# THE STRUCTURE OF COMPETITION

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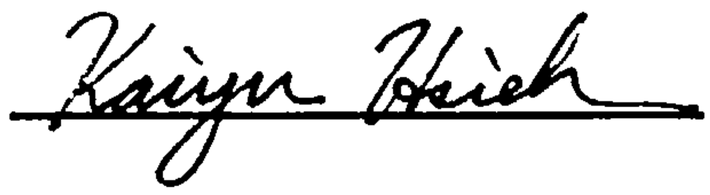
of the requirements for the degree of Doctor of Philosophy

# Declaration

I declare that the work presented in this thesis is my own.



# ABSTRACT

This thesis examines the structural patterns of interfirm competitive relationships using network analysis – a set of methods originally developed for analyzing the structure of social ties. The author views each firm in a multimarket space as facing a "competitive network," which consists of all market competitors of the ego firm and all competitive relationships associated with these competitors. Each competitive network has a structure, delineating how a firm's competitors interact with the ego firm, with one another, and with other market actors whom the ego firm does not directly encounter. The author develops and tests a new theory on competitive network structures, showing that a firm's conducts and performance are dependent upon the structure of its competitive network.

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# CHAPTER 1:

# INTRODUCTION

This thesis is about networks. Generally defined, a "network" consists of a set of nodes and the set of ties that connect these nodes. Here, "nodes" represent individual firms as actors in a multimarket space, while "ties" represent *not* cooperative, social relationships, such as embedded ties (Uzzi, 1997), strategic alliances (Gulati, Nohria, & Zaheer, 2000), interlocking directorates (Mizruchi, 1996), or common business group affiliations (Granovetter, 2005). In this thesis, "ties" represent competitive relationships between firms. What to be examined is *not* the structure of social networks, a subject that has attracted enormous scholarly attention (Borgatti & Foster, 2003; Brass, Galaskiewicz, Greve, & Tsai, 2004; Kilduff & Tsai, 2003). Instead, the subject of interest here is the network structure of interfirm competitive relationships.

More specifically, two firms are in a competitive relationship when they both operate in certain product or geographical markets; each market delineates a distinct set of products or buyers (Abell, 1980). For example, Figure 1 depicts firms' operation in multiple product markets in the computer industry. Firm *A* and firm *B* are in a competitive relationship because they both operate in the desktop computer market, and hence supply substitutable products. In contrast, firm *A* and firm *C* do not directly compete with each other, because they do not operate in any product markets in common.

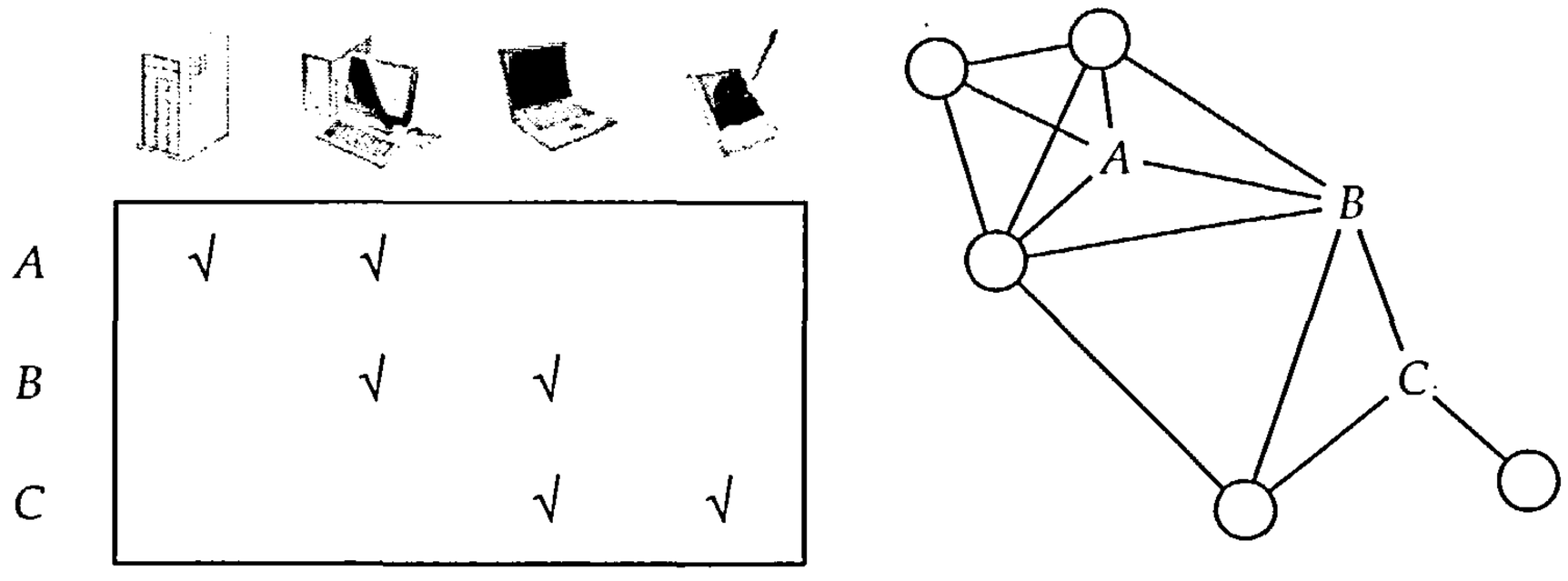


**Figure 1: The Network Structure of Interfirm Competitive Relationships**

This thesis explores the causal connections between the network structure of interfirm competitive relationships, interactive market behavior, and firm performance. Through a series of theory building works and empirical investigations, the author will demonstrate that a firm's conducts and performance are dependent upon how its competitors interact with the ego firm, with one another, and with other market actors whom the ego firm does not directly encounter.

## MOTIVATIONS

A key question in organization and management studies concerns how market environment affects firms' conducts and performance. Early literature used to depict environmental conditions using certain aggregate indices. These indices include – but are not limited to – market concentration ratio in industrial organization (Porter, 1981; Scherer & Ross, 1990), niche density in organizational ecology (Hannan & Freeman, 1989), and environmental munificence, complexity, and dynamism in open-system theory (Dess & Beard, 1984). By representing market environment in an aggregate way, the early literature implicitly assumed that all firms in a marketplace are subject to the same environmental conditions that cause the same regularities of

firm behavior. As a consequence, each firm's individual situation and conducts were largely overlooked (Astley & Van de Ven, 1983).

Network analysis (Scott, 2000; Wasserman & Faust, 1994) provides an alternative approach to depict external environment. Environment can be mapped as patterns of interorganizational ties that represent durable channels of social influences. Network analysis allows researchers to capture the wider environmental context and account for each firm's individual situation at the same time. For firms located in different positions in the wider network, the interconnected ties provide differential opportunities and impose differential constraints on firm behavior (Borgatti & Foster, 2003; Brass et al., 2004; Kilduff & Tsai, 2003).

In principle, interorganizational ties can take on endless forms. Most network studies, however, have focused only on cooperative, "social ties," which facilitate resource exchange or refract endorsement (Burt, 2000; Podolny, 2001). Little attempts have been made to examine networks of "competitive ties," which connect actors with conflicting interests (e.g., companies approaching the same buyers to sell substitutable products; academics applying for the same research grants to fund similar projects). In the network literature, competition has been conceptualized as an invisible tension between two actors who have identical social ties with similar others, hence being role substitutes for each other (Burt, 1987). Accordingly, literature has identified competitive relationships between pairs of actors through analyzing the network structure of their social ties. Nonetheless, scholars have not looked into the network structure of competitive relationships in its own right.

Such a focus on cooperative, social networks reflects the historical development of organization and network literature. Following Thompson (1967), scholars have long conceptualized organizations as open systems exchanging resources with their environment. The fundamental issue is to secure resource supply, and a key resolution is to maintain cooperative exchange relationships with crucial resource providers (Pfeffer & Salancik, 1978). As for economic sociologists, the notion of social embeddedness – that economic actions are "embedded in the concrete, ongoing systems of social relations" (Granovetter, 1985: 487) – has largely defined their research agenda. Researchers have been prompted to focus on cooperative ties, in the view that social relations usually emerge from positive experiences with identified others, through which trust, goodwill, and commitment can develop (Gulati & Gargiulo, 1999; Uzzi, 1997).

Yet, the methods developed for analyzing social network structures can well be applied to analyze the structural patterns of interfirm competitive relationships. The author expects this novel application of network analysis to generate fresh insights for research on market competition. In the extant literature, market competition has typically been treated either as dyadic interaction between paired market actors (Baum & Korn, 1999; Chen, 1996; Ferrier, Smith, & Grimm, 1999; Gimeno, 1999) or as aggregate properties of a marketplace (Hannan & Freeman, 1989; Porter, 1981; Scherer & Ross, 1990). Network analysis offers a middle ground between the predominantly micro and macro orientation: researchers may view firms' micro behavior as being influenced by the macro patterns of interfirm competitive relationships.

This thesis represents an early attempt to explore the potential of applying network analysis in the context of interfirm competitive relationships. The author views each firm in a multimarket space as facing a "competitive network," which consists of all competitors of the ego firm and all competitive relationships associated with these competitors. Thereby, the locus of analysis here is an ego-network. The working assertion here is that competitive network structures will influence interactive market behavior and firm performance.

In describing the structural properties of a firm's competitive network, the same techniques and measures developed by social network research (cf. Scott, 2000; Wasserman & Faust, 1994) will be utilized. For instance, the authors will examine the "density" of a firm's competitive network (i.e. the extent to which an ego firm's competitors directly compete with one another). Nonetheless, to makes sense of competitive network structures, researchers would need a brand new theory, since the dynamics of competitive interaction differ fundamentally from the dynamics of cooperative, social interaction. The remaining chapters of this thesis are devoted to developing a new theory that will help researchers to make sense of competitive network structures.

## STRUCTURE OF THE THESIS

The three chapters that follow present three self-contained but complementary essays. Chapter 2 and Chapter 3 lay the foundation. Each of the two chapters examines one structural property of a firm's competitive network, and shows how the specific property affects a highly prevalent form of interactive market behavior,

namely *imitation* (cf. Lieberman & Asaba, 2006). Chapter 4 integrates and extends. This final chapter utilizes the theoretical arguments and empirical findings presented in Chapter 2 and 3 to develop a general theory on competitive network structures.

Chapter 2 examines the extent to which a firm's competitors compete with one another. When a firm's competitors closely compete with one another, they will notice and react to one another's strategic moves at a higher rate. In such a situation, a move made by one competitor is likely to trigger a series of follow-on reactions by other competitors. In contrast, when many of a firm's competitors do not directly encounter one another, behavioral contagion between them will be limited. In such a situation, a strategic move made by one competitor may be perceived as an independent event. Empirical results show that a firm in this later situation is less inclined to react to its competitors' moves than a firm in the former situation.

Chapter 3 examines the extent to which a firm's competitors compete with other market actors whom the ego firm does not directly encounter. When a firm's competitors are caught up in competing with other actors, they will be left with limited capacity to monitor and compete with the ego firm. In such a situation, competitors are less likely to become aware the firm's strategic moves, and are less capable of taking counter reactions. Empirical results show that a firm's competitors have a lower rate of reacting to the firm's moves when they closely compete with other market actors.

Chapter 4 develops a general theory that integrates and extends the ideas examined in Chapter 2 and Chapter 3. The theory, illustrated graphically in Figure 2,

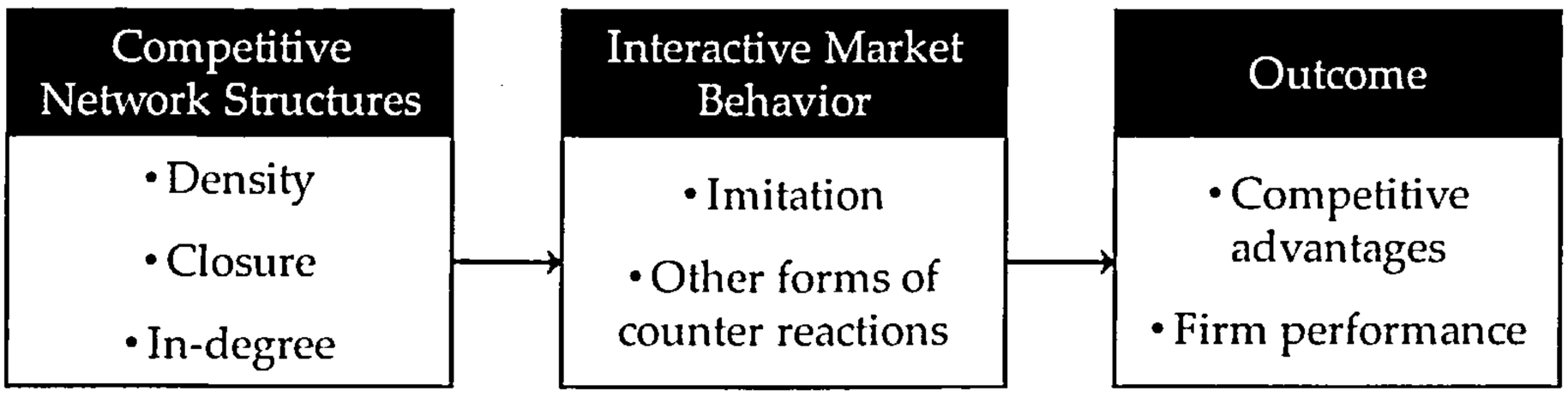


**Figure 2: A General Theory on Competitive Network Structures**

establishes the causal connections between competitive network structures, interactive market behavior, and firm performance. The author suggests that a competitive network characterized by low density, closure, and in-degree can decrease competitors' rate of reacting against the ego firm's strategic moves, allow the firm to accumulate competitive advantages through its moves, and thereby gives the firm a better opportunity for attaining superior performance. On the contrary, a performance-seeking firm is more constrained by its competitors' counter reactions when its competitive network is characterized by high density, closure, and in-degree.

# CHAPTER 2:

# ME TOO, OR NOT ME?

Imitation between market competitors is a highly prevalent form of interactive behavior that arises in a variety of business domains (Lieberman & Asaba, 2006). For instance, prior research has shown that firms are often inclined to follow their competitors into a new product or geographic market (e.g., Greve, 2000; Guillen, 2002; Haveman, 1993; Henisz & Delios, 2001). A prime reason for this behavior is uncertainty about the attractiveness of the new market (Greve, 1996). Herding theory (Banerjee, 1992; Bikhchandani, Hirshleifer, & Welch, 1992) suggests that mimetic behavior may occur when firms interpret the actions of others to reveal information unavailable to themselves. Firms may infer from the entry decisions of their competitors that a new market is attractive, which prompts them to enter too. Density dependence theory (Carroll & Hannan, 2000; Hannan & Freeman, 1989) and neo-institutional theory (DiMaggio & Powell, 1983) suggest that an increasing number of entrants creates legitimacy for a market, which makes it more attractive for others to follow suit (up to the point that heightened competition starts to deprive firms of resources). Mimetic entries stem from isomorphic pressures and increased legitimacy of the decision to become active in a particular market.

Managerial cognition also explains why firms imitate their competitors: competitors' actions are what firms observe and pay attention to (Greve, 1998). Many firms closely monitor and benchmark against their competitors (Porac, Thomas, Wilson, Paton, &

Kanfer, 1995; White, 2000). Since competitors enter the cognitive set of decision-makers, their actions are more likely to be assessed. Seeing competitors enter a particular new market increases the likelihood that the option of entering this market will be considered (Ocasio, 1997), and may focus managers' attention on the attractiveness of the market. As Greve (1998) puts it, "what you see is what you do."

While scholars have studied imitation behavior using a wide range of theoretical perspectives, most imitation studies have focused on the interaction between a potential imitator and a reference organization. For instance, firm *A* may enter a new market because *B* has entered there. The current study goes beyond this dyadic orientation, showing that the interaction between multiple reference organizations will influence a potential imitator's propensity to follow suit. For instance, firm *A* may enter a new market (or *avoid* the market in certain circumstances) by thinking that *C* and *D* will behave like *B* in entering the same market.

Specifically, the current study shows that the extent to which a firm's competitors directly compete with one another will influence the focal firm's propensity to imitate its competitors. In a multimarket industry, two market actors are in a competitive relationship when they both operate in certain common market, and are thereby "directly identifiable to each other" (Baum & Korn, 1996). For example, two market actors in the pharmaceutical industry compete with each other if they both operate within the cardiovascular market. Yet, a third actor that offers dermatological drugs, which the other two actors do not offer, is not a competitor of the two although all the three actors are in the pharmaceutical industry.

Some firms may find most of their competitors compete with one another for certain common markets, while some firms may find many of their competitors do not directly compete. Some firms may find their competitors mutually forbear from attacking one another, while some firms may find their competitors behave aggressively against one another. We will show that firms in these different situations will react differently to their competitors' market entry moves. Specifically, firms are especially inclined to follow their competitors when their competitors also directly compete, but mutually forbear from attacking one another. In contrast, firms tend to shy away from following their competitors who behave aggressively against one another. This is so, we argue, because a firm is most inclined to imitate its competitors when decision-makers perceive the competitors as belonging to a cohesive "cognitive group" (Peteraf & Shanley, 1997; Porac, Thomas, & Baden-Fuller, 1989; Reger & Huff, 1993) – a group that a firm wants to remain part of by matching group members' actions.

## MIMETIC MARKET ENTRY

### Imitating Competitors

Various studies have documented firms' propensity to match their competitors' market entry moves. For example, international business scholars have noted that when a firm sees its home-country competitors enter a new foreign market, its own propensity to enter the same market will increase (Gimeno, Hoskisson, Beal, & Wan, 2005; Knickerbocker, 1973). This mimetic tendency is particularly strong in an oligopolistic setting, where firms have relatively few competitors to pay attention to

(Yu & Ito, 1988). Firms' tendency to imitate their competitors extends to the choice of entry mode (Lu, 2002) and to location choices of production facilities (Baum & Haveman, 1997; Baum, Li, & Usher, 2000; Henisz & Delios, 2001; Sorenson & Audia, 2000).

Many firms closely monitor and benchmark against their competitors (Porac et al., 1995; White, 2000), which in and of itself may result in imitation. What decision-makers do depends on what they pay attention to (Ocasio, 1997). When attention is drawn to competitors' actions, the probability that a firm will act in a similar way increases, because the actions have entered the consciousness of decision-makers (Greve, 1998). Prior research has indicated that people value a considered behavioral option more positively, and experience psychological discomfort when not choosing it (Carmon, Wertenbroch, & Zeelenberg, 2003). Thinking about an option, even without having exercised it (Ariely & Simonson, 2003), has been shown to attach people to the considered option (Strahilevitz & Loewenstein, 1998). People are reluctant not to exercise such an option due to the anticipated discomfort of breaking the attachment (Ariely, Huber, & Wertenbroch, 2005), which results in a sense of loss that people would like to avert (Loewenstein, Weber, Hsee, & Welch, 2001). Hence, the fact that organizations pay attention to their competitors often increases the chance that they will mimic competitors' actions.

Decision-makers may also regard observing others' market entry decisions as a source of learning, which can reduce uncertainty about the attractiveness of a market. Social learning theory suggests that individuals watch the outcomes of others' actions and mimic those actions that appear to produce positive outcomes (Bandura,

1977). Similarly, firms may learn vicariously, imitating specific organizational strategies that appear to improve earlier adopters' performance (Levitt & March, 1988). Yet, while competitors' actions may be observed in the case of market entry, the outcomes of those actions are typically unobservable – at least in the short-term. In such a situation, a firm may view competitors' entry decisions as a proxy indicator of market attractiveness, reflecting competitors' privately held information (Banerjee, 1992; Bikhchandani et al., 1992). In other words, firms may imitate their competitors by assuming that "they must know something we don't."

Observing competitors' entries into a particular new market can also increase the anxiety that "we may be missing out on something important." While repeated entries can augment the public acceptance of an entry move (Haveman, 1993), not entering may seem increasingly illegitimate to decision-makers (Guler, Guillen, & MacPherson, 2002). This perception may encourage risk-averse managers to imitate the entry move, to avoid being penalized for not having acted while others reap the benefits (Brandenburger & Polak, 1996; Scharfstein & Stein, 1990). When it comes to the decision of whether or not to follow suit, the risk of "losing out" by not acting is psychologically bigger than the risk of "failing to gain" by imitating (Kahneman & Tversky, 1979). As Scharfstein and Stein (1990: 466) put it, "an unprofitable decision is not as bad for reputation when others make the same mistake." Thus, firms may imitate their competitors' market entry moves to maintain competitive parity (Gimeno et al., 2005; Knickerbocker, 1973) and to avoid becoming "the odd one out." This line of reasoning suggests that:

*Hypothesis 1: The larger the number of a firm's competitors that have entered a new market, the more likely the firm will enter the same market.*

**Direct Encounter between a Firm's Competitors**

We have suggested that firms and their decision-makers may feel increasingly anxious when they observe more and more of their competitors enter a particular new market. This anxiety is caused by the fear of potentially missing out on something important if they do not follow suit. Yet, we expect the extent of this anxiety to be dependent on the wider competitive context. Specifically, a firm that faces a dense "network of competitive relations" – in which most of the firm's competitors directly compete with one another – will respond differently to its competitors' entry moves in comparison with a firm whose competitors rarely compete with one another.

