting methodological individualism (Hayek, 1948; Mises, 1949), I try to understand the formation of the overall network structure by examining the strategic and entrepreneurial actions of individual actors in the network. However, to examine how firms can maximize their performance, I adopt the Granovetter (1985) embeddeddness perspective by taking a "middle ground" approach between an oversocialized and undersocialized view of firms' market activity (Granovetter, 1985). Specifically, I assume that firms pursue different strategies, but that the effectiveness of these strategies is affected by the network structure in which they are embedded. This approach can lead to normative statements about what would be the optimal network structure for each strategy to maximize firm performance. Thus, if in this chapter I examine "what firms do," I next examine "what firms should do" to enhance their performance.

Competitive Strategy, Network Structure, and Firm Performance

This dissertation shows that the effect of network structure on firm performance depends on the strength of the firm's internally developed capabilities. Firms that possess superior advantage-creating and advantage-enhancing capabilities can benefit more from dense network structures, whereas firms that lack superior internal capabilities find sparse network structures more beneficial.

More specifically, I find that network density, although not having a direct effect on firm performance, plays an important moderating role on the relationship between competitive strategy and firm performance. The positive relationship between advantage-creating and advantage-enhancing tendencies and firm performance is much stronger when firms are embedded in a dense network structure. This suggests that firms with superior advantage-creating capabilities can use a dense network of collaborators to continuously improve their newly created advantages and thus stay ahead of competitors.

In this case, network density plays a supplementary role by enabling firms with strong advantage-creating capabilities to achieve strategic entrepreneurship. Firms can focus their internal resources on building advantage-creating capabilities while using network density to substitute for their lack of advantage-enhancing capabilities.

I also find that network density plays a complementary role by enabling firms with superior advantage-enhancing capabilities to extract greater value from a dense network of collaborators. This combination of strategy and dense network structure provides firms with the capability to intensively and incrementally improve their existing complex products and thus sustainably retain a leadership position in the market. An obvious example (outside of computers and electronics industry) of this finding is the ability of Toyota to continuously improve its existing vehicle models and sustainably outperform rivals. Because the vehicles are also complex systems, Toyota's embeddedness in a dense network of suppliers ensures greater diffusion of knowledge among suppliers, which partially explains its ability to outperform rivals. Dyer and Nobeoka (2000) found that Toyota's dense supply network encourages exchange of knowledge (both tacit and explicit), ideas and expertise, discourages "free riding," and prevents leakage of strategic information and knowledge to rivals. Hence, this study helps to generalize Dyer and Nobeoka's (2000) findings to other industries, such as computers and electronics.

In contrast to network density, a sparse network structure has a positive direct effect on firm performance, which supports Burt's (1992) structural hole argument and is consistent with the empirical findings at the firm level of analysis (Baum et al., 2000; Zaheer & Bell, 2005). This study, however, extends this research by showing that firms' *without* superior internal capabilities can benefit more from spanning global structural holes. Although the firms with strong advantage-creating and advantage-enhancing capabilities do increase their performance when they form sparse network structures, these effects are much stronger for firms that lack such capabilities. As Figure 20 and 21 below illustrate, the effects of an increase in betweenness centrality is much stronger when advantage-creating and advantage-enhancing tendencies are at low levels, as compared with when these tendencies are at high level.

Figure 21: Moderating role of Betweenness Centrality on the Relationship Between AET and Performance

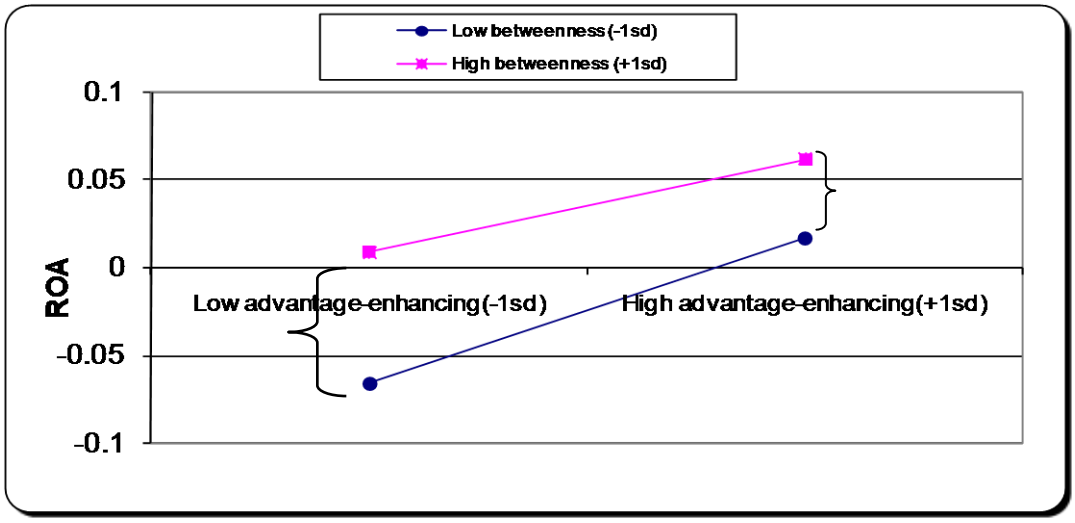
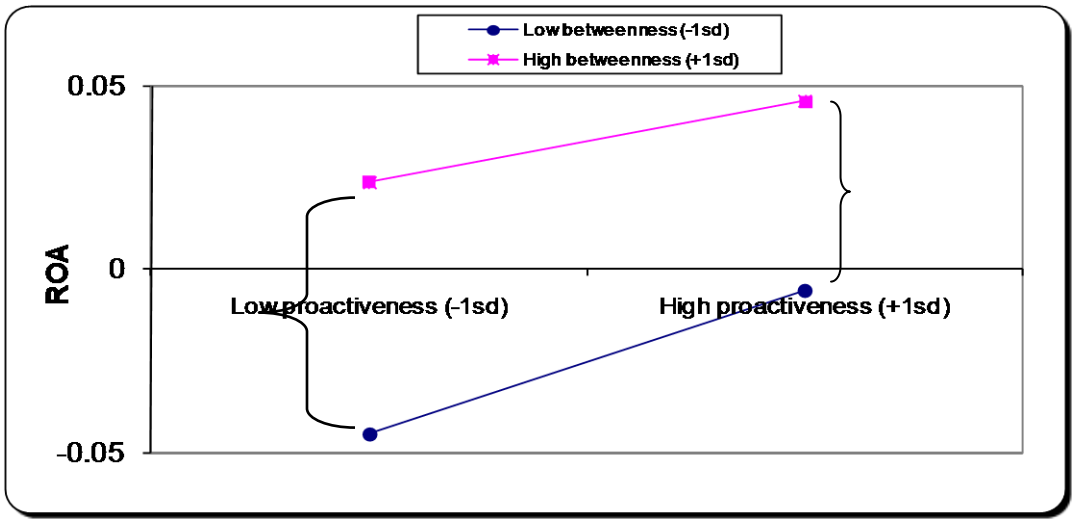


