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The Joint-Venture Paradox: Parent-firm Characteristics, Social Cues, and Joint Venture Performance

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The Joint-Venture Paradox: Parent-firm Characteristics, Social Cues, and Joint Venture Performance

by

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The Joint-Venture Paradox: Parent-firm Characteristics, Social Cues, and Joint Venture Performance

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A popular belief in both academic and business quarters is that joint ventures (JVs) are inherently unstable and short lived. This study questions this premise by arguing that the high failure rate of JVs observed in prior studies is in part an outcome of a selection process, in which, paradoxically, out of all possible JVs, the ones that are most likely to be formed are also the ones that are most likely to fail. That happens, I argue, because some of the same factors that increase a firm's likelihood of joint venturing may actually decrease JV performance. Specifically, drawing on the resource-based-view of the firm, transaction cost economies, industrial organization economics, and institutional theory, I develop the hypothesis that in technology-intensive industries, where the range of technical know-how needed to stay abreast of rapidly changing developments exceeds the capabilities of any single firm, a potential partner's age, size,

prior success, along with the number of JVs previously created in a firm's environment increase its propensity to joint venture but decrease its ability to do so successfully. That happens, I argue, because in selecting partners, executives seek readily available markers of legitimacy and capability, which unintentionally steer them to inertial partners that do not adapt well, a vital attribute of new ventures in rapidly changing, technology-intensive industries. In contrast to prior research, which has focused either on factors that influence a firm's likelihood of joint venturing or on factors that affect JV performance, but not on both simultaneously, I develop a two-stage model, in which I first examine factors affecting a JV's likelihood of being formed. Then, using a Heckman procedure (Heckman, 1979), I incorporate estimates of parameters from the first model into a second model, in which I use event history analysis to predict JV performance. Data on JVs created in twenty-six technology-intensive industries by publicly traded firms in the United States between 1986 and 2001 strongly supports the study's premise that paradox exists in JV formation process, in which executives are drawn to partners that lack the flexibility needed to sustain a new venture.

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Chapter I - Introduction

Academic work on interfirm linkages, or alliances, can be broadly categorized into two groups. One group examines which firms are more likely to enter an alliance (e.g. Gulati, 1995a; Stuart, 1998; Ahuja, 2000), whereas the second group seeks to identify factors that enhance or impede the performance of either the alliance itself, or of the alliance's parent-firms (e.g. Beamish, 1987; Harrigan, 1985; Koh and Venkatraman, 1991; Merchant, 1997). While each group of studies tells part of the story, thus far formation and performance have been studied independently of each another and have examined different causal factors. The formation studies have generally examined the effect of a focal firm's characteristics on its propensity to ally without regard to its potential partners' characteristics (for an exception see: Gulati and Westphal, 1999). Conversely, studies analyzing alliance performance have asked how the fit between the partner-firms' characteristics affects alliance performance but have failed to account for each firms' individual characteristics, i.e., the properties of each firm alone without regard to the other. This raises an interesting question, which serves as the impetus for this research: How do the factors affecting the likelihood of forming an alliance influence its subsequent performance? The study's main premise is that some of the same factors that increase a firm's likelihood of forming an alliance may actually decrease alliance performance.

Three characteristics that received considerable interest in prior research are partner-firm age, size and prior performance. Researchers seeking to understand interfirm differences in propensities to establish alliances have investigated how these traits affect

a focal firm's proclivity to form alliances but have not accounted for the impact of potential partners' age, size, and prior success on alliance formation (e.g. Barley, Freeman, and Hybles, 1992; Burgers, Hill, and Kim, 1993, Shan, Walker, and Kogut, 1994). Stated differently, prior studies have examined how age, size and prior performance affect a focal firm's tendency to ally but have failed to examine how these traits affect a firm's choice of alliance partners. This is troubling because firms may be biased towards alliance partners that are larger, older, and better performers. Alliances may therefore depend on the interactions between partners' age, size, and prior performance. Thus, examining how a firm's age, size, and prior success affect its likelihood of forming a JV, without taking into account its potential partner's corresponding traits, may lead to misleading or incorrect conclusions (Kachigan, 1982; Baron and Kenny, 1986).

In contrast, researchers seeking to understand alliance performance examined how the fit between the partners' size, age, and prior performance affect their likelihood of cooperating successfully but have failed to account for the main effects of these traits on alliance performance (e.g. Park and Ungson, 1997). This is troubling because as I explain below, I believe that a firm's age, size and prior performance affect its ability to successfully ally independently of its fit with its partners. Moreover, since studies analyzing alliance performances are restricted to samples of firms that actually formed alliances, their samples are likely to be biased towards larger, older, and more successful firms. Therefore, any work on alliance performance that examined those predictors, or

any other predictors that were correlated with them (e.g. competence, reputation, alliance experience, etc.) are likely to have given biased results (Heckman, 1979).