Compare firm *A* and firm *B* in Figure 3: while firm *B*'s competitors directly compete with one another, firm *A*'s competitors do not encounter one another in any common markets. Research on cognitive groups has suggested that a collection of market actors may be perceived as forming a cognitive group if they directly encounter and identify one another (Peteraf & Shanley, 1997; Reger & Huff, 1993), which usually occur when their market domains overlap (Porac & Thomas, 1990). Accordingly, firm *B* is more likely to regard its competitors as forming a group than firm *A*. When firm *B* sees an increasing number of its competitors enter a new market, it may interpret these entry decisions as indicating a collective movement of a group –which it has to decide whether to follow suit or not. In contrast, firm *A* may regard its competitors

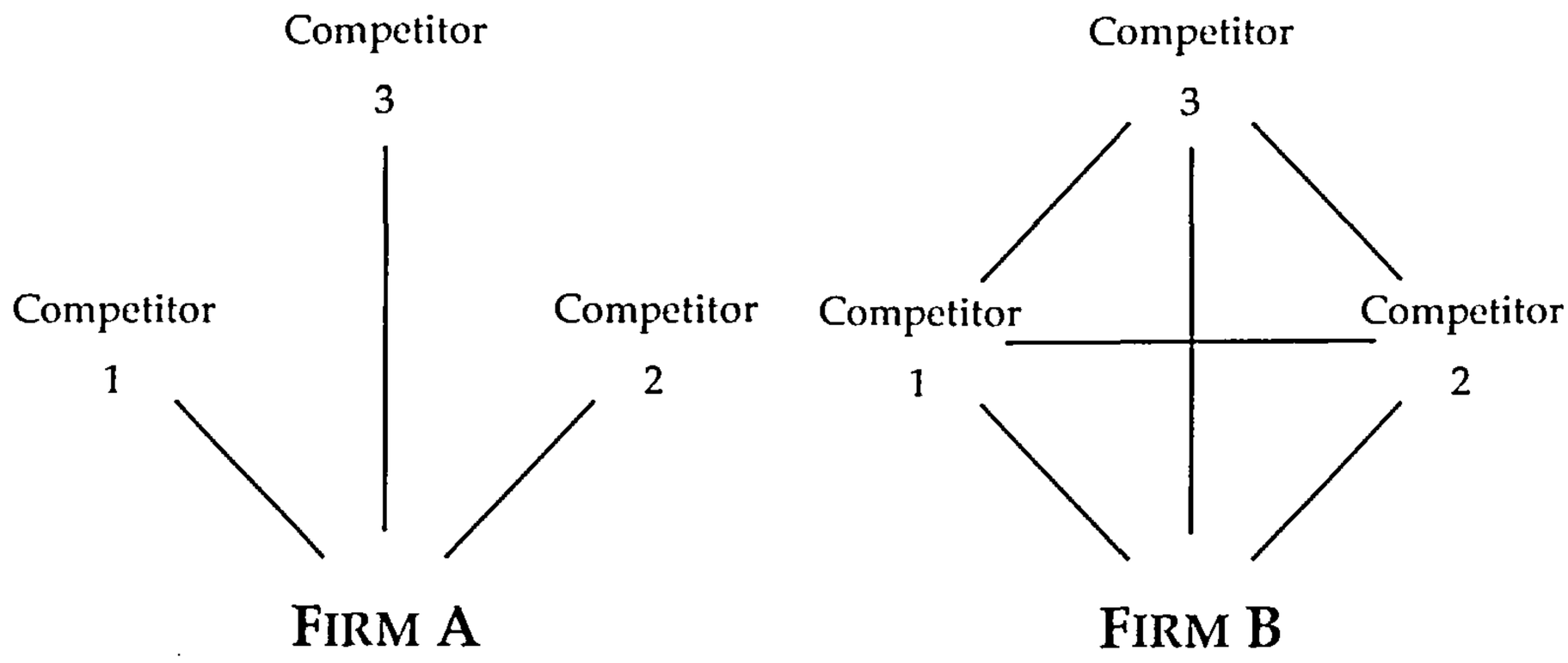


**Figure 3: Direct Encounter between a Firm's Competitors**

as individual actors. When firm *A* observes its competitors enter a new market, it may interpret these entry decisions as independent events.

Cognitive models of competition have been shown to provide the basis for interaction between market actors (Porac et al., 1989; Porac et al., 1995; Reger & Palmer, 1996). When a firm perceives its competitors' entry decisions as representing the collective movement of a group – and a group it wants to remain part of – the scenario of becoming the "odd one" in the group by choosing not to follow suit becomes increasingly unattractive. The psychological pressure to conform increases, as the risk of not being in the entering group when the market turns out to be very profitable weighs more heavily than when the entire group suffers from a faulty entry decision. Managers' perception that they are at risk of being left behind becomes more and more salient with each competitor entering.

When the entire group of competitors got it wrong and the new market turns out to be unattractive, decision-makers will not suffer the critique from stakeholders (such as investors and analysts) as much as when a loss is the result of an individual

mistake (Scharfstein & Stein, 1990), such as not entering when the firm should have done so. The idea of potentially being the only one in a group to get things wrong will be perceived as a grave mistake, which decision-makers would want to avoid. In contrast, when the competitors entering the new market did not previously encounter one another, decision-makers may perceive these entry decisions as independent events rather than a collective movement of a group. In this case, the option of not entering becomes more viable, since a firm will not lose its (social-psychological) membership of a group by staying behind, and its decision is less likely to be benchmarked against the entrants. Therefore, we predict that the extent to which a firm's competitors directly compete with one another will positively moderate the relationship specified in hypothesis 1:

*Hypothesis 2: A firm is especially inclined to follow its competitors into a new market when many of its competitors directly compete with one another.*

**Multimarket Contact between a Firm's Competitors**

When a firm's competitors directly compete with one another, some of them may encounter one another in multiple markets, creating the situation of multimarket contact (Bernheim & Whinston, 1990; Jayachandran, Gimeno, & Varadarajan, 1999; Karnani & Wernerfelt, 1985). Prior research has shown that multimarket contact between competitors can potentially lead to "mutual forbearance," in the form of non-aggressive behavior towards one another. Multimarket competitors may refrain from attacking one another to avoid multimarket retaliation. Multimarket contact has been shown to be associated with higher profits (Feinberg, 1985; Scott, 1982), more

favorable price-setting (Evans & Kessides, 1994), and lower rates of market exit (Barnett, 1993; Baum & Korn, 1999; Boeker, Goodstein, Stephan, & Murmann, 1997). Accordingly, when a firm's competitors encounter one another in multiple markets, their intensity of competition will be reduced.

Consider firm *B* and firm *C* in Figure 4: firm *B*'s competitors directly encounter one another, and so do firm *C*'s competitors. Yet, while firm *C*'s competitors are engaged in multimarket competition, firm *B*'s competitors do not. We expect firm *C* to be more prone to imitate its competitors, because these competitors will be perceived as forming a cohesive, mutual-forbearing group of market actors. Firm *C* may intend to stay close with the group and benefit from the positive spill-over of group members' affable behavior. For example, price-setting may be done in a non-aggressive way, from which everyone will benefit (Haveman & Nonnemaker, 2000).

When a firm observes some members of a cohesive, mutual-forbearing group enter a new market, it will be reluctant to be left behind. Competitors' history of benign and

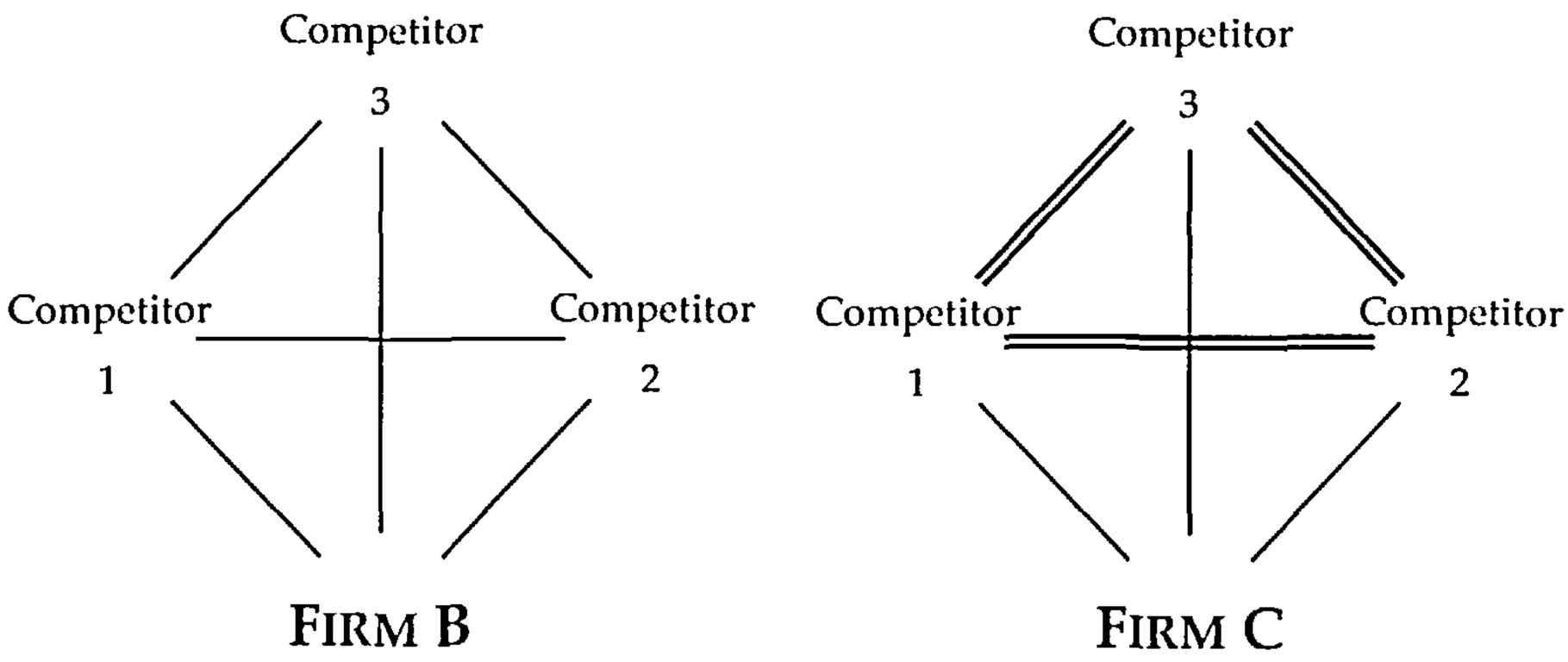


**Figure 4: Multimarket Contact between a Firm's Competitors**

forbearing behavior towards one another will make following them into a new market an attractive option. Thus, we predict that when a firm whose competitors are engaged in multimarket competition sees more and more of these competitors enter a new market, it will be particularly inclined to enter the same market. Accordingly, the extent to which a firm's competitors encounter one another in multiple markets will positively moderate the relationship specified in hypothesis 1:

> *Hypothesis 3: A firm is especially inclined to follow its competitors into a new market when many of its competitors encounter one another in multiple markets.*

**Equivalent Market Dependence between a Firm's Competitors**

While a high degree of multimarket contact between market actors can potentially lead to mutual forbearance, multimarket competition and mutual forbearance do not always go hand in hand. Mutual forbearance tends to emerge when multimarket competitors have different "spheres of influence" (Edwards, 1955; Jayachandran et al., 1999), that is, when they have asymmetric interests in their common markets. This situation occurs when two multimarket competitors have small footholds in each other's major market. For example, Gimeno (1999) showed that airlines use a relatively small presence in their competitors' main hubs to reduce the competition in their own hub. In contrast, mutual forbearance is unlikely to occur when two multimarket competitors depend heavily on the same market. For example, if two airlines share the same main hub, while all other routes are of marginal importance to both of them, competition in their shared hub is likely to be fierce. Their minor

interests in other routes do not carry sufficient weight to de-escalate competition in the shared hub. Thus, multimarket contact is not a sufficient condition for mutual forbearance, which occurs only when multimarket competitors have asymmetrical dependence on their common markets.

Consider Figure 5 as an example: two competitors of firm C encounter one another in two markets. Competitor 1 depends 90 percent on market W (e.g., it generates 90 percent of revenues there) and only 10 percent on market X. The situation for competitor 2 is almost the reverse; it depends only 12 percent on market W and 88 percent on market X. Mutual forbearance is likely in such a situation, because competitor 1 may respect competitor 2's interest in market X in exchange for competitor 2's restraint in market W. In contrast, consider the case of firm D. Again, competitor 1 depends 90 percent on market Y and 10 percent on market Z. Now, however, its market dependence pattern is highly similar to that of competitor 2, who also depends to a high degree on market Y (88 percent) and has relatively few activities in market Z (12 percent). We call this a situation of highly equivalent

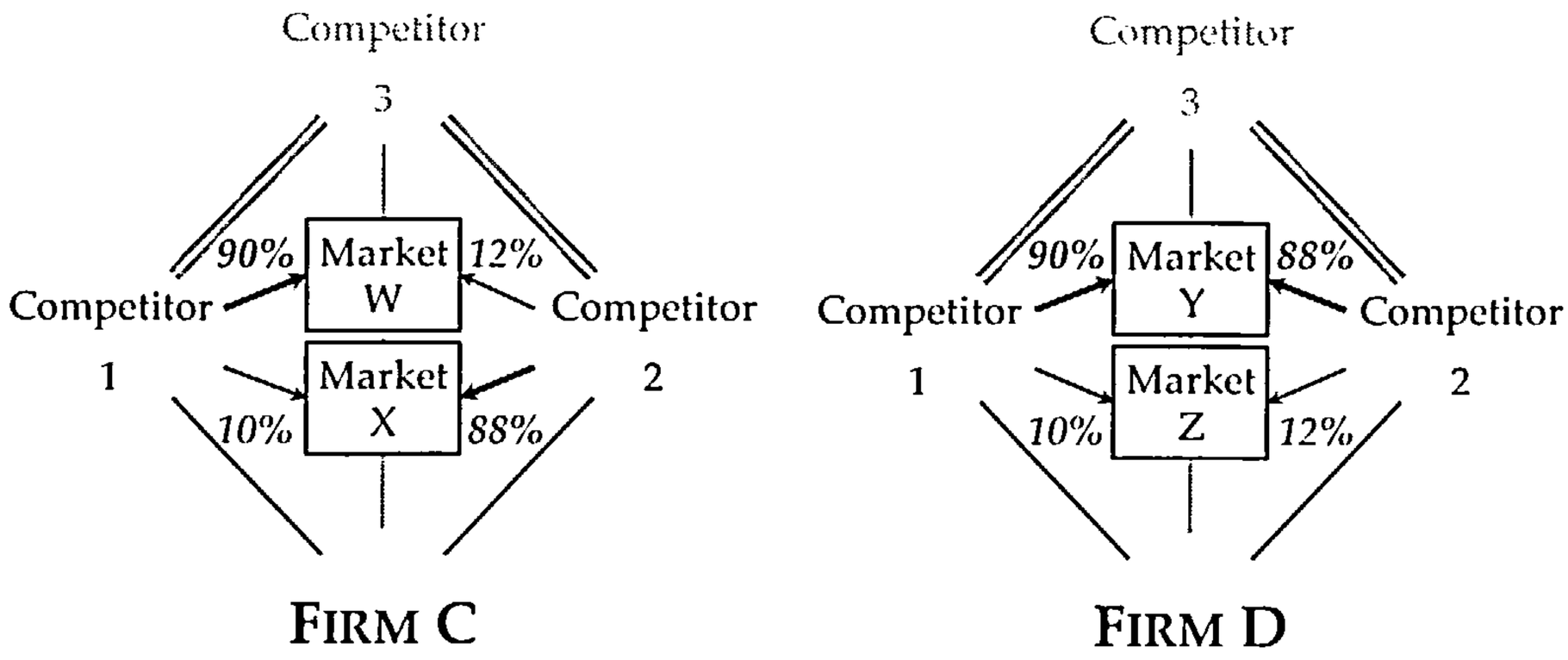


**Figure 5: Equivalent Market Dependence between a Firm's Competitors**

market dependence. In this case, aggressive, "cut-throat" competition – instead of mutual forbearance – is more likely. Since both competitors will perceive market Y as strategically important, they tend to compete intensely against one another for the important common market (Chen, 1996; Chen & MacMillan, 1992). The threat of retaliation in market Z, which is marginal to both parties, will not be much of a deterrent.

We expect that when a firm's competitors have highly equivalent market dependence – and thus are induced to aggressively compete against one another – the firm will be less inclined to imitate them. The firm will see its competitors as a group of aggressive competitors, who attempt to dominate rather than tolerate one another. Their aggressive behavior may incur negative spillover. For example, intense price competition between these competitors will also hamper everyone's profit margin. This will make competitors appear as forming a rather unattractive group, which the firm may not want to remain part of. When a firm observes some members of an aggressive group entering a new market, the option of following suit will not appear very attractive. Observing these members' aggressive behavior in the past, the firm may expect competition in the new market where they enter to become fierce as well. Thus, rather than being inclined to follow suit, the firm may be motivated not join its competitors in the new market, so that it can steer clear and distance itself from the fierce competition. Thus, we predict that if a firm whose competitors have highly equivalent market dependence sees an increasing number of its competitors enter a new market, it will avoid entering the same market.

Accordingly, the extent to which a firm's competitors have equivalent market dependence will negatively moderate the relationship specified in hypothesis 1:

> *Hypothesis 4: A firm is likely to avoid following its competitors into a new market when many of its competitors have highly equivalent market dependence.*

## METHODS

We performed two complementary studies to test our hypotheses. The first study concerns all domestic drug producers in the Chinese pharmaceutical industry during the period 1993-2001, and their propensity to imitate one another's product market entry moves. In this study, product markets are identified as therapeutic drug categories, such as cardiovascular drugs, dermatological drugs, etc. The second study concerns all Taiwanese PC (personal computer) hardware manufacturers during the period 1999-2005. In this case, market entry pertains to investments into different geographic regions within China. Both contexts were characterized by a high level of uncertainty due to rapid environmental changes and intense competitive pressure. Consistent results across these two studies should build confidence in the generalizability of our findings.

We modeled the likelihood of firms' entering a particular market using Cox hazard rate models (Cox, 1975). In all these models we carefully controlled for several factors affecting a firm's entry decisions that otherwise could have formed alternative explanations for our findings. For example, in study 1 we controlled for market

density and density square, to rule out the alternative explanation that firms mimic their competitors' entry moves because the target market is gaining legitimacy (Carroll & Hannan, 1989; Hannan & Freeman, 1989). Furthermore, strategy literature suggests that firms may diversify into new market domains in which they can leverage their existing capabilities (Chatterjee & Wernerfelt, 1991; Markides & Williamson, 1994). If so, firms that operate in the same market may have a similar preference when it comes to new market entry. Therefore, in both studies we stratified our models by firms to control for any firm-specific effects. We also estimated models stratified by market and added various other controls that capture general attractiveness of a particular market. Thus, our models estimate whether a firm's propensity to enter a new market increased or decreased due to its competitors' prior entry moves, as moderated by the competitive relationships between its competitors.

## Study 1: The Chinese Pharmaceutical Industry

**Research setting.** The first database used to test our hypotheses consisted of all domestic producers of active pharmaceutical ingredients in China, observed during the period 1993-2001. During the period of observation, the Chinese pharmaceutical industry was characterized by a high level of uncertainty, which is a primary motivator of mimetic behavior.

Uncertainty stemmed from a number of sources. Prior to the start of economic reform in the 1980s, individual provinces in China were encouraged to become self-sufficient in major industrial sectors, which had guided local governments to set up a

large number of drug producers and distributors. These drug producers had operated solely in accordance with the production plans set by the government's public health agency, whose primary concern was with assuring the supply of basic pharmaceuticals, not profit or innovation. Consequently, the industry became characterized by bulk capacity of generic drugs, not novel drugs, and a focus on output volume (White & Liu, 1998). Firms were primarily engaged with meeting the output targets that had been centrally set for them.

Towards the late 1980s, and continued in the 1990s, China's economic reform towards a market economy started to force drug manufacturers to move beyond their traditional production role and assume the administrative responsibilities that had been previously handled by government agencies (Guthrie, 1997). These moves toward a market economy also faced managers with a changing interorganizational environment, in the sense that interaction between firms started to be increasingly guided by price, competition, and profit seeking. Thus, more and more, managers had to become involved in strategic decision-making (White, 2000). All these developments confronted managers with considerable uncertainty – which before they had been shielded from – in terms of possible strategic actions by their competitors and the consequences of their own decisions.

The economic reform also exposed firms to uncertainty in other areas, such as customer demand. Previously, drugs had been subject to price regulations, but many of those were abolished in the process of market liberalization, triggering substantial rises in drug prices. Concurrently, a series of changes in China's national healthcare system all but terminated the old cooperative medical system in the large rural areas,

leaving a sizeable part of the country's population without public health coverage. In industrialized urban areas, where demand for Western drugs had been growing rapidly, residents, who were covered by the national insurance scheme, passed on their medical bills to the government, who therefore faced rapidly rising healthcare expenditure. Drug price increases were exacerbated by hospitals, who sold around eighty percent of the drugs in the urban areas. Urban hospitals served the dual role of both prescribing and selling medication. This situation often resulted in over-prescription and high mark-ups.

The Chinese government attempted to rationalize drug production, distribution, and prescription in response to these developments. This resulted in a series of policy measures throughout the observation period (1993-2001). For example, in 1995, the Ministry of Health launched the Good Manufacturing Practice (GMP) certification program, which all firms in the industry had to comply with or cease operations. The Ministry of Health also attempted to curb medical bills by developing a list of drugs that were approved for reimbursement, at particular prices, under the national insurance scheme. The initial list (of about 1,400 drugs) was continuously amended and, when it started to expand significantly, the government introduced a series of mandatory price caps. These developments put considerable pressure on drug producers' margins.

The Chinese government also sought to separate the functions of medical consultation and drug dispensing in order to remove hospitals' incentives to over-prescribe and over-charge for drugs. In 1997, a regulatory distinction between "ethical" and "over-the-counter" drugs was introduced, which was followed by the

rapid development of retail pharmacy. Subsequently in 2000, the state council issued a policy statement that forced hospitals to transform their outpatient drug dispensing divisions into independent retail outlets with separate profit-and-loss accounts. In addition, to further strengthen retail and distribution, the Ministry of Health launched the Good Selling Practice (GSP) certification program, which all drug distributors in China had to conform to by 2004. These various ongoing public policy changes intensified competitive pressure on drug producers, often urging them to make substantial investments (for instance to comply with the GMP standards), to explore more profitable market positions, or to achieve efficient scale. All these changes in the country's healthcare system, government regulations, and customer demand introduced considerable uncertainty in the entire industry in terms of the attractiveness of the different product markets.