Figure 22: Moderating role of Betweenness Centrality on the Relationship Between ACT (proactivenes) and Performance



These findings suggest that firms that lack superior internal capabilities can increase their performance when they have access to diverse knowledge and technologies. On one hand, firms that lack advantage-creating tendencies can use a sparse network structure to increase their innovative and proactive capabilities in the future and thus enhance their performance. On the other hand, firms that lack advantage-enhancing capabilities are less likely to be considered attractive network partners either because this

firms have higher risk of free riding (i.e., they can gain much more than what they can contribute to the network members) or because they cannot provide the needed resources. Hence, forming new alliances from distant technological domains may be used to leverage their internal innovative capabilities, which in turn may increase their legitimacy as valuable network partners in the future.

Finally, this study also extends the research in competitive dynamics area (e.g., Smith, Ferrier, & Ndofor, 2001; Grimm, Lee, & Smith, 2006). It suggests that firms systematically differ in their tendencies to initiate "proactive" versus "advantage-enhancing" competitive actions. The extent to which firms exhibit tendencies to carry out either proactive or advantage-enhancing *competitive actions* is powerful predictor of the intensity and the pattern of *collaborative actions* (i.e., strategic alliances). Relatedly, this study extends the application of the awareness-motivation-capability (A-M-C) framework (Chen, 1996) to the relationship between competitive strategy and alliance network structure. On one hand, different types of network structure increase the effectiveness of each type of competitive strategy by increasing the firm's awareness of profit opportunities and by leveraging its capabilities with those of network partners. On the other hand, firms with different types of capabilities have different needs and motivation to collaborate with other firms.

Limitations and Future Research

This study measures competitive strategy and alliance network structure based on the firm's competitive and collaborative activity over a three-year window. Indeed, the reliability of the strategic and network variables could be increased as the time over which these variables are measured becomes longer. In addition, the stability of firms' positions in the network structure would be more reliably estimated over longer periods. Nevertheless, previous research suggests that in the computers and electronics industries, the intensity of new product introduction is almost one new product per year (Nadkarni & Narayanan, 2007), and the firms in my sample initiated 43 patents per year on average. This indicates sufficient variation of the advantage-creating strategic tendencies across firms. In addition, the alliance duration in highly competitive environments is about three

years (e.g., Pangarkar, 2003), which provides justification for using a three-year moving window in mapping network structure.

Another limitation of this study is that the data are drawn from several interrelated industries in hypercompetitive context. This choice is important for this study to isolate the effect of firms' strategies from other industry-specific factors that may affect firm performance. However, this approach also limits the external validity of the findings. For example, the type of strategy and the rate of change in alliance and innovative activity of firms is likely to be different in more stable industries. Future research should, therefore, examine how the competitive environment in different industries affects the propositions tested in this study.

Relatedly, this dissertation focuses on only two types of strategies that the recent research in dynamic capabilities, first mover advantages, and strategic entrepreneurship has suggested can enable firms to gain superior performance in hypercompetitive environments. Other typologies of competitive strategies such as those proposed by Miles and Snow (1978) or Porter (1985) may also be used to study the interplay between network structure and competitive strategy in multi-industry samples.

Furthermore, the focus of this study is at firm level of analysis. Future research should examine the effect of competitive strategy on alliance formation at the dyadic level of analysis. For example, the likelihood of alliance formation between two firms will also be affected by their type of competitive strategy. Firms with advantage-creating capabilities may choose to collaborate with partners with strong advantage-enhancing capabilities beyond the effect of prior alliance activity and the position in the network structure (Gulati & Garguilo, 1999). On the other hand, we can expect a higher level of competitive tension between two firms pursuing a similar competitive strategy and thus have a lower likelihood of alliance formation. In addition, rivals with similar strategic tendencies may also be prone to terminate their alliances sooner and at a faster rate than firms that pursue different strategies. The risk of leakage of proprietary knowledge and technologies between partners can have more adverse effect when firms pursue similar strategies, because they are more likely to perceive each other as direct rivals. This can create higher tension and distrust between partners, which increases the risk of terminating the alliance.