Given these shortcomings I ask the following questions: First, how do age, size, and prior performance affect a focal firm's propensity to ally, and how does the interaction between these traits and those of the firm's potential partners affect their likelihood of allying with one another? Second, I use estimates of parameters from the model of the probability of alliance formation to control for sample selection biases while asking: How do a focal firm's age, size, and prior performance, as well as the interaction between these traits and those of its partner, affect alliance performance? The study's main premise is that a focal firm's age, size and prior performance, as well as their interaction with the corresponding traits of its potential partners increase the focal firm's propensity to ally but decrease its ability to do so successfully. That happens because age, size and prior successes make a JV partner attractive but constrain its ability to adapt to environmental change, which is vital to new ventures in rapidly changing, technology-intensive industries.

While an alliance can be "any voluntary initiated cooperative agreement between firms" (Gulati, 1999), this study focuses on joint ventures (hereafter JVs) in technology-intensive industries. JVs, defined as "partnerships in which two or more firms create a separate entity to carry out a productive economic activity and take an active role in its strategic decision making" (Harrigan, 1986), are a particularly useful venue within which to examine the above questions for several reasons. First, the use of JVs has increased dramatically in the past decade, making them an integral part of the strategy of many

firms. With more than 35,000 reported ventures worldwide in just the last 10 years, JVs constitute an intrinsically interesting organizational form (Thompson Financials, 2002).

Second, JVs are particularly prevalent in technology-intensive industries, which are the focus of this study (Mowery, Oxley, and Silverman, 1998). Among the various kinds of alliances, JVs are more likely to be observed in situations where alliance partners are faced with greater ambiguity, since a clear and well-specified contract is difficult and costly to articulate a priori (Williamson, 1985). Therefore, interests are more likely to be aligned through equity sharing (Pisano, 1989; Oxley, 1997). Given that ambiguity and uncertainty are high in technology-intensive situations (Mody, 1993; Pisano, Russo, and Teece, 1988) JVs tend to be a preferred choice (Anand and Khanna, 2000).

The alliance literature suggests that a firm's likelihood of entering a JVs is a function of its ability to (1) offer potential partners access to resources and capabilities which they cannot readily purchase on factor markets or imitate internally (Oliver, 1997), (2) identify, and be identified by potential partners (Dyer and Singh, 1998), and (3) signal its reliability and trustworthiness (Stuart, 1998). For several reasons, these conditions favor larger and older firms with an established record of prior performance. Firms joint venture to access resources that cannot be imitated internally because they must be built gradually across time in a path-dependent manner and/or their development entails other similar as well as interconnected resources (Dierickx and Cool, 1989). Such resources are more likely to be offered by older and larger firms who have had the time and the complimentary resources required to develop them. Firms may also fail to imitate others'

resources because they do not understand the relationship between the resources and capabilities controlled by a firm and its performance. When faced with such causal ambiguity (Dierickx and Cool, 1989) firms may resort to easily observed variables such as age and size, as a readily available indicator of resources and capabilities.

A firm's ability to identify and be identified by potential partners is also a function of its visibility to other firms and its access to information. Since size, age, and performance enhance a firm's visibility, larger, older and more successful firms attract more interest and enjoy a larger set of potential partners (Baldi, 1997). Larger and older firms also tend to be more centrally located within industry networks, thereby enjoying informational advantages about potential partners, which, again, enhances their collaborative opportunities (Gulati, 1999; Mizruchi, 1996).

In addition, collaborating firms face considerable risk due to the unpredictability of the behavior of partners, particularly if partners are opportunistic. Hence, a firm that can signal its reliability as a partner would be more desirable. Since older and larger firms would usually have a longer track record of prior alliances by which they can be evaluated, they may enjoy a larger set of potential partners.

In sum, size, age, and prior performance increase a firm's likelihood of forming JVs. Yet, how these parental factors affect a JV's performance has not yet been examined. This is surprising, given the abundant research examining JV performance (e.g. Inkpen and Beamish, 1997; Park and Ungson, 1997; Beamish and Banks, 1987; Blodgett, 1992; Kogut, 1988). A central theme in the literature on JV performance is that JVs are risky, highly unstable (Blodgett, 1992; Parakhe, 1993), and tend to have high

rates of failure (Park and Ungson, 1997). Authors of several empirical studies have reported that the hazard of failure is close to 50 percent during a JV's first 5 years (e.g. Bleeke and Ernst, 1991; Kogut, 1988, 1989).