**Data.** We compiled our longitudinal data for the period 1993-2001 using the *Pharmaceutical Industry Yearbook,* an industry directory published annually by the Chinese National Bureau of Statistics. The Yearbook combines the government records of various public healthcare agencies and covers every drug manufacturer in China, providing detailed production data on all the drugs produced by each manufacturer in any given year. As the pharmaceutical industry is highly regulated and monitored, these official records are very comprehensive. Using this information source, we were able to identify the whole population of drug manufacturers in China, as well as every product-line-expansion event during our period of observation.

Our database consists of the entire population of Chinese producers of Western scientific medicine, as listed in the Yearbook. During the observation period, there were 1,529 firms with their own manufacturing facilities for active pharmaceutical ingredients. These firms included state-owned enterprises, private firms, and some joint-ventures with foreign companies. Industry experts suggested that a large number of these firms were highly specialized companies who focused their efforts on the production of just few specific ingredients, and were often short-lived and unlikely to diversify into other product categories. Since this might distort statistical results, in the analysis presented below, we only included 709 firms that had ever produced at least two distinct active ingredients during the observation period. Yet, we repeated the analyses on the data covering all firms, and found consistent results.

In total, these drug manufacturers produced 1,120 active ingredients. The State Food and Drug Administration classified all active ingredients into 22 therapeutic categories (see Appendix for details). Ingredients that act on the same organ or system and have similar therapeutic characteristics are grouped into the same category. Producing ingredients with different therapeutic effects requires drug producers to acquire and exercise different technical know-how, and deal with different distributors and physicians. Therefore, each therapeutic category delineates a distinct product market within the pharmaceutical industry. We used these categories to define interfirm competitive relations and identify market entry actions. Two drugs producers were regarded as competing with each other if they produced active ingredients in at least one common category. A market entry move was

defined to occur if a drug manufacturer started to produce an ingredient in a therapeutic category that it was not active in before.

### Study 2: The Taiwanese Computer Hardware Industry

**Research setting.** Our second database consists of all manufacturers of personal computers and ancillary hardware in Taiwan in the period 1999-2005, and all their investments into China up to the year 2005. Taiwan's computer industry emerged in the 1980s when IBM introduced the PC architecture using a modular design, and decided to subcontract the production of almost all PC hardware components to outside vendors. In the wake of IBM's initial success in the market, a large number of producers of so-called "clones" emerged, which assembled IBM compatible computers using the same design and standardized components. Low product differentiation resulted in aggressive price competition, shifting production of the standard components to a large extent to countries in the Far East, such as Japan, Korea, and Taiwan. Nowadays, most Taiwanese computer hardware producers are contract manufacturers for foreign brands such HP, Dell, and IBM. Yet, unlike manufacturers in Japan and Korea where production is dominated by few large, diversified conglomerates, Taiwan's PC industry consists of a large number of medium-sized producers, located in a 50-mile stretch south of the capital Taipei. These medium-sized companies specialized in rapidly adapting their production to technological innovations, by moving quickly into emerging product technologies, while jumping onto the next technology available as soon as margins eroded. This flexibility enabled Taiwan to emerge as a key player in the global PC industry in 1990s (Dedrick & Kraemer, 1998).

Yet, in the late 1990s, this strategy also became associated with increasing uncertainty. Product life cycles, for instance, had shortened dramatically. In 1985, the product life cycle in the PC industry was about one year, while by 1999 a new product technology would typically be replaced by a more advanced model within three months (Curry & Kenny, 1999). In addition, the global PC market experienced large price erosion. In the United States, during 1997-1998 the average retail price of a PC decreased from $1,800 to about $1,000. By 1999, PC's selling for less than $1,000 accounted for 68 percent of the retail market, while the sub-$600 segment was growing rapidly, and a sub-$400 market was beginning to emerge (Curry & Kenny, 1999). One important factor behind the price erosion was the entry of three Intel-compatible microprocessor producers – AMD, Cyrix, and IDT. Losing its monopoly position in the PC microprocessor market, Intel reacted by further accelerating product innovation, confining its competitors in the medium and low-performance market. Soon, however, most PCs became so powerful that few applications required an even faster machine. As a result, corporations and consumers began to slow down their replacement cycles. Consequently, between 2000 and 2001, the market demand for PCs declined – for the very first time ever since IBM introduced the PC in 1981. The 1997 Asian Financial Crisis further exacerbated these developments.

While Taiwanese PC hardware producers were struggling to adapt to the changing business environment, the Chinese economy had been relatively sheltered from the Asian Financial Crisis. Towards the late 1990s, a significant amount of economic wealth had shifted from other Eastern Asian countries to China. Concurrently, from 1991 onwards, the Taiwanese government gradually relaxed its regulatory

restrictions, permitting high-technology companies, such as computer hardware manufacturers, to invest in China. For Taiwanese manufacturers, China not only offered the possibility to set up low-cost production facilities, but also became increasingly significant as a market in itself. Levels of economic wealth were increasing rapidly in various areas within China, with local demand for PCs surging. Therefore, although few companies had a significant presence in China in the middle 1990s, by 2005 (the end of our sample period) investment by Taiwanese PC manufacturers into China accounted for 65 percent of their total foreign investments.

**Data.** The data used in this study concerns all Taiwan's listed companies that had ever produced PC hardware using in-house manufacturing facilities during the period 1999-2005. Companies were identified from two bourses in Taiwan: the Taiwan Stock Exchange, where larger and more established companies are listed, and the GreTai Securities Market, which lists securities of smaller, entrepreneurial companies. Regulations in Taiwan require listed companies to disclose in annual reports their sales of every product type accounting for no less than 10 percent of a company's total sales. Using Standard Industry Classification (SIC) categories, we selected all firms that were reported to be active in at least one of the following five product markets: computers, monitors and terminals, computer peripherals, audio and video equipment, and communication equipment. This resulted in 205 companies.

From these 205 companies we proceeded to identify all their competitors. Two companies were regarded as competing with each other if they operated in at least one common product market. Since many of the 205 companies had diversified into

other related sectors – for example optoelectronics components – we also obtained information about their competitors in those sectors. This concerned another 344 companies. In total, the 549 competitors operated in 20 different product markets (see Appendix for details).

For all 549 companies, we traced back all their investments into China – up to the year of 1980, before which Taiwanese investment into China was non-existent – using two complementary sources. First, the Investment Commission – the regulation agency of foreign investment in Taiwan – reviewed and kept records of every investment project over US$20,000. In addition, Taiwan's listed companies self-reported their activities in China to the Market Observation Post System; an open information platform managed by the Taiwan Stock Exchange. In combination, these two sources provided a comprehensive coverage of all investments into China by Taiwanese companies. These data were updated by quarters. During the period 1999-2005, 389 of the 549 companies in the database had made 650 new entries into 22 different geographical markets in China. A geographical market was defined as a province, a municipality, or an autonomous region in China. A market entry was defined as the first direct investment made by the company in a particular geographic market.

**Dependent Variables and Method of Analysis**

Our hypotheses pertain to the chance that a firm will enter a specific new market, as influenced by its competitors' prior entry moves. We estimated market entry rate using Cox's semi-parametric proportional hazard model (Cox, 1975). A firm was "at

risk" of entering a market that it was not yet active in. The dependent variable in a Cox model is *hazard rate*, or instantaneous probability of a firm entering a particular (product or geographic) market at a specific point in time.

In study 1 (the Chinese pharmaceutical industry), observations were determined by firm, year, and therapeutic category. A "spell," or time-to-event, started either at the beginning of the period of observation (1993), in which case the observation was left-censored, or at the point of founding of a specific drug manufacturer (if after 1993). A spell ended in an event when the firm entered the particular market, or was right-censored at the end of the observation period (2001) or because the firm went out of business before then. In study 2 (the Taiwanese PC industry), observations were determined by firm, quarter, and geographic region within China. A spell ended into an event if the firm entered the particular market; otherwise the observation was right-censored, either in the quarter that the firm was dissolved or because it had not entered by the end of 2001.

Cox's semi-parametric models do not require researchers to make restrictive assumptions about the probability distribution of the hazard rate, in that they do not require the specification of a particular functional form for the baseline hazard. The basic analytical question we intended to model is "does the probability that this firm will enter this particular market increase or decrease as a consequence of its competitors' entry moves?" Our models can be written as:

$$h(u) = h_0(u) \cdot \exp\left(X'\beta + \varepsilon\right)$$

In the equation above, $h(u)$ denotes a firm's hazard of entering a specific new market with a spell duration $u$. $h(u)$ is the product of the baseline hazard $h_0(u)$ – which is left unspecified except for being non-negative – and an exponential linear function of time-varying covariates (denoted by $X$). We stratified the baseline hazard by both individual firms and calendar time. Thus, our models control for any firm-specific and time-variant influences on a firm's market entry rate.

As a robustness check, we also estimated all our models stratified by market (in addition to firm and calendar time) to account for unobserved factors that might make some markets particularly attractive, which could potentially have led to the faulty interpretation that firms are imitating each others' moves while in reality they independently pursued the same attractive market. These models yielded consistent results.

**Explanatory Variables**

*Prior entry by competitors* was a time-variant variable measured as the number of a firm's competitors that had entered into the particular market before. Below, we report the results as based on this simple count measure, since they can be easily interpreted. Yet, we also computed a measure weighed by the size of each of the competitors (using annual sales), since prior literature has suggested that organizations may be more inclined to imitate large firms (Greve, 2000; Haunschild & Miner, 1997; Haveman, 1993). This weighted measure yielded consistent results.

*Competitors' direct encounters* captured the extent to which a firm's competitors also competed directly with each other, in the sense that they operated in at least one

common market. In study 1, a market is defined as one of the therapeutic categories. In study 2, a market is identified as one of the 20 product types. We measured this variable as the proportion of a firm's competitors that encountered each other in certain common markets:

$$\text{Competitors' direct encounter} = \frac{\sum_{k=1}^{N_i} \sum_{l=1}^{N_i - k} c_{kl}}{N_i \cdot (N_i - 1)/2}$$

In the above equation, $k$ and $l$ denote pairs of firm $i$'s competitors. $c_{kl}$ is a dummy that is set to one if competitors $k$ and $l$ competed with each other in at least one common market. $N_i$ denotes the number of firm $i$'s competitors, while $N_i*(N_i - 1)/2$ is the number of all possible competitor-by-competitor pairs.

*Competitors' multimarket contact* captured the extent to which a firm's competitors were engaged in multimarket competition, in the sense that they encountered each other in at least two markets. We measured this variable by computing what proportion of the firms' competitors who directly competed with one another did so in multiple markets:

$$\text{Competitors' multimarket contact} = \frac{\sum_{k=1}^{N_i} \sum_{l=1}^{N_i - k} mmc_{kl}}{\sum_{k=1}^{N_i} \sum_{l=1}^{N_i - k} c_{kl}}$$

In the above equation, $mmc_{kl}$ is a dummy set to one if competitor $k$ and $l$ directly competed with each other in two or more markets.

*Competitors' equivalent dependence* measured the extent to which a firm's competitors had similar dependence on the same set of markets. In study 2, we captured the level

of a firm's dependence on a particular market through the proportion of its sales that was generated in that market. In study 1, however, firms' sales per market were not always available. Therefore, we captured the level of a firm's dependence on a particular market through the proportion of its total drug portfolio that the firm offered in that market. This measure assumes that, on average, if a firm has only one product in a particular market, it will depend less on that market than on the market in which it offers a whole range of products. Subsequently, for both studies, equivalence between a firm's two competitors was measured as the inverse of the following Euclidean distance score:

$$d_{k,l} = \sqrt{\sum_m \left( \frac{s_{k,m}}{s_k} - \frac{s_{l,m}}{s_l} \right)^2}$$

In the above equation, $s_{k,m}$ denotes the number of active pharmaceutical ingredients (study 1) or the sales (study 2) that competitor $k$ generated in market $m$, and $s_k$ denotes the total number of ingredients or sales of competitor $k$. The equivalence score between $k$ and $l$, denoted by $q_{k,l}$, was computed by subtracting $d_{k,l}$ from a constant equal to the maximum distance score in the sample. The variable *competitors' equivalence* was measured as the average of $q_{k,l}$ across all competitors' direct encounters:

$$\text{Competitors' equivalent dependence} = \frac{\sum_{k=1}^{N_i} \sum_{l=1}^{N_i - k} q_{k,l}}{\sum_{k=1}^{N_i} \sum_{l=1}^{N_i - k} c_{k,l}}$$

## Control Variables

Our predictions concern firms' differing propensity to follow their competitors into a particular new market. A firm's hazard of entering into a particular market is expected to rise or decline as a result of competitors entering, depending on the particular competitive relations between those firms. Observed similarity between a manufacturer's entry decisions and those of its competitors, however, may not necessarily point at imitative behavior, since different actors can sometimes reach the same entry decision independently. Therefore, in addition to firm and market stratification, we controlled for various characteristics of a particular market that can cause behavioral similarity.

**Study 1.** In all our models pertaining to the Chinese pharmaceutical industry we accounted for density-dependent legitimation and competition dynamics (Hannan & Freeman, 1989) by controlling for *market density*, measured as the total number of firms that were active in a market at any given time, and *density squared* (divided by 100 for rescaling). In accordance with prior literature, we expected the entry hazard to increase with density but decrease with density squared, that is, to follow an inverted U-shape (Carroll & Hannan, 1989; Greve, 2000; Haveman, 1993).

The attractiveness of a particular market could increase due to some exogenous factors. An increase in market attractiveness could manifest itself in growth in the total number of firms entering the market. Therefore, we controlled for annual *growth in the number of firms*, measured proportionally as the net change in market density

divided by the density of the market in the previous year. We expected the entry rate to increase with the annual growth in the number of firms.

Literature in industrial economics has suggested that excess capacity and high market concentration can deter entry (Scherer & Ross, 1990). To construct a measure for *excess capacity* in a market, we cumulated the firms' production capacity and subtracted the market's total production volume, and then divided this number by the product's total production volume to arrive at a measure of relative excess capacity. We controlled for *market concentration* by measuring the proportion of market output by the four largest manufactures in a market (the CR4 index). We expected the entry rate to decrease with both excess capacity and market concentration. Finally, in all our models, we included the natural logarithm of *total market output*, to indicate the current size of a market.

**Study 2.** To control for the attractiveness of a particular geographic market in China, we added four time-variant controls: *wealth per capita* (captured by average gross domestic product, disposable income, and household expenditure per capita), the level of *internationalization of the market* (captured by imports, exports, and total foreign capital), the availability of *skilled labor* (captured through indicators of the proportion of the population with college degrees, number of recent college graduates, and number of professionals in the region), and the extent to which the market had a well developed *transportation infrastructure* (captured through highway and railway density indicators). These variables were constructed using macroeconomic indicators obtained from the *China Statistical Yearbooks*. Appendix lists all these variables and indicators and a test of discriminant validity using

## Table 1: Summary Statistics

**The Chinese Pharmaceutical Industry**

| Variable | Mean | S.D. | Min | Max | Correlations | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 No. of competitors' prior entry | 18.59 | 18.51 | 0 | 149 | | | | | | | | |
| 2 Competitors' direct encounter | 0.85 | 0.15 | 0.44 | 1.00 | -.19 | | | | | | | |
| 3 Competitors' multimarket contact | 0.31 | 0.15 | 0.09 | 1.00 | -.15 | .08 | | | | | | |
| 4 Competitors' equivalent dependence | 0.79 | 0.04 | 0.66 | 0.92 | .20 | .20 | -.50 | | | | | |
| 5 Market: number of firms | 56.52 | 52.11 | 4 | 348 | .62 | .06 | .10 | -.05 | | | | |
| 6 Market: growth in number of firms (%) | -2.83 | 9.46 | -35.71 | 25.00 | .01 | .01 | .03 | .02 | -.06 | | | |
| 7 Market: excess capacity (%) | 2.02 | 5.61 | -0.14 | 60.57 | -.16 | -.02 | -.02 | .00 | -.19 | .23 | | |
| 8 Market: concentration (CR4) | 0.64 | 0.23 | 0.16 | 1.00 | -.59 | -.06 | -.05 | .01 | -.76 | .04 | .28 | |
| 9 Market: total output (ln) (tons) | 7.76 | 2.76 | 0.20 | 11.88 | .36 | .03 | .01 | -.01 | .57 | -.15 | -.46 | -.70 |

**The Taiwanese PC Industry**

| Variable | Mean | S.D. | Min | Max | Correlations | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 No. of competitors' prior entries | 2.56 | 7.85 | 0 | 133 | | | | | | | |
| 2 Competitors' direct encounter | 0.84 | 0.20 | 0.35 | 1.00 | -.12 | | | | | | |
| 3 Competitors' multimarket contact | 0.04 | 0.02 | 0.00 | 0.15 | -.12 | .20 | | | | | |
| 4 Competitors' equivalent dependence | 0.89 | 0.11 | 0.57 | 1.32 | .02 | .00 | -.63 | | | | |
| 5 Location: wealth of population | 0 | 1 | -2.01 | 3.25 | .26 | .03 | -.07 | .11 | | | |
| 6 Location: internationalization | 0 | 1 | -1.22 | 2.97 | .42 | .00 | .02 | -.04 | .00 | | |
| 7 Location: skilled labor | 0 | 1 | -1.54 | 2.62 | .08 | .03 | -.06 | .11 | .00 | .00 | |
| 8 Location: transportation infrastructure | 0 | 1 | -1.32 | 3.11 | .02 | .00 | .01 | -.01 | .00 | .00 | .00 |

exploratory factor analysis, which was highly supportive. These local factors were expected to attract competitors' investments.

## RESULTS

Table 1 reports descriptive statistics for variables used in the two studies. The results with Cox models are presented in Table 2 and Table 3.[1] In both tables, model 1 includes the control variables regarding the attractiveness of the various markets.

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[1] In these models, baseline hazard rates are stratified by firms and calendar time. Note that the main terms of the competitors' direct encounters, multimarket contact, and equivalent dependence cannot be separately included in the models. They variables are measured at the firm-level, while all firm-level effects will be absorbed by the stratification of the baseline hazard by individual firm and calendar years. We also estimated un-stratified versions of our models, which allow for inclusion of the main terms. In these models, all hypotheses were equally supported.

## Table 2: Cox Models for Study 1 (Chinese Pharmaceutical Industry)

| | Model | | | | | |
|---|---|---|---|---|---|---|
| **Variable** | **1** | **2** | **3** | **4** | **5** | **6** |
| *Hypotheses* | | | | | | |
| No. of competitors' prior entries | | 0.011 ** | 0.022 ** | 0.019 ** | 0.030 ** | 0.027 ** |
| | | (0.004) | (0.005) | (0.005) | (0.005) | (0.006) |
| Competitors' direct encounter X | | | 0.072 ** | 0.065 ** | 0.143 ** | 0.123 ** |
| no. of competitors' prior entries | | | (0.017) | (0.017) | (0.021) | (0.023) |
| Competitors' multimarket contact X | | | | 0.096 ** | | 0.051 * |
| no. of competitors' prior entries | | | | (0.019) | | (0.023) |
| Competitors' equivalent dependence X | | | | | -0.651 ** | -0.489 ** |
| no. of competitors' prior entries | | | | | (0.114) | (0.133) |
| *Controls* | | | | | | |
| Market: number of firms | 0.023 ** | 0.016 ** | 0.012 * | 0.015 ** | 0.009 † | 0.011 * |
| | (0.004) | (0.005) | (0.005) | (0.005) | (0.005) | (0.005) |
| Market: number of firms squared /100 | -0.005 ** | -0.004 ** | -0.003 ** | -0.005 ** | -0.003 ** | -0.004 ** |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| Market: growth in number of firms (%) | 0.046 ** | 0.046 ** | 0.045 ** | 0.046 ** | 0.045 ** | 0.045 ** |
| | (0.008) | (0.008) | (0.008) | (0.008) | (0.008) | (0.008) |
| Market: excess capacity (%) | -0.048 † | -0.043 | -0.041 | -0.044 | -0.041 | -0.043 |
| | (0.028) | (0.027) | (0.027) | (0.027) | (0.026) | (0.026) |
| Market: concentration (CR4) | -1.326 ** | -1.249 ** | -1.299 ** | -1.273 ** | -1.444 ** | -1.401 ** |
| | (0.476) | (0.478) | (0.480) | (0.480) | (0.480) | (0.480) |
| Market: total output (ln) (tons) | -0.097 ** | -0.064 † | -0.043 | -0.052 | -0.032 | -0.038 |
| | (0.034) | (0.036) | (0.036) | (0.036) | (0.036) | (0.036) |
| Log likelihood | -1063.53 | -1060.15 | -1050.48 | -1037.26 | -1032.92 | -1030.30 |
| LR chi-sq against null model | 247.61 ** | 254.37 ** | 273.71 ** | 300.15 ** | 308.82 ** | 314.06 ** |
| Akaike information criterion | 2139.05 | 2134.30 | 2116.95 | 2092.52 | 2083.85 | 2080.60 |

† $p < .1$; * $p < .05$; ** $p < .01$; all two-tailed tests. Standard errors are in parentheses.

Table 2 shows the results for the Chinese pharmaceutical industry. In line with prior research, the market entry rate follows an inverted U-shape; entry first increases significantly with density, but decreases significantly with density squared. Furthermore, a firm is significantly more likely to enter a market in which the number of firms is growing rapidly, as indicated by the positive coefficient on the variable, which probably acts as a proxy for the market's current general popularity. Also in line with our expectations are the significantly negative coefficients on excess capacity and market concentration, which deter entry. Finally, firms are less inclined to enter larger markets, showing a moderately significant preference for smaller markets, perhaps as an indicator of yet unrealized growth potential.