In addition, I collected data on advantage-enhancing activity of firms at the firm level of analysis. An alternative approach would be to collect data at the product level and examine how the intensity and the type of advantage-enhancing actions will affect its market share and profits. Future research could examine how the alliance network at the product level would increase the firm's ability to continuously enhance the value of a given product and whether the network structure varies over different stages in the product life cycle.

This study focuses mainly on two types of network structure: sparse versus dense. Future research is needed to explore how differences in firms' strategies will affect other relational and structural network measures such as alliance network diversity (i.e., functional variety of alliance in the firm's portfolio) (Powell et al., 1996) or closeness centrality (Gnyawali & Madhavan, 2001). In addition, the similarities in strategic orientation between two firms can be important predictor of their tendency to occupy structurally equivalent position in the network structure. Two firms pursuing same competitive strategies may exhibit similar patterns of network ties (i.e., being structurally equivalent) despite being disconnected with one another. This interplay between competitive strategies and the degree of structural equivalence between two firms can have important implications for predicting the intensity of the competitive interaction between firms. On one hand, firms with similar strategies that are also structurally equivalent may become fierce competitors because they will closely monitor each other and because they have access to similar information and resources from third parties. On the other hand, firms that are connected with the same partners may have more opportunities to interact and tacitly collude (through third parties) and thus decrease their level of rivalry. Hence, future research should empirically investigate these opposing arguments.

In explaining why firms with high advantage-creating strategies will become embedded in sparse network structures, I argue that proactive firms have a greater need for forming new alliances and thus will frequently bring new partners into their networks (because the new partners are not connected with the existing network partners, these firms are more likely to span structural holes). This in turn implies that proactive firms will have a higher rate of alliance termination, assuming that all firms face resource

constraints (i.e., firms cannot maintain an infinite number of alliances.) However, more rigorous examination is needed to establish whether proactive firms do terminate their alliances sooner or they just form alliances of shorter duration.

In this study, I measured advantage-enhancing strategy as a count of advantage-enhancing actions such as price cuts, marketing, product improvements and market expansions, initiated by firms in a given year. These four types of competitive actions loaded in one factor, which represents the firm's strategic focus and capability toward continuously enhancing the existing product and services. However, it is possible to use other operationalizations of advantage-enhancing activity of the firm. Researchers in competitive dynamics literature have used measures that capture more interactive and dynamic aspects of competitive behavior of firms. For example, the extent to which a firm uses different types of actions – competitive repertoire complexity (Ferrier, 2001; Miller & Chen, 1994) can capture finer distinction between different types of advantage-enhancing activity (e.g., some firms may have greater emphasis on price cuts and advertising, whereas others may launch more balanced repertoire of actions. Another potentially useful operationalization of advantage-enhancing tendency is to measure the degree of conformity of the firm's advantage-enhancing tendency with the industry norms (Ferrier, 2001; Deephouse, 1999). Firms' conformity with industry norms can be assessed based on the type and timing of actions over time (in calendar days or months). The greater overlap of the type and timing of advantage-enhancing actions with those of rivals can mitigate the positive effect of advantage-enhancing capability on firm performance. As a result, firms may have greater need for collaboration with rivals to reduce the intensity of rivalry.

Furthermore, in this study, I did not directly capture the firm's order and speed of response to rivals' new products. Competitive dynamics research have provided more nuanced measures of the firms' speed of response to rivals' new products by counting the number of days elapsed between the proactive action and the subsequent reaction of rivals (Basdeo et al. 2006; Lee, Smith, & Grimm, 2003; Chen & Hambrick, 1995; Ferrier, Smith, & Grimm, 1999). Although, this study's focus was to capture the firm's advantage-enhancing capability rather than the firm's propensity to quickly respond to rivals' actions, measuring directly a firm's responsive capability can provide additional

understanding of how the access to information through network partners can affect firms' ability to quickly imitate and respond to the pioneering products of first-movers.

This dissertation focused on the firm's observable product-market activity of firms to capture its advantage-enhancing capability. I assume that firms' strategies can be more comprehensively measured by examining the consistency in their observable competitive behavior over time. By focusing on the realized competitive activity of firms, I was able to capture both the intended and emergent strategies of firms (Mintzberg, 1978). This approach, however, prevented me to examine the firm's resource allocation decisions that lead to market-based actions such as new products, improvements, or new market entry. Future research should examine how firms' internally oriented actions such as changes in human resource management practices (e.g., initiation of new employee training programs, profit-sharing plans, or recruiting practices), or the top management team's decision making processes affect firms' advantage-creating and advantage-enhancing tendencies.