High failure rates, however, are definitely not a unique feature of JVs. Prior research suggests that 50 to 70 percent of all new firms fail within their first 5 years and over 80 percent in their first decade (Aldrich and Auster, 1986). The predominant explanation for the high failure rate of young organizations is that their members have to learn new roles and routines at a time when organizational resources are scarce and stretched to the limit (Stinchcombe, 1965; Hannan and Freeman, 1984). New organizations are also assumed to lack bases of influence and endorsement, stable relationships with important external constituents, and legitimacy (Baum, 1996). Since these factors take time to develop, new organizations tend to fail at higher rates than older ones (Singh and Lumsden, 1990). Yet, the generalizability of these arguments to JVs may be limited.

Since a JV is not a truly new entity, but rather the product of two or more existing organizations (Kogut, 1988), I theorize that it inherits its social roles, routines, relationships, and legitimacy from its parent organizations, as opposed to creating them from scratch. Hence, the challenge a JV faces in its early years is not the creation of original routines, but rather the fusion of old ones, which have been handed down to it from its parents. Consequently, while firms are more likely to joint venture with old and large, visible and reliable partners, who can offer them access to resources and capabilities that would be very difficult for them to develop on their own, a successful JV

also requires sufficient capabilities to (a) migrate those resources from the parents to the JV, (b) synthesize those resources with the other parent's capabilities, and (c) develop any new routines required to deal with the JV's environment, which may differ from both of its parents' environments. Taken together, these conditions suggest a possible paradox.

A JV's parents' ability to migrate their resources, and adapt their routines to each other's and/or to the JV's new environment, is essentially a function of their capacity to change (Chakravarthy, 1982). Yet, prior research suggests that firm age, size, and prior success may all impair a firm's ability to change. Whereas older organizations have had time to accumulate valuable resources, they have also had time to formalize internal relationships, standardize routines (Stinchcombe, 1965), and enhance their competence in current activities (March, 1991), thereby producing strong pressures against change (Hannan and Freeman, 1989). Resistance to change is also associated with organizational size. As organizations increase in size they emphasize formalized roles and control systems (Downs, 1967), which render their behavior more predictable, rigid, and inflexible (Quinn and Cameron, 1983; Kelly and Amburgey, 1991). Likewise, past success in developing valuable resources can cause managers to be risk averse, (Kahneman and Tversky, 1979; Greve, 1998), and lead to strategic persistence (Lant, Milliken, and Batra, 1992, Miller and Chen, 1994; Audia, Locke, and Smith, 2000), which, again, increases resistance to change. Consequently, the firms that are most likely to form JVs may also be the ones with the least adaptive capabilities, and hence, paradoxically, their JVs may generate lower performance and experience higher failure rates. The present study addresses this potential paradox by proposing several hypotheses

examining the influence of a JV's parent-firms' age, size and prior performance on the venture's subsequent performance.

Contributions of this Research

This study makes several contributions to the organizations literature. First, by bridging between studies that examine a firm's likelihood of forming JVs and ones that study JVs outcomes without regard to formation likelihood, it sheds a new light on the received wisdom about JV performance and longevity. A consistent theme in the literature is that JVs are inherently unstable. This study questions this premise, arguing that JVs might not be as fragile as prior research suggests, but instead, that their high failure rate might be the outcome of a selection process in which the JVs that are more likely to be formed are also the ones that are more likely to fail. This argument also draws attention to sample selection issues in alliance research in general, raising the possibility that prior estimates of factors that affect the performance of alliances may be biased.

To better understand this problem, consider the following analogy. With about 30 people dying in parachuting accidents in the United States each year, many consider skydiving a dangerous sport (U.S. Parachute Association, 2002). Nevertheless, a closer look at the causes of these fatalities finds that many of them result from skydivers taking unnecessary risks (US Skydiving Incident Reports, 2002). It can therefore be argued that people who chose to skydive are risk-takers to begin with and are likely to behave differently while they dive than are the more conservative. Hence, without accounting for the likelihood of a given person to skydive, we cannot separate that person's propensity

to take risks from skydiving's inherent dangers. As a result, it is difficult to conclude how safe skydiving is in general, since the high number of accidents may result from the people this sport attracts and how they act while pursuing it, and not because it is particularly dangerous.