## Table 3: Cox Models for Study 2 (Taiwanese PC Industry)

| | Model | | | | | |
|---|---|---|---|---|---|---|
| **Variable** | **1** | **2** | **3** | **4** | **5** | **6** |
| *Hypotheses* | | | | | | |
| No. of competitors' prior entries | | 0.042 ** | 0.078 ** | 0.117 ** | 0.037 * | 0.065 ** |
| | | (0.008) | (0.011) | (0.015) | (0.016) | (0.020) |
| Competitors' direct encounter X | | | 0.189 ** | 0.168 ** | 0.264 ** | 0.234 ** |
| no. of competitors' prior entry | | | (0.038) | (0.037) | (0.047) | (0.047) |
| Competitors' multimarket contact X | | | | 2.154 ** | | 1.293 * |
| no. of competitors' prior entry | | | | (0.496) | | (0.569) |
| Competitors' equivalent dependence X | | | | | -0.537 ** | -0.433 ** |
| no. of competitors' prior entry | | | | | (0.113) | (0.117) |
| *Controls* | | | | | | |
| Location: wealth of population | 1.370 ** | 1.249 ** | 1.212 ** | 1.078 ** | 1.246 ** | 1.173 ** |
| | (0.164) | (0.175) | (0.183) | (0.188) | (0.183) | (0.186) |
| Location: internationalization | 1.134 ** | 0.814 ** | 0.709 ** | 0.550 ** | 0.727 ** | 0.644 ** |
| | (0.096) | (0.107) | (0.109) | (0.114) | (0.112) | (0.117) |
| Location: skilled labor | 1.150 ** | 1.076 ** | 1.078 ** | 0.993 ** | 1.093 ** | 1.045 ** |
| | (0.208) | (0.222) | (0.232) | (0.238) | (0.228) | (0.231) |
| Location: transportation infrastructure | 0.279 ** | 0.244 ** | 0.224 ** | 0.197 ** | 0.236 ** | 0.221 ** |
| | (0.068) | (0.070) | (0.072) | (0.074) | (0.072) | (0.074) |
| Log likelihood | -478.25 | -458.54 | -444.71 | -433.98 | -426.93 | -424.33 |
| LR chi-sq against null model | 573.93 ** | 613.34 ** | 641.01 ** | 662.46 ** | 676.56 ** | 681.77 ** |
| LR chi-sq of against model 1 | | 39.41 ** | 67.08 ** | 88.52 ** | 102.63 ** | 107.83 ** |
| Akaike information criterion | 964.49 | 927.09 | 901.41 | 881.97 | 867.86 | 864.66 |

$^{+}p<.1$; $^{*}p<.05$; $^{**}p<.01$; all two-tailed tests. Standard errors are in parentheses.

Table 3 shows the results for the Taiwanese computer producers. As expected, firms are significantly more inclined to enter geographical markets with higher consumer affluence, that are more international, have better skilled labor, and better infrastructure. The various significant estimates of the control variables in our studies, which are fully in line with expectations, raise additional confidence in the reliability of our data.

*Hypothesis 1* predicts that the hazard of a firm moving into a particular market would increase as a result of its competitors having entered it earlier. This hypothesis about imitative market entry is tested through the variable "competitors' prior entry," as displayed in models 2-6 in both tables. In all models, for both studies, the coefficient of the variable is positive and significant, corroborating hypothesis 1. For the Chinese

pharmaceutical firms (Table 2, model 6), the size of the multiplier indicates that, on average, for each additional competitor entering the market, the probability that the firm will enter too increases with 2.7 percent. For Taiwanese firms (Table 3, model 6), this result is even stronger; for each additional competitor entering a particular geographical market within China, the probability that the firm will enter that same region increased with 6.7 percent.

*Hypothesis 2* predicts that a firm's propensity to imitate its competitors would be stronger if its competitors also competed directly with one another. This prediction is tested through the interaction between "competitors' prior entry" and "competitors' direct encounters," because the influence of the variable competitors' prior entry should be positively moderated by competitors' direct encounters. As predicted, in both studies, the coefficient of the interaction between the two variables is positive and significant, corroborating the hypothesis. In study 1, when direct encounters between a firm's competitors is high (one standard deviation above the mean), each additional competitor entering the new market will raise the probability that the firm will enter too by 4.6 percent. In contrast, when direct encounters between a firm's competitors are rare (one standard deviation below the mean), this figure drops to .9 percent. Similarly, in study 2, the probabilities are 11.9 and 1.7 percent. These results indicate that in both industries, companies are especially inclined to imitate the market entry moves of their competitors if these firms form a coherent group by also competing with one another. If none of the firm's competitors meet one another in any market, this propensity all but disappears.

*Hypothesis 3* predicts that a firm's propensity to imitate grows even stronger if its competitors are engaged in multimarket competition. As predicted, in both studies, the coefficient on the interaction between "competitors' prior entry" and "competitors' multimarket contact," is positive and significant, which supports the hypothesis. In study 1, when multimarket contact between a firm's competitors is high (one standard deviation above the mean), each additional competitor entering the new market will raise the probability that the firm will enter too by 3.5 percent. In contrast, when multimarket contact is relatively rare (one standard deviation below the mean) the size of this effect is 1.9 percent. In study 2, the probabilities are 10.1 and 3.5 percent.

*Hypothesis 4* predicts that propensity to mimetically enter a market will be lower for firms whose competitors have equivalent dependence on the same set of markets. As predicted, the interaction between "competitors' prior entry" and "competitors' equivalent dependence" is negative and significant, which indicates that the latter variable negatively moderates the influence of the former on the hazard of entry. The results show that under these circumstances firms may be disinclined to follow their competitors into a new market. In study 1, when competitors' equivalence is very high (two standard deviations above the mean), each additional competitor entering the market will *decrease* the probability that the firm will enter too by 1.2 percent. In study 2, this effect is 2.6 percent per entrant. Hence, when competitors have highly equivalent dependence on the same markets, a firm will be less attracted to a market as a new market where many of its competitors have entered.

# DISCUSSION

In this article, we argue that firms' mimetic tendency is dependent on how their competitors relate towards one another in a multimarket space. We theorize that firms are especially inclined to follow their competitors when these competitors also directly compete – but mutually forbear from attacking one another. In contrast, firms tend to shy away from following competitors who behave aggressively against one another. Strong empirical supports for our predictions were found in two distinct contexts: Chinese drug producers' entry into new product markets during 1993-2001, and Taiwanese PC hardware manufacturers' entry into new geographic markets in China during 1999-2005.

This article extends the literature on mimetic behavior (e.g., Greve, 1995, 1996; Guillen, 2002; Haunschild & Miner, 1997). Building on previous studies, we shed further light on why and when firms imitate their competitors, but we also show certain circumstances under which firms opt to do the opposite. We argue that firms behave in this way because some firms may perceive their competitors as forming a cognitive group – which a firm may or may not want to remain part of – while some firms may perceive their competitors as independent market actors. This article also contributes to the literature on multimarket contact (e.g., Baum & Korn, 1999; Gimeno, 1999; Haveman & Nonnemaker, 2000), which has focused on the encounter between a firm and a competitor. We show that encounters *between* a firm's competitors may also influence firm behavior.

Choices concerning the adoption of new organizational structures (Burns & Wholey, 1993; Fligstein, 1985), management practices (Guler et al., 2002), innovations (Rogers, 2003), and strategies (Greve, 1995, 1996) have been shown to spread across an interorganizational field. So far, the literature has established that new behavioral options often diffuse through a process of interorganizational contagion, in which organizations imitate others who are similar or occupy a comparable social position, or with whom they have shared corporate ties (Davis & Greve, 1997; Galaskiewicz & Burt, 1991; Haunschild, 1993; Hedstrom, 1994). This article shows that organizations may observe their competitors closely, but sometimes this can cause them to prefer *not* to do what their competitors have done. Examining how the patterns of competitive relationships affect the process of interorganizational contagion may represent a fruitful avenue for future research.

# CHAPTER 3:

# TROTTING AT MY HEELS?

Conventional wisdom often cites the potential benefits when one's opponents fight against other enemies on a separate front. A well-known example in military history is the European theater of World War II, where Nazi Germany could not simultaneously repel Allies' advance on the western front and the Soviet Union's advance on the eastern front, and were eventually defeated (cf. Weinberg, 1994). When facing a "two-front war," opponents are forced to split their attention and resources to deal with challenges on different fronts, weakening their maneuverability on either front.

The situation where opponents are weakened by a two-front war can be found in the business world. For instance, Porter (1985) discussed the case where companies simultaneously compete with low-cost and differentiated players. These companies were shown to be "stuck in the middle," failing to achieve an advantage vis-à-vis either type of players. In a similar vein, the resource-partitioning model (Carroll, 1985) in organizational ecology showed that firms who simultaneously compete with large generalists (for mass markets) and small specialists (for niche markets) tend to be squeezed out. Further to these scholarly works, news press and business periodicals regularly report stories where a company triumphed over its over-diversified market competitors. A recent story is the "Peanut Butter Manifesto" of

Yahoo, who was thought to have lost its competitive agility by spreading itself too thinly (cf. *Wall Street Journal*, 2006).

Although widely acknowledged, the dynamics of a two-front war have received little direct treatment in market competition literature. A prime reason is that by far, most organization and management scholars have studied market competition either at the level of an aggregate market, or at the level of two paired firms. Industrial organization (Porter, 1981; Scherer & Ross, 1990) and organizational ecology (Hannan & Freeman, 1989) treated all firms in a market as de facto competitors against one another, but overlooked each firm's individual competitive situation. In contrast, research on interfirm rivalry behavior (Baum & Korn, 1999; Chen, 1996; Ferrier et al., 1999; Gimeno, 1999) treated market competition as pair-wise interaction between a firm and a competitor, but overlooked the two parties' competitive interdependence with other market actors. Nevertheless, a two-front war involves at least three identified parties interacting with one another in at least two distinct market spheres. Such a multiparty, multimarket interplay can hardly be captured using either an aggregate or a dyadic orientation to study market competition.

Considering a two-front war, therefore, unveils a significant gap in market competition literature; namely, the literature has not satisfactorily accounted for the competitive interdependence between multiple market actors. For instance, *j*'s interaction with *i* may be influenced by *j*'s interaction with *k*, which, in turn, may be influenced by *k*'s interaction with *x*. To tackle this type of issue, scholars not only need to map the overall pattern of market encounters between multiple parties, but also need to display each party's individual competitive situation as influenced by

the overall pattern. Prior research, however, often selectively focused on either aggregate markets or firm-dyads only, and thus did not provide much middle ground between the predominantly macro and micro orientation. As a result, relatively little is known about multiparty competitive interdependence.

The current study attempts to narrow this literature gap. Adopting a firm-centric approach, the author identifies all market actors in a firm's local competitive environment. These nearby actors include a firm's direct market competitors, as well as its *indirect contacts* – who compete with the firm's competitors, but not with the focal firm. The overall pattern of market interdependence between these nearby actors is expected to shape a firm's individual competitive situation. This study looks into the particular setting where a firm has just invested in an emerging foreign market, and assesses the extent to which its investment move will elicit imitative reactions from its market competitors in the home country. International business studies have long documented that companies competing in their home country are inclined to follow one another into a new foreign market (e.g. Flowers, 1976; Gimeno et al., 2005; Knickerbocker, 1973; Yu & Ito, 1988). The return on a foreign investment, however, tends to be eroded as competitors continue to pour into the same foreign market and escalate competition there. Hence, one critical firm-specific competitive situation concerns a firm's leeway to exploit new market opportunities without eliciting imitative reactions from its competitors. Such leeway, the author argues, depends not only on a firm's market relations with its competitors, but also on the competitive encounters between its competitors and its indirect contacts.

This study builds on the idea of a two-front war to examine the multiparty interplay between a firm, its competitors, and its indirect contacts. The research context is a broadly defined industry that consists of multiple product markets; each market delineates a distinct "front" for market actors. Competitors of a firm face a "two-front war" when they compete not only in certain markets with the focal firm, but also in separate markets that the focal firm does not serve. Following conventional wisdom, a two-front war is expected to divert competitors' attention and resources towards separate markets. Diverted competitors are less capable of matching a firm's investment move. Accordingly, the greater the extent to which a firm's competitors are caught in their competitive encounters with others in separate markets, the fewer imitative reactions the firm will elicit from its competitors after making a new foreign investment.

# COMPETITIVE IMITATION

## Motivations for Competitive Imitation

In examining competitive interaction between market actors, the current study focuses on a particular form of interactive behavior, namely imitation. Prior studies have found that firms are inclined to follow one another when adopting new product technologies (Bothner, 2003), when implementing new organizational structure (Burns & Wholey, 1993) and practices (Guler et al., 2002), and when entering new business domains (Haveman, 1993), geographical locations (Greve, 2000), and foreign markets (Gimeno et al., 2005). These prior studies have shown that imitation behavior is highly prevalent, arising in a wide range of settings (Lieberman & Asaba,

2006). The current study looks into the specific setting where a firm has just invested in an emerging foreign market, and assesses the extent to which its investment move will elicit imitative reactions from its market competitors in the home country.

Scholars have proposed numerous motives for imitation behavior. Firstly, imitation may occur when organizations refer to each other's actions for clues as to how to behave appropriately. Neo-institutional theory (DiMaggio & Powell, 1983) and organizational ecology (Hannan & Freeman, 1989) suggested that a course of action appears more legitimate after it has been taken by a number of organizations, especially by organizations with higher status (Haunschild & Miner, 1997; Haveman, 1993). Perceived legitimacy increases the chance that even more organizations will take the same course of action. Further, economics theory of herding behavior (Banerjee, 1992; Bikhchandani et al., 1992) suggested that one's decision to take a course of action reveals its positive assessment of the corresponding behavioral option, encouraging others to do the same. Accordingly, a firm's foreign investment move may be imitated by others either because making the same move is thought to convey legitimacy, or because the firm is viewed as well-informed about the nature of the target foreign market.

When imitation behavior occurs between market competitors, another prime motive concerns the maintenance of competitive parity. This notion has been widely cited by international business scholars to explain the phenomenon that firms competing in their home country are inclined to follow one another into a new foreign market (e.g. Flowers, 1976; Gimeno et al., 2005; Knickerbocker, 1973; Yu & Ito, 1988). A new foreign investment may allow a firm to acquire new resources and customer bases in

the target foreign market, and hence can potentially improve the firm's competitive position vis-à-vis its competitors in the home country. From competitors' perspective, their competitive positions will be in jeopardy if they do not react to the focal firm's investment move. For competitors to avert such a threat, an effective measure is to react mimetically. Imitative reactions secure competitive parity by placing the competitors and the focal firm on the same footing in exploiting new opportunities in the target foreign market. Thereby, competitors' imitative reactions prevent a firm from obtaining a superior competitive position.

Competitive imitation does not only prevent a firm from obtaining competitive supremacy. Further, the financial return on exploiting new market opportunities tends to be eroded as competitors continuously pour in and escalate competition there. For example, when Taiwanese PC companies expanded their manufacturing facilities in China to exploit China's low-cost labor and land, their market competitors in Taiwan often matched the expansion move to maintain cost-structure parity. As a growing number of companies had established low-cost manufacturing sites in China, price competition in the PC market became increasingly extensive, eroding the profit margin of every producer. Eroded profit margin, however, forced even more producers to established low-cost manufacturing sites in China, further escalating price competition. This dynamic interplay can be characterized using the notion of Schumpeterian competition (cf. Jacobson, 1992; Schumpeter, 1934), where firms' creative initiatives elicit competitors' reactions that erode and eventually eliminate the reward for the creative initiatives. The reward for making a new

foreign investment is transitory, allowed by the virtue of competitors' lagged and non-responses.

**Conditions for Competitive Imitation**

If competitive imitation is undesirable, who is more or less likely to be imitated by its competitors? Firstly, a firm is imitated only when competitors pay attention to what it has done. Studies on interorganizational contagion proposed that observability and perceived relevance are two preconditions for imitation behavior (Greve, 1998). For a move to influence the behavior of potential imitators, the move must be made by someone visible to potential imitators. The move must also be made by someone similar to potential imitators, so that potential imitators will perceive the move as informative about what constitutes an appropriate course of action (Haunschild & Miner, 1997). These attention aspects of interactive behavior were also highlighted in competitive dynamics research (Chen, 1996; Smith, Ferrier, & Ndofor, 2001). This line of research showed that for competitors to react to a firm's move, they must be aware of the firm and the move it made. They must also perceive the firm's move as consequential, so that they are motivated to react (Miller & Chen, 1994).

In addition to gaining attention from competitors, another condition for competitive imitation concerns competitors' capability to carry out imitative reactions. In the setting of investing in an emerging foreign market, foreign expansion involves a number of challenging tasks that require significant resource commitment. New entrants to a foreign market are faced with an unfamiliar business and institutional environment. Before they eventually acquire sufficient local knowledge, as well as



establish adequate connections with local suppliers, customers, and institutional actors, they typically suffer from a "liability of foreignness" (Hymer, 1976) for a considerable length of time. Soon after entering a new foreign market, new entrants also need to carefully assimilate their new foreign subsidiaries into their existing organizational structure, so that activities can be coordinated and knowledge can be shared across national borders (Bartlett & Ghoshal, 1989). For competitors to follow a firm into a new foreign market, they must be able to mobilize a significant amount of resources in support of these challenging tasks associated with foreign expansion.

Hence, who is more or less likely to be imitated depends on the extent to which a firm's competitors allocate their attention and resources towards monitoring and competing with the focal firm. The next section will show that competitors' attention and resource allocation is influenced not only by their market encounters with the focal firm, but also by their encounters with others in separate markets that the focal firm does not serve. The conventional wisdom of a "two-front war" suggests that competitors' encounters with other actors in separate markets may divert their attention and resources away from a focal firm, reducing their ability to react to the firm's move.

## Indirect Contacts and Competitive Imitation

### A Firm's Competitors and Indirect Contacts

The current study investigates multiparty market interdependence in a multimarket industry. A typical industry consists of multiple sub-markets, delineated by

geographical regions or types of products and services. In the airline industry, for example, air carriers operate in multiple routes that connect different regions. Another example is the pharmaceutical industry, where different therapeutic functions of drugs define multiple product markets. While these multiple sub-markets in an industry have distinguishable boundaries, they are often inhabited by overlapping sets of organizations. Thereby, these sub-markets are interdependent, in that organizations' behavior in one market will be influenced by the dynamics in another market.

The current study draws the boundaries between sub-markets in an industry using product types (e.g. computers; monitors; communication equipment). Prior research on managerial cognition has shown that managers quite often rely on product types as a primary indicator to categorize market actors and to identify competitors (e.g. Clark & Montgomery, 1999; Hodgkinson & Johnson, 1994; Porac & Thomas, 1994; Porac et al., 1995; Walton, 1986). A possible reason behind this phenomenon is information availability. Most business activity documentation is organized around products or product technologies, and human decision-makers are inclined to use the most accessible information – not necessarily the most diagnostic information – in making a judgment (Sherman, Judd, & Park, 1989). Informed by these prior studies, the author identifies two market actors as direct market competitors to each other if they operate in at least one common product market.

Adopting a firm-centric approach, the author identifies not only a firm's direct market competitors, but also its *indirect contacts* – who compete with the firm's competitors, but not with the focal firm (as shown in Figure 6). Drawing from the

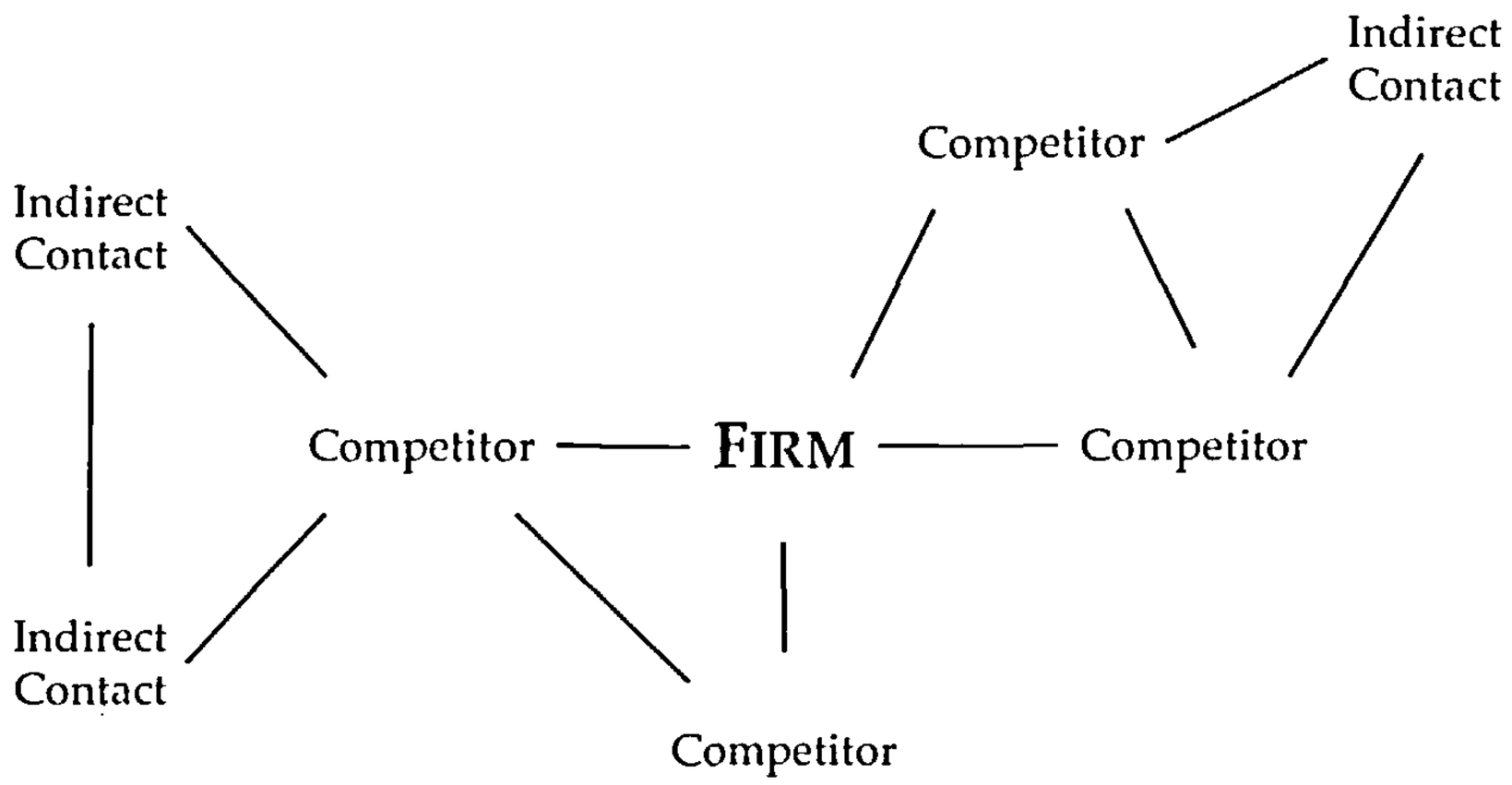



**Figure 6: A Firm's Competitors and Indirect Contacts**

idea of a "two-front war," this study argues that the greater the extent to which a firm's competitors are caught in their competitive encounters with others in separate markets, the fewer imitative reactions the firm will elicit after making a new foreign investment. Along this general argument, the author derives a coherent set of four hypotheses that pertain to the relationship between competitors' interaction with indirect contacts and competitors' propensity to imitate the focal firm. The first baseline hypothesis predicts that a large number of indirect contacts will reduce competitors' imitative reactions. The remaining hypotheses predict that such an effect will be moderated by factors including relative size, relative profitability, and equivalence in market dependence, because these factors decide to what extent competitors will attend to their competitive encounters with indirect contacts.