Finally, this dissertation uses a combination of archival sources and structured content analysis of published news announcements to measure competitive strategies of firms. An alternative approach to obtain data on competitive activity of firms is through use of survey-based techniques. This approach increases the construct validity of the measures, as managers are directly asked to report their perceived and intended strategies (Lyon, Lumpkin, & Dess, 2000). Both approaches have some limitations. For example, using questionnaire as a data collection instrument may bias the results due to systematic differences between respondents and non-respondents. In addition, because this method often relies on single informants, the responses on different measures can be systematically affected by managers' unobservable and stable characteristics, which in turn can bias the results because of the presence of common method variance. On the other hand, content analysis of published news announcements is susceptible to media reporting bias (e.g., toward more prominent firms) and fails to capture many internal strategic actions that the media do not report. Because it was critical for this study to examine changes in firms' strategies and network positions over time, the combination of content analysis and archival data was the preferable data collection method. The

shortcoming of this approach was reduced to some extent by careful sample selection process and by achieving high interrater reliability coefficients.

Conclusion

Performance differences across firms can be explained, at least partially, by the extent to which firms enjoy favorable access to external resources and capabilities developed by other market participants. Previous research has suggested that two types of network structure – dense and sparse – are especially beneficial for firms to maximize the effect of their internally developed entrepreneurial and strategic capabilities. Given that these two types of network structure are important sources of firms' competitive advantages, it is critical for strategic management research and practice to explain why some firms (and not others) enjoy such advantageous access to network resources. In this dissertation I attempt to provide greater understanding of (1) why some firms become embedded in a sparse alliance network structure rich with structural holes, whereas others form dense network structure, and (2) why some firms benefit from sparse network structure, whereas others benefit from dense network structure.

My results show that firms become embedded in different types of network structure because they pursue different competitive strategies. As firms increase the degree of advantage-creating tendency, they tend to frequently bring new partners into their alliance network and thus continuously create new structural holes. On the other hand, when firms exhibit strong advantage-enhancing tendency, they tend to stimulate greater collaborative activity between network partners and thus form dense network structure. Despite the frequent and dynamic evolution of the overall alliance network, firms occupy stable positions in the network structure because they pursue recurrent patterns of strategic behavior.

However, this study reveals that these tendencies of firms are not universally beneficial for all firms. I found that firms with superior advantage-creating or advantage-enhancing capabilities could benefit more from dense network structure, whereas firms with inferior capabilities are better off when they form alliances with firms from distant network clusters and thus form a network structure rich with global structural holes. These findings suggest that managers should carefully construct their alliance networks.

Firms with superior advantage-creating or advantage-enhancing capabilities should encourage partners to actively collaborate with one another. On the other hand, firms that lack superior capabilities need to economize their network structure by forming nonredundant ties with firms from distant technological areas and thus increase their potential to discover new entrepreneurial opportunities.

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APPENDIX

Table 17: Selected News Reports on Apple and Rivals

October, 23, 2001	**Apple introduces iPod:** "Apple today introduced iPod(TM), a breakthrough MP3 music player that packs up to 1,000 CD-quality songs into an ..."
March 21, 2002	**Apple enhances iPod:** "Apple today announced a second model of its groundbreaking iPod(R) digital music player that features a 10GB hard drive …"
October 14, 2002	**Creative imitates iPod:** "Creative launches its NOMAD Jukebox Zen , a pocket-sized, 20GB MP3 player priced 40% less than Apple's iPod…"
July 17, 2002	**Apple enhances iPod:** "Apple chief Steve Jobs said on Wednesday that Apple has expanded the audience for its popular iPod music player with new versions of the device designed to work with Windows-based personal computers..."
March 1, 2003	**Creative enhances Zen:** "Thanks for the R&D, Apple! Creative takes a look at Apple's iPod and—thankfully—bites its design in new product extension…"
April 28, 2003	**Creative enhances Zen:** "Creative introduces three exciting new speaker systems to match the Apple iPod…"
November 11, 2003	**Gateway imitates iPod:** "Gateway's new digital jukebox is $100 less than Apple iPod; the 20GB Jukebox delivers industry's best value…"
December 8, 2003	**Dell imitates iPod:** "Hoping to duplicate the success of Apple's iPod and iTunes music store, Dell introduces DJ Player with Dell Jukebox powered by Musicmatch ($249 for 15 GB; $299 for 20 GB)…"
January 6, 2004	**Apple enhances iPod:** "Apple today introduced iPod(TM) mini, the smallest portable music player ever to hold up to 1,000 CD-quality songs. The new iPod mini is encased in an ultra-portable, lightweight..."
June 21, 2004	**Apple enhances iPod:** "Apple Computer Inc. and BMW Group on Monday introduced an adapter that allows iPod and BMW customers to plug their music collections directly into their car sound systems…"
July 19, 2004	**Apple enhances iPod:** "Apple introduces the new fourth-generation iPod featuring Apple's 'click wheel' and 12-hour battery life…"
October 26, 2004	**Apple enhances iPod:** "Apple introduces iPod Photo, your entire music and photo library in your pocket…"
November 3, 2004	**Apple enhances iPod:** "iTunes 4.7, the version of Apple's music player released to coincide with iPod Photo…"
January 11, 2005	**Apple enhances iPod:** "Apple introduces iPod shuffle, first iPod under $100…"
September 7, 2005	**Apple enhances iPod:** "Apple today introduced the iPod(R) nano, a revolutionary full-featured iPod that holds 1,000 songs, yet is thinner than a standard #2 pencil and less than half the size of…"
September 7, 2005	**Apple enhances iPod:** "Motorola, Apple unveil 'iPod Phone'…"
October 12, 2005	**Apple enhances iPod:** "Apple unveils new video iPod, Disney TV deal…"
November 20, 2005	**Apple enhances iPod:** "Apple launches iPod Movie…"
February 5, 2006	**Apple enhances iPod:** "Apple introduces cheaper iPod…"
February 28, 2006	**Apple enhances iPod:** "Apple unveils iPod hi-fi home stereo system…"
March 29, 2006	**Apple enhances iPod:** "Apple Computer unveils iPod max volume software update…"
May 24, 2006	**Apple enhances iPod:** "Nike and Apple team up to launch Nike+iPod…"
July 10, 2006	**Apple enhances iPod:** "Apple introduces talking iPod…"
September 12, 2006	**Apple enhances iPod:** "Apple's CEO Jobs unveils games for iPod…"
April 16, 2007	**Apple enhances iPod:** "Apple to release WiFi iPod…"