Similarly, given this study's premise that the JVs that get formed may also be the ones that are more likely to fail, without accounting for a JV parents' likelihood of forming a JV, we cannot accurately determine whether JVs are inherently unstable and what affects their performance. As in the case of skydivers, that occurs because factors that affect the likelihood of venturing (e.g. age) also affect behaviors during the life of the venture (e.g. resistance to change). In turn, that seriously biases analyses of venture performance because treatment effects are confounded with selection effects. Fortunately, sample selection biases can be dealt with empirically. I do so by developing a two-stage model, in which I first examine factors affecting a JV's likelihood of being formed. Then, using a Heckman procedure (Heckman, 1979), I incorporate estimates of parameters from the first model into a second model, in which I use event history analysis to predict JV performance.

A second contribution of this study pertains to prior research that has focused on the value of parental resources and capabilities (e.g. Baum, Calabrese and Silverman, 2000; Stuart, Hoang and Hybels, 1999), and/or their complementarity and compatibility (e.g. Hamel, 1991; Hill and Helliriegel, 1994; Shan, Walker and Kogut, 1994; Mowery et al., 1996) as key factors driving returns from JVs. That work, however, has failed to account for the mobility of these resources from the parents to the JV. While this study

does not examine a JV's parents' ability to transfer their resources directly, it develops the argument that a JV's performance is contingent on its parents' ability to transfer resources, and it examines key indicators of this ability: age, size, and past success.

Third, recent studies of startups indicate that a startup's corporate affiliation may affect its subsequent performance. In their study of the U.S.A automobile industry, for example, Carroll, Bigelow, Seidel and Tsai, (1996) found differences in mortality rates between genuinely new startup entrants and diversifying entrants who came from other industries. Similarly, in their study of the Manhattan hotel industry, Ingram and Baum (1997) found chain affiliation to significantly affect hotels' failure likelihood. This paper examines a similar phenomenon in the realm of JVs and adds to this nascent stream of research by linking JVs' early performance to their parents' characteristics.

Boundary Conditions and Limitations

Like all research, this study faces certain boundary conditions and limitations. First, it focuses solely on JVs. However, a notable characteristic of the dramatic growth of inter-firm alliances has been the increasing variation in the formal structure of such alliances (Gulati, 1998: Powell, 1990). JVs are a unique kind of alliance as they entail the creation of a new entity with shared equity between partners. While this unique feature makes it easier to identify and dissect empirically, it limits the generalizability of this study's results to other kinds of alliances (Pan and Chi, 1999). This occurs for several reasons. One, the commitment of "non-recoverable investments" tends to be higher in JVs, making it more costly to cease a JV than other forms of alliances (Parkhe, 1993).

Two, a key assumption in this study is that a JV's performance is contingent on its parents' ability to transfer resources to the JV, which does not hold equally in other kinds of alliances such as licensing agreements, in which firms do not need to transfer substantial resources beyond their boundaries. Three, a JV is ultimately a separate firm competing in its own market. Thus, as opposed to other kinds of alliances, such as licensing agreements, a JV may need to overcome the same liabilities of newness and/or smallness as any other firm. A JV may develop its own set of routines and decrease its dependence on its parents, which is not an option in other forms of alliances.

Second, this study is based on the assumption that firms form JVs mainly to access their partner's inimitable, nontransferable resources and capabilities, and that therefore firms look for partners who can offer them such resources. While this is a reasonable assumption to make when studying technology-intensive industries (Mowery et al., 1996), there are nevertheless numerous other motives to form JVs, such as conserving resources and sharing risks (e.g. Hamel, Doz, and Prahalad, 1989), gaining market power (Hagedoorn, 1993), or moving quickly into new markets (Kogut, 1991). The study's generalizability to other settings and industries where other motives may play a more central role may therefore be limited (Burgers, Hill and Kim, 1993).

In the next chapter I review the prior research on JV formation and performance, and identify several gaps in this literature. Chapter 3 develops hypotheses aimed at bridging these gaps. Chapter 4 describes the setting and methodology I used to test these hypotheses. Chapter 5 reports the findings of this study. Finally, Chapter 6 summarizes the implications of the paper and points towards avenues for future research.

Chapter II - Literature Review

The purpose of this research is to develop and empirically examine the thesis that some of the same factors that increase a firm's likelihood of forming a JV may decrease the JV's performance. To do so, this study brings together two bodies of literature that have thus far been largely disjoint. The first examines which firms are more likely to enter a JV, whereas the second seeks to identify factors that enhance or impede its performance. These two bodies of literature are reviewed in this chapter.