### Number of Indirect Contacts

A firm in a multimarket industry quite often faces competitors who operate in separate markets that the focal firm does not serve, and hence compete with other

market actors whom the focal firm does not directly encounter. These other actors are indirect contacts of the focal firm, in that they are in contact with the focal firm indirectly by competing with the same competitors in different markets. For example, a computer company producing desktop and laptop computers may find some of its competitors in these two markets also produce image scanners, and hence compete with other scanner producers. Some of these scanner producers may not supply either desktop or laptop computers, and thus do not directly compete with the focal computer company.

Indirect contacts may divert competitors' attention away from the focal firm. For competitors who compete with both the focal firm and indirect contacts, they often need to make separate efforts to trace and evaluate the two parties' moves in different markets. Decision-makers of these competitors, however, have limited attentive capacity to scan their environment and to process environmental stimuli (Simon, 1947). As a result, competitors can be forced to split their attention between the focal firm and indirect contacts, or to selectively concentrate their attention on either of the two parties. The greater the extent to which these competitors devote their attention to monitoring indirect contacts, the less attention they will have left for monitoring the focal firm. As competitors pay less attention to the focal firm, they are less likely to be aware of what the firm has just done and to carefully consider what they should do in response (cf. Miller & Chen, 1994).

Indirect contacts may also divert competitors' resources away from a focal firm. For competitors who compete with both the focal firm and indirect contacts, they often find that competing with each of the two parties requires them to take distinct course

of action, forcing them to split their resources in support of these different actions. Consider the example where some competitors of a focal firm in the desktop computer market also produce image scanners. Competition with other scanner producers may push these competitors to increase their investments in image sensor technologies. Sensor technologies, however, will not help these competitors in competing with the focal firm in the desktop market. Instead, as these competitors increase their investments in sensor technologies, they will be left with less disposable resources that can support them to actively compete with the focal firm. As a result, even when these competitors intend to respond to a move made by the focal firm – such as relocating manufacturing facilities to a low-wage region – they may not be able to mobilize sufficient resources that effective reactions would require.

To assess the extent to which competitors' attention and resources are diverted towards indirect contacts, a simple indicator is how many indirect contacts are around in the focal firm's local environment. Consider the case where a firm's competitors compete with a small number of others in separate markets. Together, a small number of indirect contacts can make few strategic moves, and impose lower competitive pressure on the focal firm's competitors. As such, competitors may be able to monitor and actively compete with these few indirect contacts without consuming much managerial attention and disposable resources. Consider the opposite case where a firm's competitors compete with a large number of others in separate markets. A large number of indirect contacts can make many distinct strategic moves, and impose a high competitive pressure on the focal firm's

competitors. As such, competitors are more likely to be caught in monitoring and competing with these many indirect contacts. Accordingly, an increasing number of indirect contacts will reduce the amount of attention and resources that competitors have left for monitoring and competing with the focal firm.

As competitors' attention and resource are diverted towards a large number of competitors, the focal firm becomes less likely to be imitated by its competitors. For example, a Taiwanese PC company may expand its manufacturing facility in Guangdong province in the southeastern China to take advantage of Guangdong's rich labor pool and geographical proximity to Hong Kong. This company may also establish a new research unit in Beijing's Zhongguancun Science Park to take advantage of local knowledge spillover there. If the company's competitors in Taiwan are preoccupied by their competition with many other companies in separate product markets, they may fail to notice the company's new investments, or may not cautiously assess the competitive consequences of these investments. Even if these competitors intend to follow suit by making similar investments in Guangdong and Beijing, they may still find that their budgets and work force have been locked up in their bitter competition in separate product markets. In such a situation, the focal company is expected to elicit fewer imitative reactions from its competitors after it makes a new investment in China.

*Hypothesis 5: A firm that has a larger number of indirect contacts will elicit fewer imitative reactions from its competitors after making a new foreign investment.*

**Relative Size and Profitability**

Hypothesis 5 is built on the assertion that a firm's competitors generally need to devote more attention to separate product markets when they compete with many others there. Nevertheless, each of these indirect contacts may differ in their propensity to attract competitors' attention. One deciding factor is whether an indirect contact is larger or smaller than the focal firm. Larger organizations have higher visibility (Smith, Grimm, Gannon, & Chen, 1991) and decision-makers are especially attentive to visible organizations when they simply act upon what they see (Greve, 1998). Larger organizations are often perceived as more prestigious and successful, and decision-makers tend to follow high-status organizations in the interests of improving their own legitimacy or replicating others' success (Haunschild & Miner, 1997; Haveman, 1993). Finally, larger organizations can take advantage of their market power and economies of scale to employ predatory tactics (Scherer & Ross, 1990). Therefore, decision makers are prompted to view large organizations as major potential threats that need to be placed under close surveillance. As a larger size corresponds with higher visibility, status, and competiveness, indirect contacts that are larger than the focal firm attract more attention from the firm's competitors. In contrast, competitors may overlook indirect contacts that are relatively smaller, but place more attention on monitoring the focal firm's move.

Therefore, the extent to which a large number of indirect contacts will reduce competitors' imitative reactions depends on the relative sizes of these contacts. Considering the case where there are many indirect contacts in a firm's local

competitive environment, but few of these contacts are larger than the focal firm. Although its competitors encounter many smaller players in separate product markets, the focal firm may still be highly visible to its competitors and be perceived as more prestigious and threatening. As a result, the focal firm will remain closely monitored by these competitors and tends to elicit competitive imitation after making a new foreign investment. Consider an opposite case where competitors of a firm compete with many others in separate product markets, and when most of these indirect contacts are larger than the focal firm. The firm's competitors are likely to devote much of their attention to these many indirect contacts, who are more visible, prestigious, and threatening in comparison to the focal firm. Therefore, the focal firm will receive only scant attention from their competitors and will have more leeway to exploit an emerging foreign market without eliciting competitive imitation behavior. Comparing these two cases suggests that a large number of indirect contacts will reduce competitors' imitative reactions especially when most indirect contacts are larger than the focal firm, but less so when most indirect contacts are relatively smaller.

*Hypothesis 6: Indirect contacts will reduce competitors' imitative reactions especially when most indirect contacts are larger than the focal firm.*

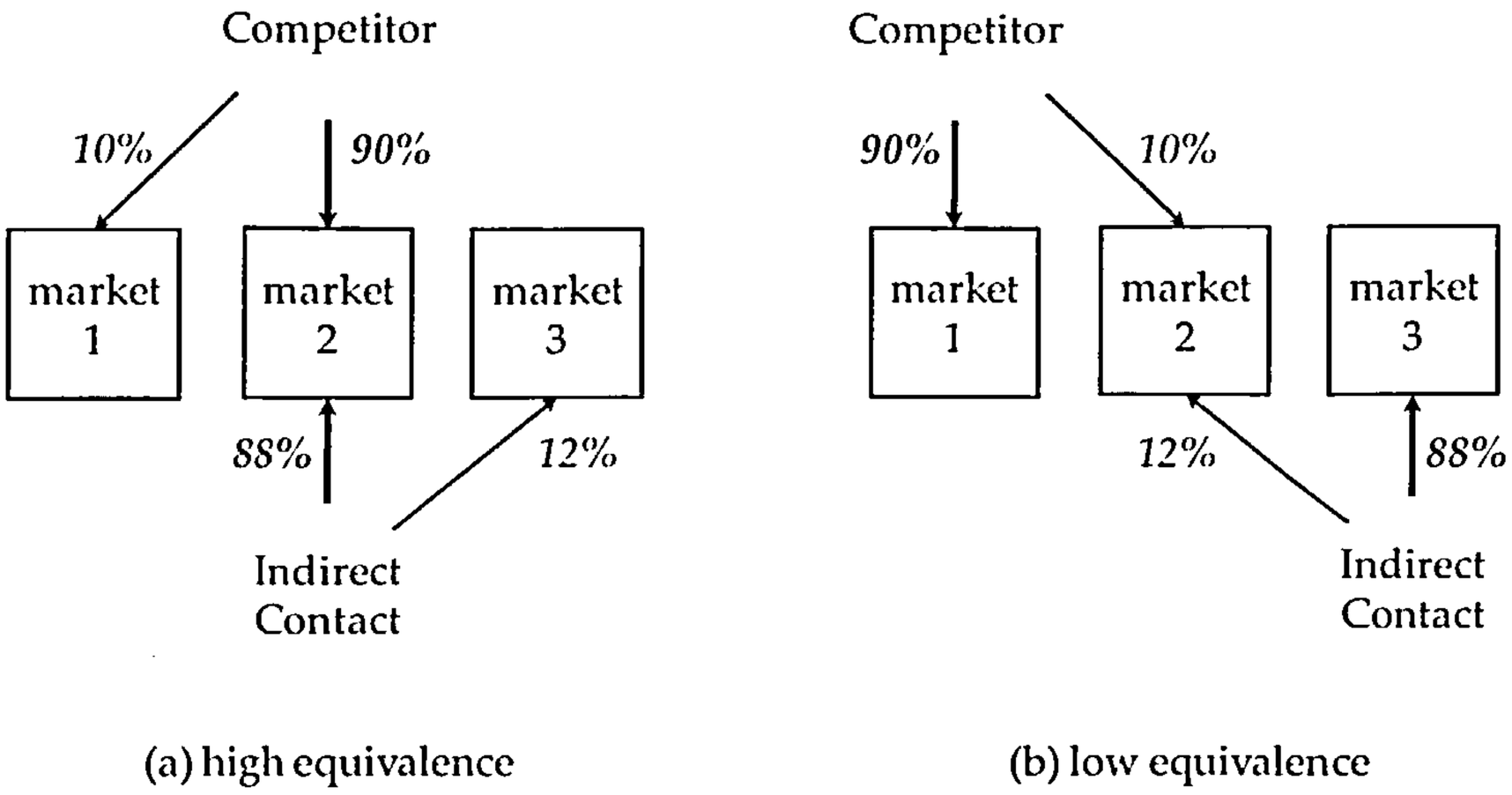
Like having a larger size, being more profitable also increases the visibility and prestige of organizations. Most profitable organizations often serve as models in a for-profit sector (Haunschild & Miner, 1997; Haveman, 1993). Decision-makers are particularly attentive to most profitable organizations, thinking that these organizations are more informed about how to succeed and have better odds of

choosing the right course of action. Hence, if a firm has many indirect contacts, but few of these contacts are more profitable than the firm, the firm may still stand out as a salient model for its competitors and remain be closely monitored. In an opposite case, a firm may have many indirect contacts, with most of these contacts being more profitable than the focal firm. In this case, the firm's competitors are likely to devote their attention to modeling these more profitable indirect contacts, paying only scant attention to monitoring the focal firm. Along this line of reasoning, a large number of indirect contacts will reduce competitors' imitative reactions especially when most indirect contacts are more profitable than the focal firm, but less so when most indirect contacts are relatively less profitable.

*Hypothesis 7: Indirect contacts will reduce competitors' imitative reactions especially when most indirect contacts are more profitable than the focal firm.*

**Equivalent Market Dependence**

Further to diverting competitors' attention, another assertion behind hypothesis 5 is that a firm's competitors generally need to allocate more resources to separate product markets when they compete with many others within. Nevertheless, a competitor and an indirect contact may compete against each other more or less actively in their common markets. One deciding factor is the extent to which these two parties have equivalent market dependence. A competitor and an indirect contact have highly equivalent dependence when they both heavily depend on their common markets, and do not depend much on other markets.




(a) high equivalence (b) low equivalence

**Figure 7: Equivalent Market Dependence**

As an example, Figure 7(a) shows that both a competitor and an indirect contact of a firm raise a large majority of their revenues (80% and 90% respectively) from market 2, and have a very limited stake in market's 1 and 3. As both parties view market 2 as strategically important, they tend to actively compete against each other in this common market (Chen and MacMillan, 1992; Chen, 1996). In contrast, a competitor and an indirect contact have very distinct patterns of market dependence when neither party depends much on their common markets, but depends heavily on other markets. In Figure 7(b), both parties raise a small minority of their revenue (20% and 10% respectively) from market 2, which they share, but have a very large stake in market's 1 or 3. Viewing market 2 as less important than other markets that they serve (i.e. market's 1 and 3), they are less motivated to actively compete against each other in this common market.

Therefore, the extent to which a large number of indirect contacts will reduce competitors' imitative reactions depends on how equivalent a firm's competitors and

its indirect contacts are in terms of market dependence. Considering the case where there are many indirect contacts in a firm's local competitive environment, but the firm's competitors' and these many indirect contacts have very distinct patterns of market dependence. In this case, the competitors and indirect contacts may not actively compete against each other in separate markets, leaving the competitors more disposable resources that can support them to promptly react to the focal firm's move. Considering an opposite case where the competitors of a firm compete with many others in separate product markets, and the firm's competitors and indirect contacts are highly equivalent concerning market dependence. In this case, the competitors are likely to allocate a significant amount of their resources to actively compete with these many indirect contacts. With competitors' resources being diverted away, the focal firm will have more leeway to exploit an emerging foreign market without eliciting its competitors' imitative reactions. Comparing these two cases suggests that a larger number of indirect contacts will reduce competitors' imitative reactions especially when competitors and indirect contacts have highly equivalent market dependence, but less so when competitors and indirect contacts have very distinct patterns of market dependence.

*Hypothesis 8: Indirect contacts will reduce competitors' imitative reactions especially when the competitors and indirect contacts are highly equivalent.*

# METHODS

## Research Context

The research context is Taiwanese PC (personal computer) hardware producers' investments in Mainland China during the period 1999-2005. Initially emerged as a low-cost production base in the 1980s, Taiwan established itself as a leading player in the global PC industry through its flexibility to adapt to the accelerating product innovation cycles (Dedrick & Kraemer, 1998). In 1998, Taiwanese computer hardware producers registered a production value of US$34 billion, up from US$30 billion in the previous year. Such a figure made Taiwan the third largest hardware supplier in the global PC industry (after the United States and Japan). Most Taiwanese PC companies positioned themselves as contract manufacturers for foreign brands, such as IBM, HP, and Dell. After the 1997 Asian Financial Crisis, Taiwanese computer companies began to expand their operations in China at a rapid pace. By the end of 2005, their investments in China had accounted for 65 percent of their total foreign investments.

This research context is attractive because most PC companies in Taiwan were specialized, geographically clustered, and had a comparable size. Taiwan was very different from its Asian neighbors, Japan and Korea, whose computer industry was dominated by large, diversified conglomerates. By contrast, Taiwan's computer industry was decentralized, but not fragmented. It mainly consisted of small and medium-sized enterprises, who were geographically clustered and closely interacted with one another. Most Taiwanese computer companies were located in a 70-km

stretch, starting north in Taipei, Taiwan's capital city and financial center, and ending southwest in Hsinchu, home to two of Taiwan's top universities and its national research center for information technologies. These companies specialized in several related product categories to keep themselves thin and lean, while at the same time benefited from the agglomeration economies of geographic clustering. In such a setting, the study population has a well-defined boundary, allowing the author to identify not only all competitors of a company in the sample, but also all indirect contacts that compete with a company's competitors in separate product markets.

During the period of study, the global PC industry experienced serious price erosions, coupled with accelerating product life cycles. In the United States, for example, the average retail price of a PC decreased from $1,800 to under $1,000 during 1997-1998. By 1999, sub-$1,000 PCs had accounted for 68 percent of the retail market, with the sub-$600 market grew very rapidly, and the sub-$400 machines began to appear in the marketplace (Curry & Kenny, 1999). An important factor behind the price erosions was the entry of three Intel-compatible microprocessor producers – AMD, Cyrix, and IDT. Losing its monopoly position in the PC microprocessor market, Intel reacted by speeding up its product innovation, confining its competitors in the medium and low-end market. Such a move accelerated the product life cycles in the PC industry. By 1999, a top-of-the-line product would typically be replaced by more advanced models within three months. Very soon, however, most PCs became powerful enough that few applications required faster machines. Customers began to slow down their replacement cycles.

As a result, in 2000 to 2001, the market demand for PCs declined for the very first time since IBM introduced its first PC in 1981.

These developments placed extreme pressure on the entire PC industry to cut cost and improve logistics. In a stagnant market, even the most advanced models would quickly be subject to intense price competition, with their premium margin being short-lived. Costs and speed mattered more than ever. Cost pressure pushed the industry to consolidate around large players, who could take advantage of scale economies. Further, with a product life cycle of merely three months, PC hardware came to share the attributes of perishable goods – such as fresh fruits and vegetables – for which keeping inventories would expose the owner to a huge depreciation cost. In response, the industry supply chain evolved from a forecast-driven model based towards a just-in-time model.

When Taiwanese PC companies struggled to adapt to the changing environment, their expanding operation in China played a pivotal role. With China's ability to shelter itself and quickly recover from the devastating impact of Asian Financial Crisis, a significant amount of economic wealth shifted from other Eastern Asian countries to China in the late 1990s. At the same time, Taiwanese government gradually relaxed its regulatory restrictions and permitted high-technology companies to invest in China. Managers in Taiwan were soon attracted to the immense market opportunities in the emerging China. Specifically, Taiwanese PC companies used their expanding operation in China as a lever to transform themselves from specialized component manufacturers into integrated-service providers. By 2005, a leading Taiwanese company would have a sophisticated

research unit in Taiwan, large manufacturing facilities and distribution networks in China, and efficient logistics centers in major markets around the world. With such a configuration, the company could make use of the knowledge externalities in the Taipei-Hsinchu cluster, take advantage of China's low-cost production factors and growing local demand, and provide global logistics services to customers worldwide.

## Data

The data used in this study contains all Taiwan's listed companies that produced PC hardware with in-house manufacturing facilities during 1999-2005. To identify relevant samples, the author first obtained a comprehensive list of companies from two bourses in Taiwan: the Taiwan Stock Exchange, where larger and more established companies were listed, and the GreTai Securities Market, where securities of smaller and entrepreneurial companies were traded. The two bourses classified listed companies into thirty broad sectors. Between them, six sectors (electrical; electronic; semiconductor; computer and peripherals; optoelectronic; communication) were potentially associated with PC hardware production.

Using the six industry sectors as a preliminary sampling criterion, the author identified 997 listed companies in these sectors, and followed by collecting fine-grained information on the product-market profiles of these companies. Regulations in Taiwan required listed companies to disclose their sales of every product accounting for no less than 10 percent of a company's total sales. Hence, information on the 997 companies' major products was publicly available in companies' annual reports. Nevertheless, these companies did not categorize their products in the same

manner. To ensure data consistency, the author defined 20 product markets (as shown in Appendix) with reference to Taiwan's Standard Industry Classification, and re-coded product sales data accordingly. Of the 20 product markets, three (computers; monitors and terminals; computer peripherals) directly corresponded with computer hardware manufacturing. Another two (audio and video equipment; communication equipment) were highly relevant, because most PCs produced since the late 1990s were equipped with multimedia and data communication devices.

During the period of study, 205 companies had operated in the fore-mentioned five product markets. The author used these 205 companies as the focal sample of Taiwanese PC hardware producers, and followed by identifying their competitors and indirect contacts. Two companies were viewed as direct market competitors if they operated in at least one common product market. Since a number of these focal companies had diversified into several related product markets, they directly competed not only between themselves, but also with other companies who, for example, supplied optoelectronic components. Since the hypotheses here pertain to the influences of a company's indirect contacts, all other companies who did not directly compete with any focal companies, but did compete with any competitors of the focal companies need to be accounted for as well. Using product sales data, the author identified another 394 companies who either directly or indirectly competed with the 205 focal companies. Thus, the extended sample contains 599 companies.

Data on the 599 companies' investments in Mainland China were collected from two sources. The Investment Commission, the regulation agency of foreign investment in Taiwan, reviewed and kept records for every investment project above US$20,000. In

addition, Taiwan's listed companies self-reported their major activities in China to the Market Observation Post System, an open information platform managed by the Taiwan Stock Exchange. Combining the two sources provided a comprehensive coverage of Taiwanese companies' investments in China. The data, updated on a quarterly basis, revealed that 459 of the 599 companies in my extended sample had made 3,756 new investments during 1999-2005. These new investments were made when a company entered a new geographical location, established a new subsidiary, or expanded an existing subsidiary. Figure 8 shows the geographical distribution of these investments, where darker shadings indicate regions with larger numbers of investments. The figure shows that Taiwanese companies' investments in China were more concentrated in coastal regions.