Table 18: Summary Statistics of Alliances

Year	Total Number of Alliances	International Alliances	Domestic Alliances	Equity Alliances	Non-Equity Alliances
1993	3771	2520	1251	1549	2222
1994	4471	2952	1519	2095	2376
1995	4402	2964	1438	2454	1948
1996	2620	1732	888	1341	1279
1997	3090	1866	1224	1353	1737
1998	3415	2078	1337	1061	2354
1999	3837	2175	1662	1069	2768
2000	4577	2617	1960	1431	3146
2001	2953	1842	1111	847	2106
2002	1971	1327	644	689	1282
2003	1659	1076	583	332	1327
Total	36766	23149	13617	14221	22545

Year	Total Number of Alliances	Licensing Agreements	% of total	R&D	% of total	Manufacturing	% of total	Marketing	% of total	Supply Alliances	% of total
1993	3771	486	12.9%	1010	26.8%	1134	30.1%	1541	40.9%	167	4.4%
1994	4471	707	15.8%	1237	27.7%	1411	31.6%	1593	35.6%	169	3.8%
1995	4402	826	18.8%	940	21.4%	1477	33.6%	1410	32.0%	82	1.9%
1996	2620	534	20.4%	397	15.2%	729	27.8%	653	24.9%	32	1.2%
1997	3090	651	21.1%	544	17.6%	702	22.7%	603	19.5%	40	1.3%
1998	3415	661	19.4%	252	7.4%	730	21.4%	521	15.3%	88	2.6%
1999	3837	494	12.9%	181	4.7%	693	18.1%	436	11.4%	53	1.4%
2000	4577	141	3.1%	309	6.8%	460	10.1%	452	9.9%	103	2.3%
2001	2953	101	3.4%	244	8.3%	391	13.2%	357	12.1%	166	5.6%
2002	1971	78	4.0%	202	10.2%	430	21.8%	290	14.7%	53	2.7%
2003	1659	162	9.8%	177	10.7%	261	15.7%	309	18.6%	28	1.7%
Total	36766	4841	13.2%	5493	14.9%	8418	22.9%	8165	22.2%	981	2.7%

Note: A single alliance maybe coded in two or more categories (e.g., marketing and manufacturing). Thus, the alliance categories shown above are neither exhaustive nor unique.

Table 19: Examples of Words that Indicated "Proactiveness" of New Products

- Most innovative to date
- First to offer
- Revolutionary
- Breakthrough (technology/product)
- Industry's first
- First of its kind
- First ever
- First generation
- First product to bring
- First company
- Revolutionary design
- World's first
- World's fastest
- Fastest and most versatile model ever
- Smallest and lightest in the industry
- Industry's only
- The world's smallest and most cost-effective
- First commercially available
- Smallest module on the market
- First to market new technology
- "there isn't anything like this on the market"
- Takes the lead in…
- It is the first company to have brought c.d. technology to the stage of practical use
- Highest performance available
- Superior to industry standard
- The only device on the market
- New world standard
- Moves ahead of competitors
- Pioneering
- Up to 10 (100,1000) times/faster, better etc.
- Set industry standards