Joint Venture Formation

Research examining which firms are more likely to engage in interfirm alliances is not of recent origin, and a fair number of studies dealing with this question can be identified. While this literature is not limited to JVs, it offers two broad classes of explanations to the formation of cooperative arrangements in general (Ahuja, 2000). The first set (hereafter "the motivational explanation"), focuses on firms' inducements or incentives to collaborate. It recognizes various benefits that cooperative relationships can offer firms, such as, new competencies (e.g. Hagedoorn, 1993; Hennart, 1991), enhanced legitimacy (e.g. Baum and Oliver, 1991), and market power (e.g. Hagedoorn, 1993), and argues that a firm's likelihood of entering an alliance is influenced, on the one hand, by its ability to offer potential partners such benefits, (Hagedoorn and Schankenraad, 1990; Harrigan, 1988; Hennart, 1991), and on the other, by its own strategic needs (Eisenhardt and Schoonhooven, 1996). The second set, comes from a structural sociological perspective, arguing that a firm's likelihood to engage in interfirm alliances is a function

of its position in interfirm networks, which is influenced by its past alliances (hereafter "the structural-sociological explanation").

The Motivational Explanation

Most of the work on interfirm alliance formation has asked, what motivates firms to form alliances (Stuart, 1998). The literature answers this question using a variety of theoretical perspectives. Four perspectives that have had a profound affect on the analyses of interfirm collaboration are the Resource-Based View of the firm (RBV), Transaction Cost Economies (TCE), Industrial Organization Economics (IO), and Institutional Theory. These are reviewed next.

The resource-based-view of the firm (RBV). The RBV's core premise is that a firm's principal competitive advantage rests on its idiosyncratic, non-tradable, inimitable and non-substitutable resources (Dierickx and Cool, 1989; Barney, 1991). However, to maintain their competitive stand, businesses must continually respond to changes in their competitive environment by obtaining new competencies and upgrading their existing ones (Capron, Dussauge, and Mitchell, 1998; Caves, 1982; Teece, 1986). Yet, environmental changes that necessitate rapid development and deployment of distinct skill bases, or increase significantly the resources required to compete effectively, can create a gap between the firm's actual and desired competitive position (Quelin and Garrette, 1994). This is especially likely to be the case in technology intensive industries, where keeping pace with changing technological developments and bringing them quickly to market is critical to firm success (Vesey, 1991; Eisenhardt and Tabrizi, 1995),

and the range of technical know-how and scientific skills needed to stay abreast of rapidly changing developments far exceeds the capabilities of any single firm (Hagedoorn, 1993; Powell, Koput, and Smith-Doerr, 1996). Interorganizational relationships offer a quick, and in some cases, the only solution to this mismatch (Powell et al. 1996; Das and Teng, 2000).

When firms can develop the resources they need to remain competitive internally, or purchase them on the market, firms are more likely to continue alone (Eisenhardt and Schoonhoven, 1996). However, the RBV suggests that resources that can confer a competitive advantage often take a long time to develop and necessitate numerous supporting assets (Dierickx and Cool, 1989; Henderson, 1999). Moreover, to generate a sustainable advantage such resources must be imperfectly imitable, substitutable, or transferable, meaning that it is difficult for competitors to internally replicate them, develop resources that can substitute them, or purchase them on factor markets (Barney, 1991; Peteraf, 1993; Combs and Ketchen, 1999). Resources are imperfectly imitable, substitutable, or transferable when they have a strong tacit dimension (Winter, 1987; Grant, 1991), are mingled with other resources, or are embedded in organizational cultures and routines (Chi, 1994). When firms cannot rely on the market for valuable resources and are hindered from developing such resources themselves quickly and reliably, they resort to mergers, acquisitions and strategic alliances (Hagedoorn and Schakenraad, 1994; Shenkar and Li, 1999).

Through mergers, acquisitions, and strategic alliances, firms can create a unique pool of resources that is potentially valuable and difficult to imitate, generating competitive

advantages and values that are otherwise unavailable (Das and Teng, 2000). The major difference between alliances and acquisitions, though, is that the former is "a voluntary initiated cooperative agreement" (Gulati, 1999: 397) that ideally enable all partners to make advances that they could not make alone, while the latter are executed to primarily benefit the acquiring firm (Hitt, Harrison and Ireland, 2001). Therefore, while acquisitions are executed to supplement and upgrade the acquiring-firm's stock of resources, JVs are formed only when both partners see a clear benefit in aggregating, sharing and exchanging their resources, which occurs only if both partners perceive they have something to gain from the partnership (Harrigan, 1985).

According to the RBV then, JVs are likely to be formed by firms that are in need of critical resources, which they cannot produce internally and are not available for purchase on factor markets, and at the same time, possess some resources that other firms value and seek. Indeed, as I review in more detail later, studies have found a positive relationship between a firm's propensity to joint venture and its stock of resources (e.g. Stuart, 1988; Ahuja, 2000), and others, between a firm's need for resources and the rate at which it forms alliances (e.g. Eisenhardt and Schoonhoven, 1996). Unfortunately however, these studies stop short of examining both stocks of resources and needs for resources in a single model.