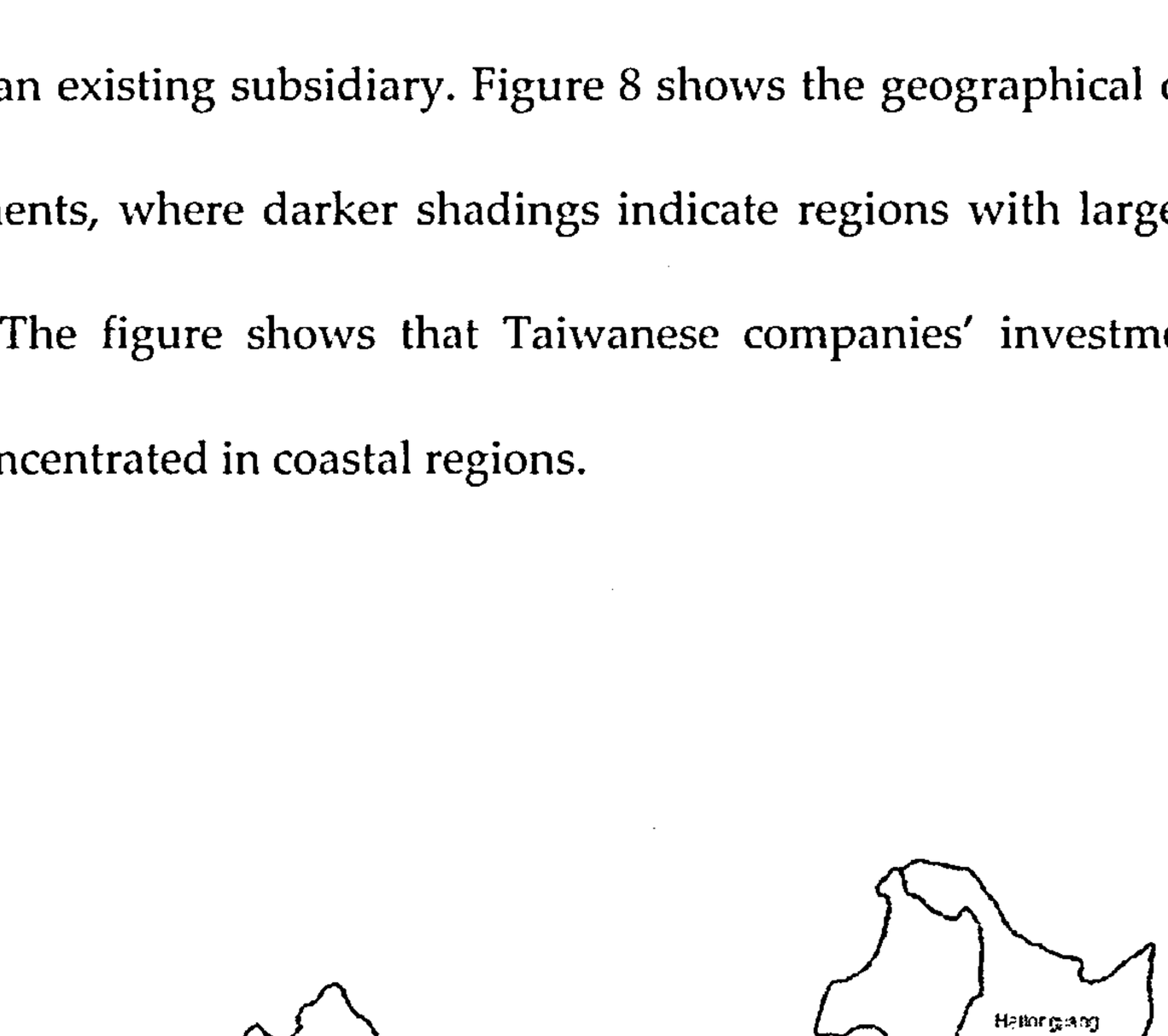



**Figure 8: Taiwanese PC Companies' Investments in Mainland China, 1999-2005**

## Dependent Variable and Method of Analysis

The four hypotheses in this study predict competitors' imitative reactions to a company's new investment in China. Here, a competitor was regarded as taking an imitative reaction if after the focal company made a new investment, this competitor invested in the same geographical location in China (delineated by the administrative boundaries of different provinces, municipalities, or autonomous regions in China) within a moving window of half year. Since different geographical locations in China have unique local conditions, investing in different locations usually served distinct strategic objectives for a Taiwanese investor. The half-year observation window was chosen because the data suggested that companies took an average of four months to carry out a new investment project. Analysis based on a window of one quarter and one year yielded highly consistent results, suggesting that the results reported in this paper are robust against alternative observation windows.

Accordingly, the author took each new investment made by a Taiwanese PC company as the unit of observation. During 1999-2005, 159 of the 205 companies in the focal sample made a total of 1,133 new investments in 22 different provinces, municipalities, or autonomous regions in China. For each of the 1,133 observations, the author counted the number of a focal company's competitors that followed suit by investing in the same location in China within half year, as well as the total number of competitors facing the focal company when it made a new investment. The dependent variable was then measured as the *percentage (%) of the company's competitors taking imitative reactions*. Because the values of this dependent variable are

confined within the range of 0 to 100, a two-limit tobit model (cf. Tobin, 1958) can provide the baseline for model specification:

$$y^* = x'\beta + \varepsilon$$

$$y = \begin{cases} 0 & if\ y^* \le 0 \\ 100 & if\ y^* \ge 100 \\ y^* & if\ 0 < y^* < 100 \end{cases}$$

The above model specifies a latent variable ($y^*$) that is linearly dependent on the vector of explanatory variables ($x$). The observed dependent variable ($y$) is equal to $y^*$ when $y^*$ is above the lower limit (0) and below the upper limit (100), and is equal to either the lower or upper limit otherwise. In the current research setting, $y^*$ can be thought as competitors' latent propensity to respond mimetically to a focal company's new investment in a specific location. The number of observed imitative reactions manifests the magnitude of this latent propensity, such that a higher propensity to respond will cause more imitative reactions. The magnitude of competitors' propensity to respond is unobservable when it is too low such that no competitors react (i.e. $y = 0$), resulting in left-censoring. Of the 1,133 investments in the sample, 125 did not elicit any imitative reactions. Theoretically speaking, the magnitude of competitors' propensity to respond is also indistinguishable after it becomes too strong such that all competitors react (i.e. $y = 100$). In the sample, however, even the maximum value of $y$ (63.16) is still much lower than the theoretical upper limit. Hence, specifying the upper limit or not will not have much influence on statistical estimations.

It is important to note that the parameter vector ($\beta$) defines the relationship between $x$ and $y^*$, rather than the relationship between $x$ and $y$. Therefore, beta coefficients of a tobit model represent the marginal effects of explanatory variables on latent variable $y^*$, rather than on observed $y$. To obtain the marginal effects of explanatory variables on $y$, the disturbance term ($\varepsilon$) can be assumed to be normally distributed with mean 0 and variance $\sigma^2$, so that:

$$\frac{\partial E[y \mid x]}{\partial x} = \beta \cdot \Phi\left(\frac{\beta' x}{\sigma}\right)$$

The above equation (cf. Greene, 1999) suggests that the marginal effects of the explanatory variables on $y$ are equal to the beta coefficients times a scale factor $\Phi$. Because the sample used in this study is not heavily dominated by censored observations, the scale factor here is not very far from unity (~ 0.9).

In addition to the limited dependent variable, another estimation issue in this study concerns correlated disturbance ($\varepsilon$), because many of the 1,133 investments in the sample were made during the same time, into the same location, or by the same company. To obtain reliable estimators under such a situation, a statistical model needs to account for temporal, location, and company-specific factor that can influence competitors' investment decisions, so that $\varepsilon$ can be reasonably treated as independently distributed. Firstly, investments made during an overlapping time span might be influenced by the same temporal incidents. To account for the influences of temporal incidents, the author included in regression models an array of time dummies corresponding with 28 quarters during the period 1999-2005.

Secondly, investments made into the same location in China might be influenced by the same local conditions. To account for the influences of location conditions, the author added four time-variant controls: *wealth of population* (captured by gross domestic product, disposable income, and household expenditure per capita), the level of *internationalization* (captured by imports, exports, and total foreign capital), the availability of *skilled labor* (captured through indicators of the proportion of the population with college degrees, number of recent college graduates, and number of professionals in the region), and the extent to which a market had a well developed *transportation infrastructure* (captured through highway and railway density indicators). These variables were constructed using macroeconomic indicators obtained from the *China Statistical Yearbooks*. Appendix lists all these variables and indicators and a test of discriminant validity using exploratory factor analysis, which was highly supportive. These local factors were expected to attract competitors' investments.

Thirdly, observations associated with the same company might be affected by the unobserved characteristics of the company. To account for the influences of unobserved company characteristics, the author specified both random and fixed firm effects in regression models, and performed Hausman test (Hausman, 1978) to examine whether unobserved firm effects are correlated with explanatory variables. The test did not reject the null hypothesis that unobserved firm effects are randomly distributed. Since random and fixed effects models yielded consistent results, and random effects estimators are more efficient when unobserved firm effects are

randomly distributed, the results reported here were based on random effects models.

**Explanatory Variables**

*Number of indirect contacts* was measured as the number of other Taiwanese companies that competed with a company's competitors, but not with the focal company. In other words, this variable measured the number of competitors' own competitors. In the current research setting, the number of indirect contacts was generally non-trivial, because competitors of the 205 focal companies operated in a wide range of related product markets.

*Indirect contacts with a larger size* denoted the proportion of a company's indirect contacts being larger than the focal company. Three common indicators of size – including total sales, total assets, and the number of employees – were available from companies' annual reports. These three indicators of size were highly correlated and yielded virtually identical results when being used to construct the explanatory variable. The results reported here used total sales as the indicator of size.

*Indirect contacts with a higher profitability* denoted the proportion of a company's indirect contacts being more profitable than the focal company. Three indicators of profitability – including return on sales, return on assets, and Tobin's $q$ (Tobin, 1969) – were available. These three indicators of profitability were moderately to highly correlated and yielded consistent results in hypothesis testing. The results reported here used return on assets as the indicator of profitability.

*Equivalence between competitors and indirect contacts* captured the average equivalence between a company's competitors and its indirect contacts in terms of market dependence. The equivalence score between a competitor, *j*, and an indirect contact *z*, was measured as the inverse of the following Euclidean distance:

$$d_{j,z} = \sqrt{\sum_m \left( \frac{s_{j,m}}{s_j} - \frac{s_{z,m}}{s_z} \right)^2}$$

In the above equation, the dependence of *j* on product market *m* that it shared with *z* was operationalized as the proportion of *j*'s sales in *m* (denoted by $s_{j,m}$) to *j*'s total sales (denoted by $s_j$). The equivalence score between *j* and *z* was computed by re-coding $d_{j,z}$ reversely (subtracting $d_{j,z}$ from a constant equal to the maximum distance score in the sample). Finally, the variable *equivalence between competitors and indirect contacts* was measured as the average of the equivalence scores between all pairs of competitors and indirect contacts that competed with each other.

**Control Variables**

In addition to time dummies and location factors presented earlier, three more control variables were included. *Competitors with prior investment in the current location* captured, in the location where a company has just invested, how many competitors of the company had invested there before? Because competitors with established operation in the same location could more easily detect and respond to the company's new investment, this variable was expected to increase competitors' reactions. *Competitors' new investments in other locations* captured, after a company made a new investment into a location, how many new investments were made by

the company's competitors in other locations within half year? Because investments in other location could divert competitors' attention and resources away, this variable was expected to decrease competitors' reactions. *Others' new investments in the same locations* captured, as a company made a new investment into a location, how many others in the extended sample (of 599 companies) also invested there at the same time (operationalized as within the same quarter). Because the company's competitors might be inclined to react to these others' investments, this variable was expected to increase competitors' investments in the same location.

## RESULTS

Table 4 presents summary statistics of all the variables. Table 5 presents the results of tobit regression analysis, which shows that, except for "supply of skilled labor" in a location, all other control variables have significant effects fully in line with theoretical speculations. These various significant estimates raise additional confidence in the reliability of the data and methods employed in the current study.

**Table 4: Summary Statistics**

| | Variable | Mean | S.D. | Min | Max | Correlations | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 | Rivals taking imitative reactions (%) | 12.76 | 9.31 | 0.00 | 57.14 | | | | | | | | |
| 2 | Indirect contacts | 298.91 | 54.56 | 7 | 427 | -.02 | | | | | | | |
| 3 | Indirect contacts with a larger size | 64.02 | 65.90 | 0 | 299 | -.17 | .18 | | | | | | |
| 4 | Indirect contacts with a higher profitability | 106.90 | 73.67 | 0 | 324 | -.28 | .24 | .16 | | | | | |
| 5 | Indirect contacts with a higher equivalence to rivals | 71.27 | 81.13 | 0 | 387 | -.11 | .31 | .05 | .01 | | | | |
| 6 | Rivals with prior investments in the current location | 21.33 | 24.65 | 0 | 105 | .41 | .01 | .02 | -.20 | .19 | | | |
| 7 | Rivals' new investments in other locations | 7.26 | 21.24 | 0 | 149 | -.12 | .07 | -.07 | -.01 | .10 | .09 | | |
| 8 | Others' new investments in the current location | 42.06 | 31.61 | 0 | 110 | .56 | -.02 | -.08 | -.13 | -.06 | .31 | -.15 | |
| 9 | Location: wealth of population | 0 | 1 | -1.41 | 4.01 | -.14 | -.27 | .03 | -.06 | -.05 | .11 | -.02 | -.23 |
| 10 | Location: internationalization | 0 | 1 | -1.44 | 2.97 | .41 | .09 | -.08 | -.13 | .07 | .29 | -.18 | .41 |
| 11 | Location: supply of skilled labor | 0 | 1 | -1.51 | 3.43 | .31 | -.29 | -.09 | -.08 | -.10 | .30 | -.05 | .47 |
| 12 | Location: transportation infrastructure | 0 | 1 | -1.49 | 3.11 | -.30 | .05 | .10 | .04 | .00 | -.25 | .01 | -.38 |

## Table 5: Random Firm-Effects Tobit Models for Competitors' Imitative Reactions

| Variable | Model 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| *Hypotheses* | | | | | | |
| Indirect contacts | | -0.018 ** | -0.010 * | -0.008 † | -0.009 † | 0.005 |
| | | (0.005) | (0.005) | (0.005) | (0.005) | (0.005) |
| Indirect contacts with a larger size | | | -0.022 ** | | | -0.018 ** |
| | | | (0.005) | | | (0.005) |
| Indirect contacts with a higher profitability | | | | -0.023 ** | | -0.022 ** |
| | | | | (0.003) | | (0.003) |
| Indirect contacts with a higher equivalence to rivals | | | | | -0.018 ** | -0.018 ** |
| | | | | | (0.003) | (0.003) |
| *Control* | | | | | | |
| Rivals with prior investments in the current location | 0.096 ** | 0.099 ** | 0.102 ** | 0.091 ** | 0.114 ** | 0.108 ** |
| | (0.012) | (0.011) | (0.011) | (0.011) | (0.012) | (0.012) |
| Rivals' new investments in other locations | -0.032 * | -0.033 ** | -0.038 ** | -0.037 ** | -0.029 * | -0.037 ** |
| | (0.013) | (0.013) | (0.013) | (0.012) | (0.012) | (0.012) |
| Others' new investments in the current location | 0.179 ** | 0.179 ** | 0.170 ** | 0.172 ** | 0.174 ** | 0.161 ** |
| | (0.012) | (0.012) | (0.012) | (0.012) | (0.012) | (0.012) |
| Location: wealth of population | 1.403 ** | 1.316 ** | 1.332 ** | 1.328 ** | 1.179 * | 1.215 ** |
| | (0.483) | (0.480) | (0.476) | (0.473) | (0.475) | (0.465) |
| Location: internationalization | 2.890 ** | 2.854 ** | 2.808 ** | 2.807 ** | 2.823 ** | 2.727 ** |
| | (0.500) | (0.496) | (0.492) | (0.491) | (0.490) | (0.481) |
| Location: supply of skilled labor | 0.913 † | 0.821 | 0.904 † | 0.842 † | 0.734 | 0.825 † |
| | (0.509) | (0.506) | (0.501) | (0.498) | (0.500) | (0.489) |
| Location: transportation infrastructure | 0.824 * | 0.825 * | 0.871 * | 0.758 * | 0.812 * | 0.782 * |
| | (0.353) | (0.351) | (0.347) | (0.345) | (0.347) | (0.338) |
| Time dummies | included | included | included | included | included | included |
| Log likelihood | -3711.8 | -3704.7 | -3693.0 | -3681.8 | -3690.9 | -3659.4 |
| LR chi-sq | 1494.4 ** | 1525.7 ** | 1571.5 ** | 1613.6 ** | 1583.6 ** | 1705.1 ** |
| Akaike information criterion | 7497.5 | 7485.3 | 7464.0 | 7441.6 | 7459.7 | 7400.9 |

†: $p < .1$; *: $p < .05$; **: $p < .01$; all two-tailed tests. Standard errors are in parentheses.
For interaction terms, component variables are mean-centered.

*Hypothesis 5* predicts that a large number of indirect contacts will reduce competitors' imitative reactions. Corroborating this baseline hypothesis, the coefficient of the "number of indirect contacts" is negative and significant in model 2-6.

*Hypothesis 6* predicts that the negative effect of indirect contacts on competitors' imitative reactions will be stronger when most indirect contacts are larger than the focal firm. This prediction was tested through the interaction term of the "number of indirect contacts" and "indirect contacts with a larger size." Corroborating this hypothesis, the coefficient of this interaction term is negative and significant in model 3 and 6. In terms of effect size, when all indirect contacts are larger than the

focal firm, a one-standard-deviation increase in the "number of indirect contacts" will reduce the percentage of competitors taking imitating reactions by 1.67% (model 6). With reference to the standard deviation of the dependent variable (8.99%), such an effect is non-trivial. In contrast, when no indirect contacts are larger than the focal firm, a one-standard-deviation increase in the "number of indirect contacts" will reduce the percentage of competitors taking imitating reactions by only 0.14%.

*Hypothesis 7* predicts that the negative effect of indirect contacts on competitors' imitative reactions will be stronger when most indirect contacts are more profitable than the focal firm. This prediction was tested through the interaction term of the "number of indirect contacts" and "indirect contacts with a higher profitability." Corroborating this hypothesis, the coefficient of this interaction term is negative and significant in model 4 and 6. In terms of effect size, when all indirect contacts are more profitable than the focal firm, a one-standard-deviation increase in the "number of indirect contacts" will reduce the percentage of competitors taking imitating reactions by 1.54% (model 6). In contrast, when no indirect contacts are more profitable than the focal firm, a one-standard-deviation increase in the "number of indirect contacts" will reduce the percentage of competitors taking imitating reactions by only 0.16%.

*Hypothesis 8* predicts that the negative effect of indirect contacts on competitors' imitative reactions will be stronger when competitors and indirect contacts have highly equivalent market dependence. This prediction was tested through the interaction term of the "number of indirect contacts" and "equivalence between competitors and indirect contacts." Corroborating this hypothesis, the coefficient of

this interaction term is negative and significant in model 5 and 6. In terms of effect size, when the equivalence between competitors and indirect contacts is high (one standard deviation above the sample average), a one-standard-deviation increase in the "number of indirect contacts" will reduce the percentage of competitors taking imitating reactions by 0.89% (model 6). In contrast, when the equivalence between competitors and indirect contacts is low (one standard deviation below the sample average), a one-standard-deviation increase in the "number of indirect contacts" will reduce the percentage of competitors taking imitating reactions by only 0.18%.

## DISCUSSION

At a specific level, this study has developed and extended the conventional wisdom about a "two-front war," which has received limited direct treatment in market competition literature. Conventional wisdom suggests that a two-front war will force one's opponents to split attention and resources to deal with challenges on different fronts, reducing opponents' maneuverability on either front. In the context of a broadly defined multimarket industry, the current study suggests that when a firm's competitors are caught in competitive encounters with others in separate markets, their ability to closely monitor and actively compete with the focal firm will be reduced. Consequently, the firm is less constrained by the prospect of competitive imitation and has more leeway to exploit new market opportunities.

At a broader level, this study draws attention to a significant gap in market competition literature. Scholars used to selectively focus on either an aggregate marketplace or on two paired actors when studying market competition. As a result,

little is known about how to model competitive interdependence among multiple identified parties. The current study adopts a firm-centric approach, examining the market encounters between a firm, its competitors, and its competitors own competitors. Using the idea of a two-front war, the current study shows that the way through which a firm's competitors interact with the focal firm is dependent on its competitors' interaction with their own competitors. The frame of reference in this study, nonetheless, is limited to the triadic interaction between three role positions: namely a focal firm, the firm's competitor, and the firm's indirect contact. Future research may extend the triadic reference frame to examine multiparty interdependence at a higher analytical level.

# CHAPTER 4:

# A GENERAL THEORY

The volume of organization and management studies that apply network analysis has expanded rapidly in recent years (Borgatti & Foster, 2003; Brass et al., 2004; Kilduff & Tsai, 2003). Generally defined, a "network" consists of a set of nodes and the set of ties that connect these nodes. "Nodes" represent actors, who may be persons, social groups, or firms. "Ties" represent some forms of stable relationships between the actors. As such, a network depicts the structured patterns of interaction in which actors are embedded. For actors located in different positions in a network, the interconnected relationships provide differential opportunities and impose differential constraints on behavior. Using this network perspective, scholars have been able to explain a wide range of organizational phenomena, including career advancement (Burt, 1992), work group innovation (Reagans & Zuckerman, 2001), and firm performance (Gulati et al., 2000).

In principle, relationships represented by "ties" in network analysis can take on endless forms. By far, however, most studies have focused on networks of "social ties," which facilitate resource exchange and refract endorsement (Burt, 2000; Granovetter, 1985; Podolny, 2001; Uzzi, 1997). Little attempts have been made to examine networks of "competitive ties," which connect actors with conflicting interests (e.g., companies approaching the same buyers to sell substitutable products; academics applying for the same research grants to fund similar projects). In the

network literature, competition has been conceptualized as an invisible tension between two actors who have identical social ties with similar others, hence being role substitutes for each other (Burt, 1987). Accordingly, literature has identified competitive relationships between pairs of actors through analyzing the network structure of their social ties. Nonetheless, scholars have not looked into the network structure of competitive relationships in its own right.

It seems reasonable to speculate that an actor's conducts and achievements will be affected by the structured patterns of competitive interaction nearby. Hence, studying the network structure of competitive relationships may generate fresh insights for a number of research traditions. A specific example here is research on market competition. Scholars have typically studied market competition either at the level of two paired firms or at the level of an aggregate marketplace. Research on interfirm rivalry behavior (Baum & Korn, 1999; Chen, 1996; Ferrier et al., 1999; Gimeno, 1999) treated market competition as dyadic interaction between paired actors, but overlooked the wider market context. Classical industrial organization (Scherer & Ross, 1990) and organizational ecology (Hannan & Freeman, 1989) treated market competition as aggregate properties of a marketplace, but overlooked each firm's individual situation. In contrast to the predominately micro and macro orientation, viewing firms as being embedded in a network of interfirm competitive relationships may offer a middle ground, for a firm's position in the competitive network reflects its individual situation shaped by the wider patterns of competitive interaction.