Table 20: List of Sample Companies

#	SIC	COMPANY NAME	#	SIC	COMPANY NAME	#	SIC	COMPANY NAME
1	3570	HEWLETT-PACKARD CO	43	3577	XEROX CORP	84	3674	MACRONIX INTL LTD -ADR
2	3570	HITACHI LTD -ADR	44	3578	DIEBOLD INC	85	3674	MAXIM INTEGRATED PRODUCTS
3	3571	APPLE INC	45	3578	HYPERCOM CORP	86	3674	MICRON TECHNOLOGY INC
4	3571	CONCURRENT COMPUTER CP	46	3578	NCR CORP	87	3674	NATIONAL SEMICONDUCTOR CORP
5	3571	DELL INC	47	3579	PITNEY BOWES INC	88	3674	QLOGIC CORP
6	3571	GATEWAY INC	48	3651	EMERSON RADIO CORP	89	3674	SIGMA DESIGNS INC
7	3571	NEC CORP -ADR	49	3651	HARMAN INTERNATIONAL INDS	90	3674	SILICON STORAGE TECHNOLOGY
8	3571	SUN MICROSYSTEMS INC	50	3651	RECOTON CORP	91	3674	STMICROELECTRONICS NV -ADR
9	3571	XYBERNAUT CORP	51	3651	SONY CORP -ADR	92	3674	TAIWAN SEMICONDUCTOR -ADR
10	3572	DATARAM CORP	52	3670	AVX CORP	93	3674	TEXAS INSTRUMENTS INC
11	3572	EMC CORP/MA	53	3670	CTS CORP	94	3674	THREE-FIVE SYSTEMS INC
12	3572	IOMEGA CORP	54	3670	EPCOS AG -ADR	95	3674	XILINX INC
13	3572	NETWORK APPLIANCE INC	55	3670	KEMET CORP	96	3674	ZILOG INC
14	3572	QUANTUM CORP	56	3670	VISHAY INTERTECHNOLOGY INC	97	3678	AMPHENOL CORP
15	3572	READ-RITE CORP	57	3672	ACT MANUFACTURING INC	98	3678	METHODE ELECTRONICS -CL A
16	3572	SANDISK CORP	58	3672	BENCHMARK ELECTRONICS INC	99	3678	MOLEX INC
17	3572	WESTERN DIGITAL CORP	59	3672	FLEXTRONICS INTERNATIONAL	100	3679	CORNING INC
18	3575	BOUNDLESS CORP	60	3672	JABIL CIRCUIT INC	101	3679	HUTCHINSON TECHNOLOGY INC
19	3576	3COM CORP	61	3672	PARK ELECTROCHEMICAL CORP	102	3679	SPARTON CORP
20	3576	ADAPTEC INC	61	3672	PARK ELECTROCHEMICAL CORP	103	3679	STONERIDGE INC
21	3576	CIRRUS LOGIC INC	62	3672	SANMINA-SCI CORP	104	3679	TDK CORP -ADS
22	3576	CISCO SYSTEMS INC	63	3672	SOLECTRON CORP	105	3679	TECHNITROL INC
23	3576	DIGI INTERNATIONAL INC	64	3672	VIASYSTEMS INC	106	3861	AVID TECHNOLOGY INC
24	3576	EMULEX CORP	65	3674	ADVANCED MICRO DEVICES	107	3861	EASTMAN KODAK CO
25	3576	FOCUS ENHANCEMENTS INC	66	3674	ALTERA CORP	108	3861	FUJIFILM HOLDINGS CORP -ADR
26	3576	INTERPHASE CORP	67	3674	AMKOR TECHNOLOGY INC	109	3861	OCE NV -ADR
27	3576	NETWORK EQUIPMENT TECH INC	68	3674	ANADIGICS INC	110	7372	ADOBE SYSTEMS INC
28	3576	PLAINTREE SYSTEMS INC	69	3674	ANALOG DEVICES	111	7372	CA INC
29	3577	AMPEX CORP/DE -CL A	70	3674	ATMEL CORP	112	7372	CADENCE DESIGN SYSTEMS INC
30	3577	CANON INC -ADR	71	3674	BROADCOM CORP -CL A	113	7372	COMPUWARE CORP
31	3577	CREATIVE TECHNOLOGY LTD	72	3674	CELESTICA INC	114	7372	ELECTRONIC ARTS INC
32	3577	FRANKLIN ELECTRONIC PUBLISH	73	3674	CHARTERED SEMICONDUCTR -ADR	115	7372	JL HALSEY CORP
33	3577	GEMPLUS INTL SA -ADR	74	3674	CONEXANT SYSTEMS INC	116	7372	MICROSOFT CORP
34	3577	HAUPPAUGE DIGITAL INC	75	3674	CYPRESS SEMICONDUCTOR CORP	117	7372	ORACLE CORP
35	3577	INTERMEC INC	76	3674	EXAR CORP	118	7372	SUNGARD DATA SYSTEMS INC
36	3577	KEY TRONIC CORP	77	3674	INFINEON TECHNOLOGIES AG-ADR	119	7372	SYBASE INC
37	3577	LEXMARK INTL INC -CL A	78	3674	INTEGRATED DEVICE TECH INC	120	7373	AUTODESK INC
38	3577	LOGITECH INTL SA	79	3674	INTEL CORP	121	7373	FUJITSU LTD -ADR
39	3577	MEDIA 100 INC	80	3674	INTL RECTIFIER CORP	122	7373	MENTOR GRAPHICS CORP
40	3577	PRINTRONIX INC	81	3674	KYOCERA CORP -ADR	123	7373	SAFEGUARD SCIENTIFICS INC
41	3577	RADISYS CORP	82	3674	LINEAR TECHNOLOGY CORP	124	7373	TYLER TECHNOLOGIES INC
42	3577	SCM MICROSYSTEMS INC	83	3674	LSI CORP	125	7373	UNISYS CORP