Transaction cost economies (TCE). Another theoretical perspective that has had a profound affect on analyses of interfirm collaboration is transaction cost economies. Traditionally, transaction cost economists have examined which activities should be performed inside firms and which should be accessed on the market by comparing the

relative costs and benefits of markets and hierarchies, maintaining that organizations chose the one that minimizes the sum of their production and transaction costs (Williamson, 1985, 1991). Production costs come from coordinating in-house activities, in terms of learning, organizing, and managing production, while transaction costs are incurred from activities necessary for an exchange, such as negotiating, writing, monitoring and enforcing a contract. Grounded in neo-institutional economics, TCE recognizes the intrinsic merits of markets, arguing that hierarchy becomes the preferred mode of organizing only when it is very expensive to organize transactions through the market. Thus TCE concentrates on identifying the conditions under which markets fail.

Williamson (1985:1) defined a transaction as 'transfer across a technologically separable interface.' In this process of exchange, one can distinguish three stages: Contact, Contract, and Control (Nooteboom, 1999). Before a transaction can be executed one must first find a transaction partner, which entails search costs. Search costs are associated with becoming aware of possibilities for fulfilling different needs, sifting through potential solutions, and evaluating their fit. In the contract stage there are costs of preparing and concluding a contract or other type of agreement, as much as possible in anticipation of problems that might occur in the control stage. In the control stage there are costs of monitoring the execution of the agreement, renegotiating and adjusting it, and losing specific investments if the relation breaks (Nooteboom, 1999). Markets tend to fail and transaction costs rise when repeated purchases are subject to opportunism, asset specificity, and uncertainty (Williamson, 1985).

The premise of TCE is that people behave opportunistically if the market relation allows them to do so. The potential for a firm to act opportunistically increases when transactions entail specific investments that lose value when redeployed to alternative uses (Williamson, 1991). In such cases, the buyer becomes dependent on the seller because the costs of switching to a different supplier are large and therefore give the seller opportunities to behave opportunistically and increase prices on future purchases. Firms can try to evade opportunistic behavior by writing comprehensive contracts. But as uncertainty increases, writing down all possible future eventualities becomes impractical. TCE has emphasized two facets of uncertainty. One emanates from the difficulty of predicting a seller's behavior, which enhances appropriation concerns (Williamson, 1985). That is, a firm's concerns about its ability to capture a fair share of the rents from the alliance in which it is engaged, which arise from the uncertainties associated with future specifications, cost uncertainties, and problems in observing partners' contributions (Gulati and Singh, 1998). The other is associated with exogenous shocks, which may require subsequent adaptations by the buyer and seller (Williamson, 1991). The higher the frequency at which these shocks occur, and the more consequential they become, the more coordinated responses are required. Frequent renegotiations, adaptations, and increased coordination costs, may therefore render market oriented governance modes nonviable. Finally, it is argued that high transaction frequency increases the likelihood of market failure, as it repeatedly exposes the firm to holdup and renegotiations.

While early TCE analyses merely sought to examine the gross choices among hierarchies and markets, arguing that hierarchical governance structures should be

favored when asset specificity is high and market exchange should be preferred when asset specificity is low (Gulati, Nohria, and Zaheer, 2000), more recent studies have begun applying TCE principles to "hybrid" forms of organization, such as JVs (Williamson, 1991). The extension of the TCE logic to interorganizational relations suggests that firms would enter such arrangements in intermediate situations when transaction costs are not so severe as to require hierarchical control but are not so low as to enable market-based exchange (Kogut, 1988a; Bradach and Eccles, 1989).

Drawing on this logic, scholars have identified several conditions that reduce transaction costs and encourage interfirm cooperation as opposed to hierarchical control. Such conditions include successful past relationships, which engender a level of trust that reduces uncertainty and facilitates collaboration (Powell 1990, 1996), and belonging to a trust-based society where informal constraints such as reputation and broadly accepted norms of conduct play a major role, and hence, require less monitoring and safeguards against opportunistic behavior (Hill, 1995; Shane, 1994). Other researchers have emphasized conditions that render acquisitions an expensive way to access other firms' resources, arguing that JVs are preferred to acquisitions when (1) the assets sought are difficult to extricate from other unneeded assets (Hennart, 1988), (2) a full acquisition would increase management costs (Hennart and Reddy, 1997), (3) potential acquirers do not know how to value potential targets (Balakrishnan and Koza, 1993), or (4) legal or institutional constraints make acquisitions difficult (Hennart and Reddy, 2000). In addition, JV may be preferred when seeking a technology with an uncertain future value, because relative to acquisitions, JVs allow for more incremental investments and

therefore limit a firm's exposure to a technology which may turn out to have little value, while still allowing it to capitalize on growth opportunities and be ready to adapt its actions as new information about the technology is revealed (Kogut, 1991; Folta, 1998).