Motivated by this expectation, the current article looks into the network structure of interfirm competitive relationships. To describe the structural properties of a competitive network, researchers may draw from the analytical techniques developed by social network research (cf. Scott, 2000; Wasserman & Faust, 1994). Nonetheless, to ascribe concrete meaning to the competitive network structures, researchers would need a brand new theory, since the dynamics of competitive interaction differ fundamentally from the dynamics of cooperative, social interaction. The main objective of this article is to develop a new theory that will help researchers to make sense of the competitive networks structures.

The theory developed here has three essential characteristics. Firstly, the author follows Schumpeter (1934) in viewing market competition as an interactive process, driven by creative moves that generate transient advantages and counter reactions that neutralize these advantages. Secondly, this article accounts for the long-standing observation that organizations have limited attentive capacity (Simon, 1947) and tend to concentrate their attention on a selective few (Porac & Thomas, 1990). Thirdly, the unit of analysis here is an ego-network, consisting of all competitors facing an ego firm and all competitive relationships associated with these competitors. Overall, this article shows that certain competitive network structures can divert competitors' attention away from a firm, reducing their rate of reacting against the firm's moves, and allow the firm to benefit more from its creative endeavor. Thereby, a firm's opportunity for attaining superior performance is dependent upon the structure of its competitive network.

# THEORETICAL ARGUMENTS

Market competition can be viewed as an interactive process where firms make creative moves that disrupt status quo and yield transient advantages, while their competitors react by taking counter measures that neutralize these advantages. For example, a firm may achieve a cost advantage through introducing an innovative inbound logistics system. This advantage, however, is short lived. As soon as the firm's competitors react by adopting a similar system – or even an improved one – the cost advantage will be eroded and eventually be eliminated. Creative moves place a firm temporally ahead of its competitors in the quest for competitive advantages. The rate of which competitors react determines how durable this lead is, and thus how much benefit the firm can reap from its moves.

A firm's window to benefit from its creative moves is keyed to attaining superior performance and is the focus here. Firms with different market domains are confronted with different sets of competitors. In this sense, each firm can be viewed as facing a "competitive network," which consists of all competitors of the ego firm and all competitive relationships associated with these competitors. Certain network structures can increase or decrease competitors' reaction rate, thereby affecting firms' return on making creative moves. The current article depicts these structures. The arguments here are about how the wider patterns of competitive relationships allow some firms to be rewarded for their creative endeavor, while make others' a futile attempt.

## Market Competition as an Interactive Process

In his renowned theory of economic development, Joseph Schumpeter (1934) described market economies as being characterized by continuous interaction between entrepreneurial firms and the inescapable force of competition. Entrepreneurial firms obtain supra-normal profits from their creative inventions, but market competition forces these firms to hand on the gains to the wider society and to move on to the next opportunity – or lose to others who do it. Economic development is driven by firms' relentless struggle to remain competitively viable through exploring and exploiting new business opportunities.

While Schumpeter concerned mainly about the long-term performance of market economies, his theory had inspired a sizeable literature in strategy research, whose primary objective is to identify the sources of superior firm performance (e.g. D'Aveni, 1994; Jacobson, 1992; Nelson & Winter, 1982; Smith, Grimm, & Gannon, 1992). Many works in this line drew from Schumpeter's specific insight that market competition can be viewed as an interactive process: firms' creative moves generate competitive advantages and supra-normal profits, which motivate other market actors to take counter reactions to neutralize the advantages and seize the same profits. A competitive market is in a constant state of flux, disrupted by firms' creative moves and counter reactions time after time. Competitive advantages are not sustainable in the long-term. A firm attains superior performance through stringing together a series of transient advantages derived from its relentless creative endeavor.

In accordance to the interactive view on market competition, there are two crucial factors to attaining superior firm performance. The first factor concerns a firm's capability to act creatively. Creative moves can take on various forms, including the introduction of new technologies, products, or services, as well as the adoption of new strategies, organizational structures, or practices. Since this article is about competitive interaction, the complicated issue of creative capability is beyond the scope here. Yet, it is worth noting that an organization's creative capability resides not only in its internal resources and procedures (Teece, Pisano, & Shuen, 1997), but also in its collaborative relationships with others (Ahuja, 2000; Hargadon & Sutton, 1997; Powell, Koput, & Smith-Doerr, 1996).

The second crucial factor concerns counter reactions that neutralize the advantages thought by a creative firm. Common forms of counter reactions include imitation and substitution: other market actors may match a firm's creative moves, or take alternative moves that yield comparable advantages (Lieberman & Asaba, 2006). When a firm's creative moves quickly elicit counter reactions by many others, it can hardly benefit from the moves. In technology innovation, for instance, many firms who were first to commercialize a new technology failed to profit from their innovations, while fast imitators did (Teece, 1986). Lag in counter reactions allows a firm to benefit more from its creative moves. A firm can enjoy supra-normal profits for a longer period. More importantly, it is given time to accumulate experiences, control complementary resources, and build up buyers' switching costs. These efforts can help a creative first mover to defend against its challengers later on (Kerin, Varadarajan, & Peterson, 1992; Lieberman & Montgomery, 1988).

Hence, the lower the rate of counter reactions, the more benefit a firm can reap from its creative moves, which helps the firm to attain superior performance over time. The question is then: under what conditions will other market actors react against a firm's moves more quickly or slowly? Broadly speaking, actors' reaction rate will increase with (1) their selective attention on the firm and (2) their differential capability to carry out counter reactions (Chen, 1996; Smith et al., 2001).

This article downplays the second issue of differential capability to focus on the first issue of selective attention. Depending on individual attributes such as organizational structures and past performance, market actors may differ significantly in their capability to compete actively (Miller & Chen, 1994). Actors with superior capability can react against a firm's moves faster, while those with inferior capability need longer lead-time before they are ready to react – if they react at all. To address this variation, the author will need to account for each market actor's distinct attributes. Nonetheless, the main objective of this article is to identify the influences of competitive network structures that can generalize beyond the attributes of specific actors in the network. For the interest of parsimony, this article assumes a moderate level of homogeneity in actors' capability.

That leaves the issue of selective attention. Scholars have long noted that organizations have limited attentive capacity to monitor their surroundings (Simon, 1947) and tend to concentrate their attention on a selective few (Porac & Thomas, 1990). Accounting for this observation, the current article examines the network structure of competitive relationships in a firm's local environment, showing that certain structures can reduce nearby actors' attention on the ego firm's moves,

decrease their rate of taking counter reactions, and allow the firm to benefit more from its creative endeavor. Before this point can be elaborated further, it is necessary to clearly define "competitive relationships" as the basis of network analysis.

## Competitive Relationships

Network analysis emerged as a set of methods for analyzing the structured patterns of relationships. The use of these methods, thereby, depends on the availability of relational data. A general form of relational data is an incidence matrix. As Figure 1 shows, an incidence matrix has a case-by-affiliation logical format. "Cases" are actors that form the unit of analysis, while "affiliations" denote activities in which these actors may be jointly involved. The presence or absence of relationships between a particular pair of actors can be derived from an incidence matrix. For instance, actor *a* in Figure 9 is related to *b* since they are both involved in activity *M1*, while *a* is not related to *e* since they are not involved in any activities in common (cf. Scott, 2000; Wasserman & Faust, 1994).

The case-by-affiliation format provides a useful reference frame for identifying interfirm competitive relationships. Here, "cases" are firms as individual market actors, while "affiliations" denote these actors' operation in a range of product or geographic markets. Each individual actor can have its own market domain: a pharmaceutical company may produce cardiovascular and respiratory drugs but not dermatological drugs, or a domestic airline may fly East Coast and Midwest routes but not West Coast routes. To the extent that different markets delineate distinct sets of products and buyers (Abell, 1980), actors with overlapping market domains will

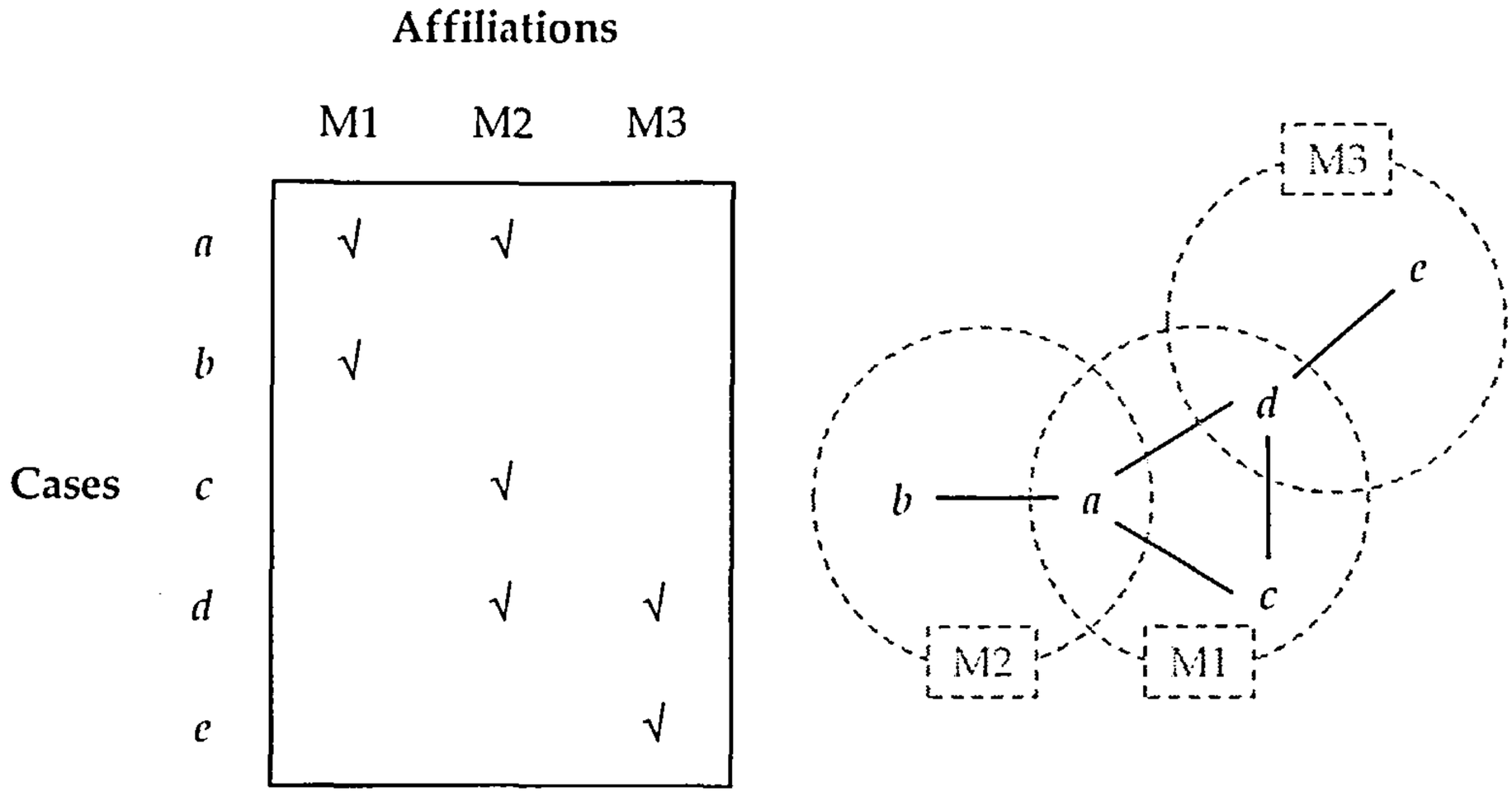



**Figure 9: An Incidence Matrix**

compete with one another, in that they supply substitutable products to the same buyers. Accordingly, to decide whether or not two actors are in a competitive relationship, a simple indicator is whether they both operate in certain product or geographic markets.

While market actors may attempt to identify and trace their competitors comprehensively, a holistic environmental scanning is not feasible for most organizations, who have but limited attentive capacity to monitor their surroundings (Simon, 1947). As a result, organizations tend to concentrate their attention on a selective few competitors whom are perceived as a major threat (Porac & Thomas, 1990) but largely overlook other competitors (Abrahamson & Fombrun, 1994). The perception of "who are our major competitors" is consequential. To react against their competitors, market actors must first become aware of their competitors' moves and be motivated to respond (Chen, 1996). If market actors do not perceive a specific competitor as threatening, they tend to pay only scant attention to it. As a result, they

may not notice this competitor's moves. Even if they do, they may not feel obligated to take counter reactions.

The perceived strength of competitive relationships, derived from overlapping market domains, can vary widely. One primary reason is that when market actors operate in multiple product or geographic markets, they may have differing interest in these markets. For example, a pharmaceutical company may obtain more than eighty percent of its revenue from the cardiovascular market, but less than twenty percent of its revenue from the respiratory market. Markets that firms depend upon in securing their revenue streams are of prime importance. Actors are likely to view competitors in their important markets as a major threat to be placed under close surveillance, but may overlook competitors in their marginal markets (Chen & MacMillan, 1992).

Market actors may also encounter competitors with differing presence in their market domains. Some competitors may hold a significant share of an important market, while some may have a small foothold. For example, a pharmaceutical company may encounter in the cardiovascular market both large players – each holds more than ten percent of the market – and small players – each holds one or two percent market share. In comparison to small players, large players are more visible (Porac et al., 1995) and are more capable of employing predatory tactics using their market power (Scherer & Ross, 1990). Actors are likely to keep a close eye on competitors who hold a significant share in their market domains, but may pay only scant attention to competitors who have limited presence in their domains.

Because market actors have differing interest and presence in the markets where they encounter one another, competitive relationships are typically asymmetric; namely, the degree to which *a* competes with *b* is not typically the same as the degree to which *b* competes with *a* (Carpenter, Cooper, Hanssens, & Midgley, 1988; Chen, 1996; DeSarbo, Grewal, & Wind, 2006). For example, Hawaii Airlines, a local airline in the Pacific region, was likely to view American Airlines, a national megacarrier, as a major competitive threat. In contrast, American Airlines might pay relatively scant attention to Hawaii Airlines, since it was caught in competing with other national megacarriers (Chen, 1996). This asymmetry occurred because the Pacific markets were far more essential to Hawaii Airlines than to American Airlines. Another well-known example is the entry of Japanese automobile manufacturers into the U.S. markets. Despite U.S. companies' inability to identify their Japanese competitors, Japanese companies actively targeted on their neglectful U.S. counterparts (Yates, 1984). This asymmetry occurred because U.S. companies controlled a majority of the U.S. automobile markets when Japanese competitors entered, while Japanese companies started from low sales figures in the U.S.

In summary, competitive relationships between pairs of market actors can be identified through their overlapping market domains. Two actors compete with each other when they both operate in certain product or geographic markets. The strength of their competitive relationship, as perceived asymmetrically by the two parties, is affected by their differing interest and presence in their common markets. A strong competitive relationship prompts one party to closely monitor the other, while a weak competitive relationship may cause negligence. Built on this relational analysis,

the next section will examine the network structure of competitive relationships in a firm's local environment.

**Structures of Competitive Networks**

Firms with different market domains are confronted with different sets of competitors: a pharmaceutical company producing cardiovascular and respiratory drugs competes with other producers of the same products, or a domestic airline flying East Coast and Midwest routes competes with other carriers in the same regions. In this sense, each firm can be viewed as facing a "competitive network," which consists of all competitors of the ego firm and all competitive relationships associated with these competitors.

Each firm's competitive network has a distinct structure, delineating to what extent a firm's competitors competing with the firm, with one another, and with other market actors whom the firm does not directly encounter. It appears reasonable to speculate that a firm's performance will be influenced by the patterns of competitive interaction around. Therefore, the structure of a firm's competitive network warrants further investigation. In accordance to the interactive view on market competition, a firm's superior performance derives from its competitors' lag in reacting against its creative moves. Therefore, competitive network structures that decrease competitors' rate of reacting against a firm are expected to be associated with to better firm performance. In contrast, structures that incur a higher reaction rate are expected to constrain a firm from out-performing its competitors.

**Competitors' relationships with the ego firm.** To predict competitors' reaction rate, a simple starting point is to examine the relationships between a firm's competitors and the ego firm. In Figure 10(a), the ego firm's competitors have strong competitive relationships with the firm. This situation occurs when the firm holds a significant share in markets that are important to its competitors. Figure 10(b) depicts an opposite example, where the ego firm's competitors view the firm as a minor threat.

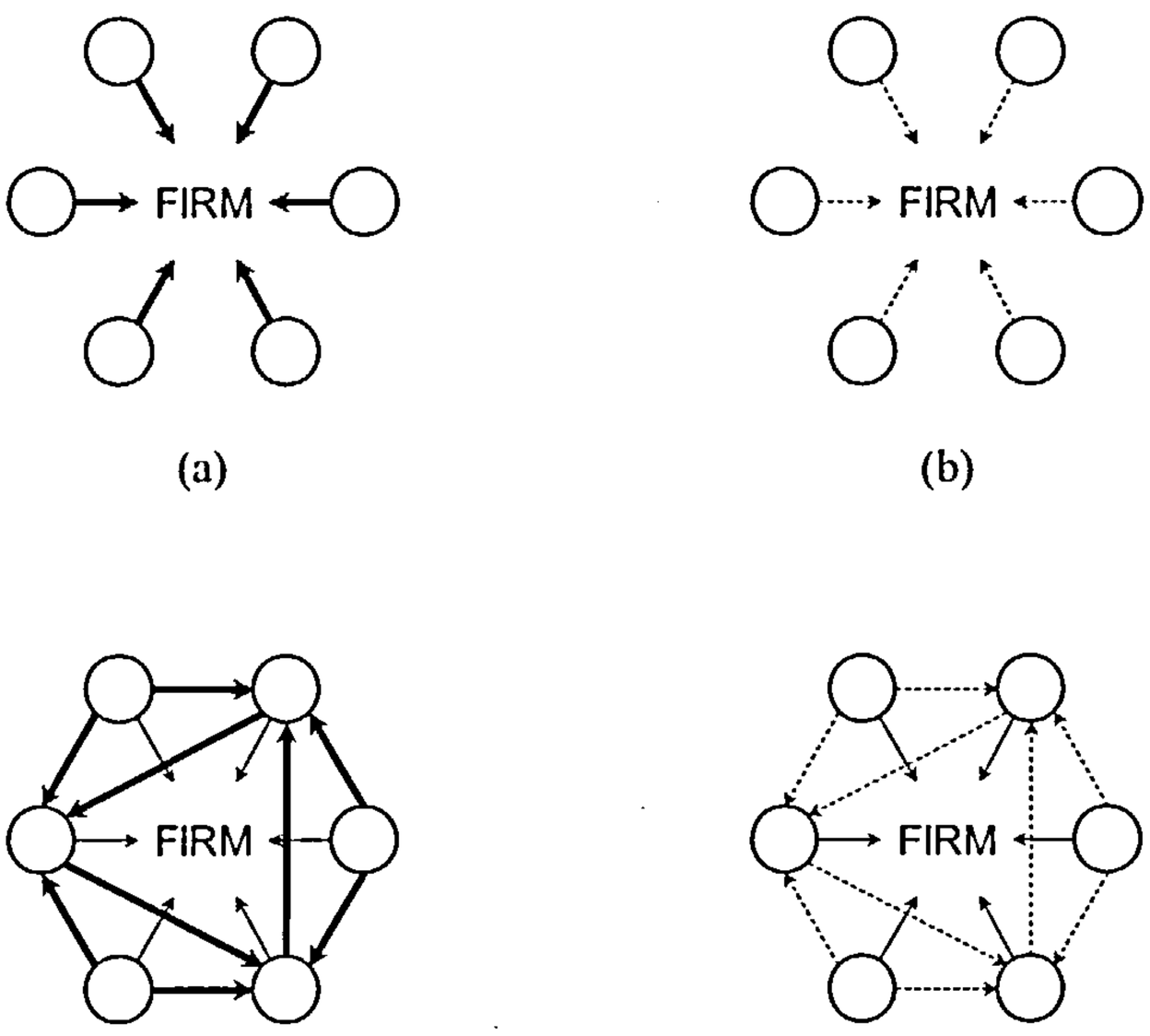



**Figure 10: Structures of Competitive Networks**

This situation occurs when the firm has limited presence in markets that are important to its competitors.

When a firm's competitors have strong competitive relationships with the ego firm, they are expected to quickly notice and react against the firm's moves. These competitors are prompted to place the ego firm under close surveillance. Moves made by the firm will soon be noticed. When competitors' attention is drawn to the ego firm's moves, they may react in an attempt to resolve concurrent issues that have entered the consciousness of decision-makers (Ocasio, 1997). Further, these competitors are prompted to frame the ego firm's moves as threatening events, since lag in responding can cause them to lose their important markets to the firm. Decision-makers are particularly anxious about events that are labeled as threats (Dutton & Jackson, 1987) and are associated with potential losses (Kahneman & Tversky, 1979). As such, competitors may feel obligated to react quickly, by taking counter measures that neutralize the ego firm's advantages and secure competitive parity (Knickerbocker, 1973).

In contrast, when a firm's competitors view the ego firm as a minor threat, they are expected to react against the firm's moves at a comparatively lower rate. These competitors may not closely monitor the ego firm. Thereby, moves made by the firm are less likely to be noticed. Even if these competitors become aware of the ego firm's moves, they may not feel motivated to react, because they have limited stakes in markets where they encounter the firm. Further, instead of interpreting the ego's firm's creative moves as threatening events that lead to potential losses, competitors may view these moves as observable clues to new business opportunities

(Bikhchandani, Hirshleifer, & Welch, 1998). New opportunities are typically associated with high uncertainty, while decision-makers are risk averse in assessing potential gains (Kahneman & Tversky, 1979). As such, these competitors may choose to wait and see, to react only after additional information about the new opportunities has been revealed.

Accordingly, strong competitive relationships between a firm's competitors and the ego firm will incur competitors' counter reactions, thereby reducing the ego firm's return on its creative moves. On the contrary, when a firm's competitors view the ego firm as a minor threat, they will have a lower rate of taking counter reactions, allowing the ego firm to attain superior performance through its creative moves.