Table 21: Key Word Searching Criteria

New Product/Version/Improve "Firm Name"/f15/ and (premier*/f15/ or release*/f15/ or launch*/f15/ or introduce*/f15/ or unveil*/f15/ or roll out/f15/ or unwrap*/f15/ or new product*/f15/ or to create/f15/ or has created/f15/ or debut*/f15/ or to start*/f15/ or newest/f15/ or replace/f15/ or improv*/f15/ or enhance*/f15/ or update*/f15/ or upgrade*/f15/ or modif*/f15/ or (new/f15/ and line/15/) or version*/f15/ or generation/f15/ or design*/f15/ or (range/f15/ and product*/f15/) or bolster*/f15/ or strengthens*/f15/) not percent not stock/f15/ not sale*/f15/ not slowdown/f15/ not report*/f15/ not earning*/f15/ not profit/f15/ not cent*/f15/ not alliance/f15/ not joint venture/f15/ not dividend/f15/ not quarter*/f15/ not acquisiton/f15/ not acquire/f15/ not equity funding/f15/ not campaign/f15/ not team up/f15/ not collaborate/f15/ not pact/f15/ not develop*/f15/
Price/Sale Incentives: "Firm Name"/f15/ and [(Price*/f15/ and drop/f20/) or (price*/f20/ and cut*/f20/) or (price*/f20/ and decrease*/f20/) or (price*/f20/ and reduc*/f20/) or (price*/f20/ and new*/f20) or (price*/f20/ and lower*/f20/) or (price*/f20/ and slash*/f20/) or (price*/f20/ and slice*/f20/) or (price*/f20/ and halv*/f20/) or (price*/f20/ and undercut*/f20/) or (price*/f20/ and plunge*/f20/) or (price*/f20/ and fall*/f20/) or (price*/f20/ and plummet/f20/) or (price*/f20/ and slump/f20/) or (price*/f20/ and shrink*/f20/) or cheaper/f15/ or rebate/f15/ or saving*/f15/ or coupon*/f15/) not profit*/f15/ not stock price/f30/
Advertising/Promotions: "Firm Name"/f15/ and (Advert*/f15/ or promot*/f15/ or campaign/f15/ or marketing*/f15/ or commercial*/f15/ or donat*/f15/ or contest/f15/ or sponsor*/f15/ or celebrat*/f15/ or promot*/f15/ or film*/f15/ or movie*/f15/ or milestone/f15/ or organizing*/f15/ or exhibit*/f15/ or celebrat*/f15/ or seminar*/f20/ or showcase/f20/ or brand*/f20/ or trademark/f20/ or conference*/f20/ or reward*/f20/ or contest/f20/ or expo/f20/ or show* off/f20/ or ad/f20/ or ads/f20/)
Market Expand: "Firm Name"/f15/ and [ns=24 or (open/f15/ and store/f15) or (market/f15/ and expansion/f15/) or expand*/f15/ or distribut*/f15/ or dealer*/f15/ or outlet/f15/ or (build/f15/ and plant/f15/) or new facility/f15/ or (start*/f15/ and services/f15/)].

Additional notes:

- The criteria were developed inductively through trial and error process. The criteria that provided the most comprehensive coverage with the fewest articles that were unrelated to a given action category were retained. Once developed, the criteria was used for all firms in the sample.
- /f15/ above indicates that the word is searched in the first 15 words of the article.
- Factiva's team of experts also provides internal codes attached to each news article. These codes allow for more efficient search for action types, as each action category (e.g., new products, advertising, pricing or capacity expansion) can be searched by specific Factiva code. I tested the reliability of these codes. For example, the internal Factiva code for new products is "ns=c22". For Dell Inc /f15/ the number of retrieved articles using ns=c22 was 924, which was very

similar to the number of articles retrieved using my own criteria – 926 (for the period 1993 - 1999). I chose to use the Factiva code because the number of unrelated articles was lower. In the Dell's example, from 924 articles generated using Factiva code, 203 news articles were unrelated with new product announcements, whereas from 926 articles generated with my own criteria 312 were unrelated (Factiva reports the number of articles in each content area – new products, political/general news, analysis comments, commodity/financials, equity markets etc.).

- The code used for Market Expand, ns=24 is used in addition to my own criteria, because it generated additional unique news articles that were not generated using my own criteria. Ns=24 is assigned to articles that are related to "production or service facilities and their capacity..."

VITA

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BIOGRAPHICAL INFORMATION

Date of Birth: July 22, 1970
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EDUCATION

M.B.A – Finance; April 2004
Grand Valley State University
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PUBLISHED CONFERENCE PROCEEDINGS

Andrevski, G., Ferrier, W.J., & Brass, D.J. 2007. Social capital and competitive behavior: A study of interfirm networks and rivalry among automakers. In George T. Solomon (Ed.), *Proceedings of the Sixty-Seven Annual Meeting of the Academy of Management* (CD), ISSN 1543-8643.

Andrevski, G. 2009. Competitive strategy and the alliance network formation: Understanding the origins of network positions. In George T. Solomon (Ed.), *Proceedings of the Sixty-Nineth Annual Meeting of the Academy of Management* (CD), ISSN 1543-8643.

MANUSCRIPTS UNDER REVIEW

Andrevski, G., Ferrier, W.J., & Brass, D.J. Social capital and competitive behavior: A study of interfirm networks and rivalry among automakers. *Under second review, Academy of Management Journal.*

Labianca, J., Fairbank, J., Andrevski, G., & Parzen, M. The dream of future aspirations and its relationship to planned organizational change. *Under second review, Strategic Organization.*

Chi, L., Ravichandran, T., & Andrevski, G. Digital platforms, network structure and competitive actions. *Revise and resubmit, Information Systems Research.*

WORK IN PROGRESS

Andrevski, G., Shaw, J.D., Richard, O., & Ferrier, W. Managerial racial diversity, competitive actions, and organizational performance. *Manuscript in preparation for Strategic Management Journal*.

Andrevski, G. Network structure, strategic entrepreneurship, and firm's ability to systematically outperform rivals. *Manuscript in preparation for Strategic Management Journal*

Andrevski, G., Shaw, J.D. Ferrier, W. Entrepreneurial proactiveness, competitive aggressiveness, and store performance among supermarkets. *Manuscript in preparation for Journal of Management.*

Yao, E., & Andrevski, G. The relationship between national culture and alliance termination: Evidence from the information technology industry. *Manuscript in preparation*.