A number of studies have also examined the relative advantages of JVs over non-equity collaboration (e.g. Kogut, 1988a; Mowery et al., 1996). A common thread that runs through these studies is that equity arrangements such as JVs are particularly effective at aligning partners' incentives and, therefore, provide a more efficient mechanism to appropriate interfirm synergies and attenuate transactional hazards than contractual arrangements and other market-based exchanges (Hennart, 1988). Through joint ownership and shared control, JVs are thought to contain opportunism, improve monitoring relative to non-equity linkages, and facilitate the transfer of organizationally embedded intangibles such as tacit knowledge (cf. Polanyi, 1967), organizational routines, skills, experiences, reputation, and goodwill (Duncan, 1982; Nelson and Winter, 1982, Shan, 1990).

Taken together, a JV is most likely to be created between two firms who (1) trust each other, (2) seek a technology with an uncertain future value and/or access to each other's organizationally embedded intangibles, which are (3) difficult to value and/or extricate from other unneeded assets, while (4) legal constraints, potential management costs, or high purchase premiums make an acquisition difficult and expensive.

Industrial organization economics (IO). The basic argument of the IO school is that a firm's returns are determined by the structure of the industry within which it competes (Mason, 1939; Bain 1956, 1968; Scherer and Ross, 1990). Industry

profitability is assumed to be determined by the ability of established firms to restrict rivalry among themselves and the protection afforded by barriers to entry (Porter 1980, 1981). Firms that are able to reduce the level of competition can charge higher prices in their market by colluding with potential rivals and/or by making it very difficult or unacceptably costly for outside firms to enter their market.

From this perspective, interorganizational relations are a means to create and/or modify the structural characteristics of an industry to favor high returns (Porter and Fuller, 1986; Kogut, 1988a). For example, by combining forces with their competitors, firms may be able to produce their products more cheaply because of economies of scale, while keeping new competition at bay by making it very expensive for new firms to enter the market. Firms would therefore look for partners with whom they are most likely to exert market power and influence the nature of competition in their industry. Empirical studies, however, have mainly examined the effects that interorganizational ties have on industry structure and have therefore failed to ask which firms are more likely to form them.

Institutional theory. Institutional theory is a fourth perspective gaining stature in research on interorganizational linkages (DiMaggio and Powell, 1983). The theory suggests that institutional environments impose pressures on organizations to appear legitimate and conform to prevailing social norms (Barringer and Harrison, 2000). Applying this theory in a business context, institutional pressures presumably motivate firms to pursue activities that will increase their legitimacy and cause them to appear to be in agreement with the prevailing roles, requirements, and norms of their business

environments (Oliver, 1990; Scott and Meyer, 1983). One way firms can establish legitimacy is by participating in interorganizational relationships. It has been shown, for example, that the legitimacy and status enjoyed by prominent organizations reflects on their affiliates (Stuart, Hoang and Hybles, 1999). Alliances with high status organizations can therefore elevate a firm's reputation and serve as a signal of enhanced legitimacy.

A corollary of this is that high status organizations enjoy abundant opportunities to cooperate with organizations that would like to be associated with them. Yet, if high status firms value their reputations, the desire to protect them can inhibit them from forming alliances with low status firms, since such associations can negatively affect their legitimacy (Fombrun and Shanley, 1990; Suchman, 1995). Nevertheless, empirical research has mainly examined how a firm's existing affiliates affect its legitimacy, without inquiring how institutional concerns affect its choice of affiliates in the first place (e.g. Miner, Amburgey and Stearns, 1990; Baum and Oliver, 1991; Stuart, Hoang and Hybles, 1999).

Evaluation and critique

Surprisingly, among the above four theories only the RBV has been systematically drawn upon to predict firms' propensity to form alliances. The other three theories have been used to study various aspects of interfirm linkages, but with a few exceptions, have not been used to predict which firms are more likely to form them. Studies drawing on TCE, for example, have focused mainly on alliances as a way to reduce the net cost of conducting business, explaining the choice between alternative

governance forms in strategic alliances, including equity versus non-equity alliances, and joint ventures versus other kinds of alliances. But such studies do not attempt to explain which firms are more likely to cooperate in the first place (Pangarkar and Klein, 2001; Osborn and Baughn, 1989; Pisano, 1989; Buckely and Casson, 1988).