**Competitors' relationships with one another.** The above analysis focuses on the direct interaction between a firm and its competitors: the ego firm makes a move, and its competitors react to the firm directly by taking counter measures. Nonetheless, competitors may also take counter measures not as a direct response the ego firm. Some competitors may react against the firm because they observe that some other competitors have done so, and decide to follow suit. In other words, competitors' counter reactions result not only from their interaction with the ego firm, but also from their interaction with one another.

Therefore, to predict competitors' reaction rate, it is necessary to account for the competitive relationships between them. In Figure 10(c), the ego firm's competitors have strong competitive relationships with one another. This situation occurs when some competitors hold a significant share in markets that are important to some

other competitors. Figure 10(d) depicts an opposite example, where the ego firm's competitors view one another as a minor threat. This situation occurs when competitors' market domains do not overlap much.

When a firm's competitors have strong competitive relationships with one another, they are expected to quickly follow one another in reacting against the ego firm's moves. After the firm has made a creative move, some of its competitors may soon react, while some may be neglectful in the very beginning. However, the strong relationships between these competitors prompt them to keep one another under close surveillance. Those who did not react in the first place will soon notice that some others had done so. Such an observation may draw their attention to the ego firm's moves and trigger follow-on reactions. Further, after observing that an increasing number of salient others had reacted, remaining non-responders will become anxious, worrying that they may be punished for missing out on something whose importance is widely acknowledged (Brandenburger & Polak, 1996; Scharfstein & Stein, 1990). As a consequence, they may quickly follow suit in reacting against the firm's moves – even if they do not view the ego firm as a major threat by itself.

In contrast, when a firm's competitors view one another as a minor threat, they are expected to react against the ego firm's moves at a comparatively lower rate. As these competitors are less inclined to trace one another's conducts, behavioral contagion will be rare. Each competitor's reaction rate mostly reflects its individual awareness and assessment of the ego firm's moves. After the ego firm has made a creative move and elicit several counter reactions, non-responders may not notice

that some others had reacted. Even if they do, they may not regard others' reactions as relevant to their decision-making context (Greve, 1998; Kiesler & Sproull, 1982), since those responders do not have significant presence in their important markets. As such, some competitors may keep ignoring the ego firm's moves although other competitors had taken counter reactions.

Accordingly, strong competitive relationships between a firm's competitors will accelerate competitors' rate of taking counter reactions, thereby reducing the ego firm's return on its creative moves. On the contrary, when a firm's competitors view one another as a minor threat, their reaction rate will be lower, allowing the ego firm to attain superior performance through its creative moves.

**Competitors' relationships with other market actors.** A firm's competitors may compete not only with the ego firm and with one another, but also with other market actors whom the ego firm does not directly encounter. For example, a pharmaceutical company may find that some of its competitors in the cardiovascular and respiratory market also produce dermatological drugs, and hence compete with other dermatological drugs producers. Among these dermatological drugs producers, some may not serve either the cardiovascular or respiratory market, and hence do not compete with the focal pharmaceutical company.

Competitors' relationships with other market actors warrant further investigation, as these relationships may influence competitors' rate of reacting against the ego firm's moves. In Figure 10(e), the ego firm's competitors have strong competitive relationships with other market actors. This situation occurs when other actors hold a

significant share in markets that are important to the firm's competitors. By definition, the ego firm does not operate in these markets keyed to its competitors. Figure 10(f) depicts an opposite example, where the ego firm's competitors view other market actors as a minor threat. This situation occurs when other actors have limited presence in markets that are important to the firm's competitors.

When a firm's competitors have strong competitive relationships with other market actors, they are expected to be slow in reacting against the ego firm's moves. These competitors may devote significant attention to competing with other actors in markets that the ego firm does not serve. However, organizations have but limited attentive capacity (Simon, 1947). The greater the extent to which competitors' attention is drawn to actors in other markets, the less attentive capacity they will have left for monitoring the ego firm. Especially when competitors view other market actors as a bigger threat in comparison with the ego firm, they may ignore the firm to concentrate on competing with these other actors. As a result, these competitors may not notice what the ego firm has just done and carefully consider how to respond.

When a firm's competitors view other market actors as a minor threat, they are expected to react against the ego firm's moves at a comparatively higher rate. These competitors may overlook other market actors, but concentrate on competing with the ego firm and with one another. By concentrating their attention on the ego firm, these competitors are more likely to become aware of the firm's moves and feel motivated to react (Chen, 1996). By concentrating their attention on one another, these competitors are more likely to follow one another in reacting against the ego

firm's moves. Therefore, soon after the ego firm has made a move, many of its competitors may take counter measures either as a direct response to the move, or as a consequence of behavioral contagion between them.

Accordingly, strong competitive relationships between a firm's competitors and other market actors will decrease competitors' rate of taking counter reactions, thereby allowing the ego firm to benefit more from its creative moves. On the contrary, when a firm's competitors view these other actors as a minor threat, their reaction rate will be higher, constraining the firm from attaining superior performance.

## Formal Indicators and Propositions

The theoretical arguments suggest that a firm's opportunity for attaining superior performance will decrease when its competitors closely compete with the ego firm or with one another, but will increase when its competitors closely compete with other market actors whom the ego firm does not directly encounter. To make these arguments ready for empirical examination, an important next step is to define formal indicators that depict the structured patterns of competitive relationships.

This section begins with defining three ego-network level indicators, namely *in-degree, density,* and *closure*. These indicators depict the overall structure of a firm's competitive network. Then, a competitor-specific indicator, termed *constraint,* is introduced. This indicator helps to identify who among a firm's competitors have

most negative influences on the ego firm's opportunity for attaining superior performance.

**Network In-degree, Density, and Closure**

Figure 11 presents several notations. In this figure, *i* denotes an ego firm, *j* and *k* denote the ego firm's competitors, and *z* denotes other market actors whom any of these competitors, but not the ego firm, compete with.

Variable $r_{ab}$ in Figure 11 denotes *a*'s competitive relationship with *b*. A high value of $r_{ab}$ indicates that *b* closely competes with *a*. Since competitive relationships are typically asymmetric, a high $r_{ab}$ does not necessarily correspond with a high $r_{ba}$. The value of $r_{ab}$ is proportional to *b*'s presence in *a*'s important markets (Chen, 1996):

$$r_{ab} = \sum_m \left( \frac{s_{am}}{s_a} \times \frac{s_{bm}}{s_m} \right)$$

In this equation, market *m* is important to *a* when *a*'s sales in this market (denoted by $s_{am}$) accounts for a large proportion of *a*'s total revenue ($s_a$), while *b* has significant presence in this market when *b*'s sales in there ($s_{am}$) accounts for a large share of the

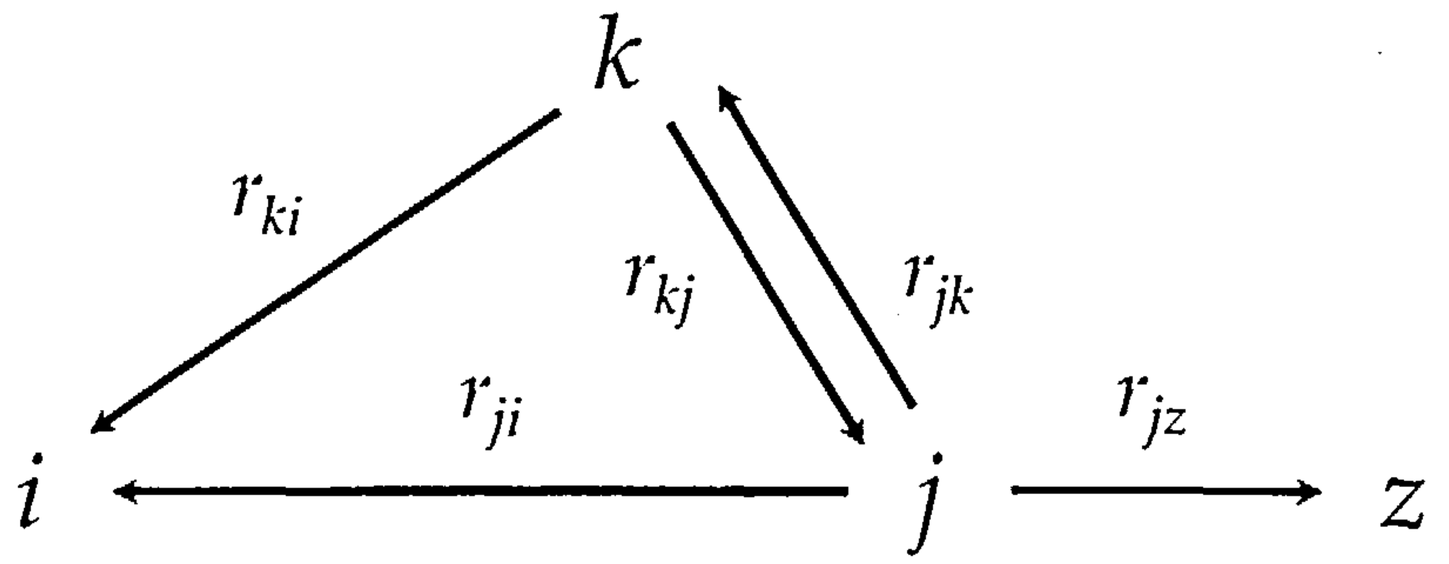



**Figure 11: Notations**

total market size ($s_m$). The relationship variable is computed by aggregating across all the markets in which *a* operates.

With the relationship variable being defined, one may move on to examining the network structure of competitive relationships. The first indicator of competitive network structures is *in-degree,* which captures the extent to which a firm's competitors compete with the ego firm (denoted by $r_{ji}$):

$$\text{In-degree of } i\text{'s competitive network} = \sum_j r_{ji}$$

Network in-degree is high when a firm's competitors have strong competitive relationships with the ego firm, a situation depicted by Figure 10(a). Since these competitors are prompted to place the ego firm under close surveillance, they may quickly notice and react against the firm's creative moves. As such, the ego firm is more constrained from attaining superior performance through its creative endeavor. In contrast, network in-degree is low when a firm's competitors view the ego firm as a minor threat, a situation depicted by Figure 10(b). Since these competitors tend to pay only scant attention to the ego firm, they may not become aware of the firm's creative moves, or may not feel obligated to take immediate reactions. As such, the ego firm is allowed for a higher return on its creative endeavor, and has a better opportunity for attaining superior performance. Accordingly:

*Proposition 1: The in-degree of a firm's competitive network will be negatively associated with the ego firm's performance.*

The second indicator of competitive network structures is *density*, which captures the extent to which a firm's competitors compete with one another (denoted by $r_{jk}$):

$$\text{Density of } i\text{'s competitive network} = \frac{\sum_j \sum_k r_{jk}}{N_i \times (N_i - 1)}$$

Network density is high when a firm's competitors have strong competitive relationships with one another, a situation depicted by Figure 10(c). Since these competitors are prompted to closely monitor one another, they may quickly follow one another in reacting against the ego firm's creative moves. As such, the ego firm is more constrained from attaining superior performance through its creative endeavor. In contrast, network density is low when a firm's competitors view one another a minor threat, a situation depicted by Figure 10(d). Since these competitors tend to overlook one another, some competitors may keep ignoring the ego firm's creative moves although other competitors had taken counter reactions. As such, the ego firm is allowed for a higher return on its creative endeavor, and has a better opportunity for attaining superior performance. Accordingly:

*Proposition 2: The density of a firm's competitive network will be negatively associated with the ego firm's performance.*

The third indicator, *closure*, concerns whether a firm's competitors concentrate on competing with other market actors whom the ego firm does not directly encounter (denoted by $r_{jz}$) or instead concentrate on competing with the ego firm ($r_{ji}$) and with one another ($r_{jk}$):

$$\text{Closure of } i\text{'s competitive network} = 1 - \frac{\sum_j \sum_z r_{jz}}{\sum_j r_{ji} + \sum_j \sum_k r_{jk} + \sum_j \sum_z r_{jz}}$$

Network closure is high (i.e. approaches unity) when a firm's competitors view other market actors as a minor threat, a situation depicted by Figure 10(f). Since these competitors are prompted to concentrate on competing with the ego firm or with one another, they may take counter measures as a direct response to the firm's creative moves, or as a result of behavioral contagion between them. As such, the ego firm is more constrained from attaining superior performance through its creative endeavor. In contrast, network closure is low when a firm's competitors closely compete with other market actors, a situation depicted by Figure 10(e). Being caught by competing with other market actors, these competitors may be left with limited attentive capacity for following the ego firm or one another. As such, the ego firm is allowed to reap more benefit from its creative moves, and has a better opportunity for attaining superior performance. Accordingly:

> *Proposition 3: The closure of a firm's competitive network will be negatively associated with the ego firm's performance.*

**Constraint Imposed by Specific Competitors**

The arguments by far can be summarized as the following. A competitive network characterized by low in-degree, density, and closure can decrease competitors' rate of reacting against the ego firm's creative moves, allow the firm to benefit more from its moves, and give the firm a better opportunity for attaining superior performance. On the contrary, a performance-seeking firm is more constrained by its competitors'

counter reactions when its competitive network is characterized by high in-degree, density, and closure.

When a firm is constrained by the prospect that its competitors will react against its creative moves, a key question that follows is: who among these competitors are most influential to the firm's opportunity for attaining superior performance? Briefly, influential competitors are those who have the highest propensity to (1) react against the ego firm's moves and (2) induce other competitors to do the same. To help identify these influential competitors, a formal indicator, termed *constraint,* is introduced here.

Obtaining this competitor-specific indicator takes several steps. Firstly, an adjusted relationship variable is defined to account for competitors' relationships with other market actors whom the ego firm does not directly encounter (denoted by $r_{jz}$). When a competitor closely competes with these other actors, it will be left with limited attentive capacity to follow the ego firm or other competitors. Accordingly, competitor $j$'s adjusted relationship with $b$ ($b$ may denote the ego firm or other competitors) is defined as:

$$r_{jb}^{*} = r_{jb} \times \left( 1 - \frac{\sum_{z} r_{jz}}{r_{ji} + \sum_{k} r_{jk} + \sum_{z} r_{jz}} \right)$$

In the above equation, $r_{jb}^{*}$ will be equal to $r_{jb}$ when competitor $j$ competes only with ego firm $i$ and with other competitors of the ego firm. However, when competitor $j$ closely competes with many other market actors, $r_{jb}^{*}$ will be discounted.

The next step is to identify each competitor's reaction rate. A competitor may take counter reactions as a direct response to the ego firm's moves, or may follow other competitors in reacting against the ego firm. The former situation is likely to occur when this competitor has a strong competitive relationship with the ego firm ($r_{ji}^*$), while the later situation is likely to occur when this competitor has strong competitive relationships with other competitors ($r_{jk}^*$) who have strong competitive relationships with the ego firm ($r_{ki}^*$). This is captured using:

$$r_{ji}^* + \sum_k r_{jk}^* r_{ki}^*$$

The third step is to assess each competitor's likelihood of being followed by other competitors in reacting against the ego firm. This likelihood depends upon whether other competitors closely compete with a specific competitor ($r_{kj}^*$). A competitor viewed by many other competitors as a major threat is especially likely to be followed by many. This is captured using:

$$\sum_k r_{kj}^*$$

Finally, the extent to which a firm's opportunity for attaining superior performance is constrained by its competitor $j$ can be defined as the product of (1) $j$'s rate of reacting against the ego firm's moves and (2) $j$'s likelihood of being followed by other competitors in reacting against the ego firm:

$$\text{Constraint imposed by } j \text{ on } i = \left(r_{ji}^* + \sum_k r_{jk}^* r_{ki}^*\right) \times \sum_k r_{kj}^*$$

Competitors who impose a high level of constraint are a firm's arch rivals. By reacting against the firm's creative moves promptly and inducing others to do the same, these competitors can make the firm's creative endeavor nothing but a futile attempt. In contrast, competitors who impose a low level of constraint have a low reaction rate and limited contagious impacts on other competitors. These competitors have little influences on a firm's opportunity for attaining superior performance. Accordingly:

> *Proposition 4: Competitors who impose a high level of constraint on a firm will negatively influence the ego firm's performance more than competitors who impose a low level of constraint.*

## Discussion

This article sets out to develop a new theory on the network structure of competitive interaction. Each firm is viewed as facing a "competitive network," which consists of all competitors of the ego firm and all competitive relationships associated with these competitors. The structure of a firm's competitive network can affect the ego firm's opportunity for attaining superior performance. Specifically, network in-degree, density, and closure are shown to be negatively associated with firm performance. The author also shows that each competitor can impose a differing level of constraint on a performance-seeking firm, depending on how a competitor is related to the ego firm, to other competitors, and to other market actors whom the ego firm does not directly encounter.

Accordingly, this article demonstrates that the analytical techniques developed by social network research (cf. Scott, 2000; Wasserman & Faust, 1994) can be applied to study interfirm competitive interaction. A sizeable body of literature has shown that actors' achievements in a competitive arena are contingent on the structured patterns of their social interaction (Burt, 2000; Granovetter, 1985; Podolny, 2001; Uzzi, 1997). Through a newly-developed theory, the author shows that firms' performance in a competitive marketplace is dependent upon the structured patterns of their competitive interaction. This is so because the patterns of competitive interaction allow some firm to be rewarded for their creative endeavor, while make others' a futile attempt.

Network analysis offers a middle ground between the predominately micro and macro orientation in organization and management studies. When deciding on the level of analysis, scholars used to place an exclusive focus either on individual organizations as self-directing actors or on total organizational populations as exhibiting their own dynamics not discernible in individual members (Astley & Van de Ven, 1983). Specifically in the research on market competition, scholars have treated competition either as dyadic interaction between paired market actors (Baum & Korn, 1999; Chen, 1996; Ferrier et al., 1999; Gimeno, 1999) or as aggregate properties of a marketplace (Hannan & Freeman, 1989; Scherer & Ross, 1990). Beyond this micro-macro dichotomy, the author explicitly connects firms' interactive behavior with the wider market context. Moves and counter reactions exchanged between market actors are shown to be affected by the wider structures of competitive relationships around.

For strategy scholars, this article introduces a new approach to investigate heterogeneity in firm performance. A large body of strategy studies have attributed superior firm performance to attractive market conditions (Porter, 1980, 1985) or to a firm's idiosyncratic resources (Barney, 1991; Peteraf, 1993) and capabilities (Teece et al., 1997). Adding to the reigning oligopolistic and resource-based approach, the author proposes a new cause of superior performance, namely the differing structure of a firm's competitive network. Certain network structures allow a firm to build up competitive advantages over time, while certain structures prohibit a firm from out-performing its competitors.

This article also introduces a new way for managers to identify their critical competitors. In monitoring their surroundings, managers tend to concentrate on those whom they compete with most closely (Abrahamson & Fombrun, 1994; Chen & MacMillan, 1992; Porac & Thomas, 1990; Porac et al., 1995). Nonetheless, since competitive relationships are typically asymmetric, a firm may be viewed as a major threat by market actors whom it largely neglects (Carpenter et al., 1988; Chen, 1996; DeSarbo et al., 2006). Further, some actors may contest a firm not because they view the ego firm as a major threat by itself, but because some other actors do so. The author develops a formal approach to take into account both competitive asymmetry and behavioral contagion. Critical competitors are identified as those who have the highest propensity to react against a firm's moves and induce other competitors to do the same.

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# APPENDIX

| Categories of Active Pharmaceutical Ingredients | |
|---|---|
| 1 Anti-infectives for systemic use | 12 Blood and blood forming organs |
| 2 Musculoskeletal system | 13 Solutions affecting the electrolyte balance |
| 3 Vitamins | 14 Anesthetics |
| 4 Antiparasitic products, insecticides and repellents | 15 Antihistamines; antidote |
| 5 Sex hormones; hormonal preparations | 16 Biochemicals |
| 6 Antineoplastic and immunomodulating agents | 17 Antiseptics and disinfectants |
| 7 Cardiovascular system | 18 Sensory organs |
| 8 Respiratory system | 19 Dermatologicals |
| 9 Nervous system | 20 Diagnostic agents |
| 10 Metabolism | 21 Alimentary tract |
| 11 Genito-urinary system | 22 Solution additives |

| PC-related Product Markets | |
|---|---|
| 1 Computers | 11 Electro-medical equipment |
| 2 Monitors and terminals | 12 Integrated circuits |
| 3 Computer peripherals | 13 Discrete devices |
| 4 Audio and video equipment | 14 Semiconductors packaging and testing |
| 5 Communication equipment | 15 Electronic passive devices |
| 6 Telephones and cellular phones | 16 Bare printed circuit boards |
| 7 Storage media | 17 Printed circuit boards assembly |
| 8 Cameras | 18 Electronic parts and components |
| 9 Optical instruments | 19 Liquid crystal panel |
| 10 Measuring and control equipment | 20 Optoelectronic materials and components |

| Factor Analysis of Local Conditions in Mainland China | | | | |
|---|---|---|---|---|
| Variable | Wealth of Population | International-ization | Supply of Skilled Labor | Transportation Infrastructure |
| 1 Gross domestic product per capita | **0.726** | 0.373 | 0.100 | 0.509 |
| 2 Disposable income per capita | **0.874** | 0.330 | 0.204 | 0.244 |
| 3 Household expenditure per capita | **0.875** | 0.318 | 0.173 | 0.246 |
| 4 Total foreign capital | 0.308 | **0.839** | 0.270 | 0.224 |
| 5 Exports | 0.462 | **0.805** | 0.291 | 0.133 |
| 6 Imports | 0.504 | **0.748** | 0.266 | 0.259 |
| 7 No. of professional personnel | -0.342 | 0.479 | **0.745** | -0.035 |
| 8 Population with a college degree | 0.263 | 0.247 | **0.905** | 0.069 |
| 9 No. of recent college graduates | 0.307 | 0.102 | **0.901** | 0.048 |
| 10 Highway density | 0.503 | 0.406 | 0.090 | **0.665** |
| 11 Railway density | 0.223 | 0.114 | 0.010 | **0.949** |
| Cumulative variance explained | 0.291 | 0.540 | 0.768 | 0.937 |

Rotation: orthogonal varimax