Andrevski, G. & Ferrier, W. Opportunity recognition, opportunity exploitation and the position in the network structure: Conceptual model and empirical investigation. *Data collection*.

PROFESSIONAL PRESENTATIONS

Andrevski, G. 2009. Competitive strategy and the alliance network formation: Understanding the origins of network positions.
To be presented at the Academy of Management 2009 conference (Chicago)

Ofem, B. & Andrevski, G. 2009. CEO versus top management teams: Performance differences in the entrepreneurial environment.
To be presented at the Academy of Management 2009 conference (Chicago)

Andrevski, G., Shaw, J., Richard, O., & Ferrier, W. Racial diversity in management, competitive actions and firm performance.
Presented at the Academy of Management 2008 conference (Anaheim).
To be presented at the Strategic Management Society 2008 conference (Cologne, Germany).

Andrevski, G., Chen, D., & Yao, E. (alphabetical order). The relationship between country culture, and alliance termination: Evidences from the information technology industry.

To be presented at the Strategic Management Society 2008 conference (Cologne, Germany).

Labianca, J., Fairbank, J., Andrevski, G., & Parzen, M. The dream of future aspirations, and its relationship to planned organizational change.
Presented at the Academy of Management 2008 conference (Anaheim).

Andrevski, G., & Ferrier, W. Toward an "Austrian" theory of sustainable competitive advantage: The role of value-enhancing actions. *Presented at the Competitive Dynamics Research Workshop 2008 (Helsinki, Finland).*

Andrevski, G., Ferrier, W., & Brass, D. Social capital and competitive behavior: A study of interfirm networks and rivalry among automakers.
Presented at the Academy of Management 2007 conference (Philadelphia).
Presented at the ACAC 2007 conference (Atlanta).

Andrevski, G. & Shaw, J.D. Entrepreneurial orientation, competitive aggressiveness, and store performance among supermarkets.
Presented at the Academy of Management 2007 conference (Philadelphia).

Andrevski, G., & Damron, J. Toward a universal definition of the construct of competitive action in competitive dynamics research.
Presented at the Academy of Management 2006 conference (Atlanta).

Ferrier, W. & Andrevski, G. Behavior-eliciting options: Testing the waters prior to launching a competitive attack on rivals.
Presented at the Strategic Management Society 2006 conference (Vienna, Austria).

Andrevski, G. & Ferrier, W. Inter-firm networks, competitive behavior and performance in Automotive Industry.
Presented at the Midwest Academy of Management 2006 conference (Louisville).

ACADEMIC EXPERIENCE

Instructor:
Management 301 (spring, 2008); University of Kentucky*;* Avg. evaluation: 3.7/4.0

Strategic Management 499 (fall 2007); University of Kentucky; Avg. evaluation: 3.8/4.0

Management 301 (spring 2007); University of Kentucky: Avg. evaluation: 3.3/4.0

Management 301 (summer, 2006); University of Kentucky; Avg. evaluation: 4.0/4.0

Management 301 (spring, 2005); University of Kentucky; Avg. evaluation: 3.2/4.0

Managerial Finance (fall, 2003); Grand Valley State University; Avg. evaluation: 3.8/5.0

HONORS AND AWARDS

Winner of the 2009 Myrle E. and Verle D. Nietzel Visiting Distinguished Faculty Program Award –only three doctoral students received this award for the quality of their doctoral research at the University of Kentucky in 2009.

Winner of the 2008 Provost's Outstanding Teaching Award – one of only three graduate students to receive this honor across all colleges at the University of Kentucky in 2008

Max Steckler Fellowship Award for outstanding academic accomplishments
University of Kentucky (2007/2008 and 2008/2009)

Research Challenge Trust Fund II Gatton Doctoral Fellowship
University of Kentucky (2005, 2006, & 2007)

Kauffman Scholarship, AOM-Entrepreneurship Division (2007)

Delta Epsilon Iota Academic Honor Society (2008)
University of Kentucky

Beta Gamma Sigma Academic Honor Society (2003)
Grand Valley State University

International Student Scholarship, Padnos International,
Grand Valley State University (2002)

Certificate for Budget, Fiscal Management and Revenue Forecasting Training Program at Georgia State University sponsored by USAID and the government of R. Macedonia (2001)

PROFESSIONAL SERVICE

Ad-hoc reviewer, *Academy of Management Journal*, 2008

Ad-hoc reviewer, *Organization Science*, 2008

Ad-hoc reviewer, *Journal of Business Research*, 2007 - 2008

Session Chair at 2007 and 2008 AOM Conference – Entrepreneurship Division

Reviewer, AOM - Entrepreneurship Division, 2006, 2007, 2008

Reviewer, AOM - Business Policy and Strategy Division, 2006, 2008

PROFESSIONAL EXPERIENCE

Center of Applied Energy Research, University of Kentucky (summer 2007)
Research Consultant

Kent County Government Offices, Grand Rapids, MI (spring, summer 2003)
Internship

Merrill Lynch, Private Client Group, Grand Rapids, MI *(2002)*
Internship

Public Revenue Office, R. of Macedonia *(2000 – 2001)*
Senior Officer

Professional Basketball Player, FIBA (1992-2000)