Likewise, IO studies have mainly examined how interorganizational ties affect the nature of competition in an industry, without exploring which firms are more likely to form such ties. For example, considerable attention has been devoted to the implications that JVs have on the rate of technological improvement, industry profits, and social welfare (e.g. Anbarci, Lemke, and Roy, 2002; Banerjee and Lin, 2001; Geroski, 1993; Jorde and Teece, 1990; Shapiro and Willig, 1990). Applying IO principles to study intraindustry performance differences, Nohria and Garcia-Pont (1991) have argued that networks of alliances create intraindustry 'strategic blocks' through which firms secure vital resources and erect entry barriers to potential competitors. Following the same logic, Burgers et al. (1993) have argued that the incentive to enter alliances is greatest for intermediate sized firms, and least for the smallest and largest firms in an industry, since the former's small market share limits their ability to exert market power, and the latter are likely to come under close antitrust scrutiny. To my knowledge, however, this is the only study that uses IO rationale to predict a firm's propensity to ally.

Other research has examined how interorganizational linkages facilitate firms' ability to acquire legitimacy, and in turn, how legitimacy affects their performance. For example, Baum and Oliver (1991) showed that institutional linkages between child service organizations in the Toronto area and municipal government or community

agencies signaled conformance to institutional prescriptions and increased thelikelihood of survival among child service organizations. Stuart, Hoang, and Hybels (1999) argued that potential investors, customers, employees, suppliers and other exchange partners rely on the prominence of affiliates of young companies when making judgments about their quality, showing that as a result, companies endorsed by prominent exchange partners perform better. Thus, with the exception of Dollinger, Golden, and Saxton (1997), who showed in an experimental design that a decision-maker's propensity to engage in a JV is increased by the positive reputation of the target firm, research drawing on institutional theory has focused on the ways in which firms acquire legitimacy, and on how legitimacy affects their performance, not their proclivity to form alliances.

The only theory, then, that has been systematically drawn upon to empirically predict firms' propensity to form alliances is the RBV. Following the idea that firms form alliances to access other firms' resources, several studies have shown that a firm's likelihood of forming alliances is a function of its ability to attract potential partners by offering them valuable skills and resources (Hagedoorn and Schankenraad, 1990; Harrigan, 1988; Hennart, 1991). For example, Hagedoorn and Schankenraad (1994) have argued that because of their innovative abilities, technologically capable firms are attractive partners and achieve a higher degree of 'courtship' than less innovative companies. Their analysis of nearly 10,000 interfirm cooperative agreements during the years 1982-86 found that a firm's total number of assigned U.S. patents had a strong positive impact on its propensity to establish strategic alliances. In a study of 150 semiconductor firms, Stuart (1998) has shown that the greater a firm's technological

prestige, the higher the rate at which it will form technology development and/or exchange alliances. A firm's technological prestige was measured by the number of times its patents were cited by other firms, which reflects its stock of technical capabilities. Ahuja (2000) found that the higher a firm's technical capital, measured as the number of patents it obtained, the greater its attractiveness to potential partners, and the greater the number of joint ventures and joint development and technology-sharing agreements it formed.

While these studies have produced important insights and delineated new research directions on interfirm linkages, they overlook a number of critical points that question whether they actually support the RBV's description of alliances. First, while it seems plausible that richly endowed firms would attract potential partners who want to access their resource set, such firms still need a good reason to share it. If a firm's competitive advantage rests on its idiosyncratic resources, as the RBV contends, unless its resource set is incomplete and the firm is incapable of completing it through the market or internally, why would the firm give it away? By not accounting for a firm's own strategic needs and the ability of potential partners to fulfill them, the above studies fail to rule out alternative explanations for the firm's cooperative behavior. It might be, for example, that the observed positive relationship between the number of patents a firm has and its likelihood to form alliances is due to an effort to maximize the present value of the rents to its existing innovations by licensing them as much as possible, as opposed to creating a novel pool of resources by fusing its resources with its partners'. In fact, it has been argued that in industries where technology is changing rapidly and the rents accruing to

intangible assets are short lived, licensing is encouraged and thus, cooperative arrangements can be expected to proliferate (Telesio, 1979; Caves, 1982).

Succinctly put, the above studies do not answer why technologically capable firms form alliances. This question, however, has been addressed by other scholars who argued that in technology intensive industries, sources of expertise are so broadly distributed that no single firm has all the internal capabilities necessary for success (Powell et al., 1996). Consequently, even the most technologically capable firms are in a constant search for partners with whom they can aggregate, share, and exchange resources (Hagedoorn, 1993). Drawing on this argument, a number of studies have shown that the research and development (R&D) intensity or the level of technological sophistication of industries is positively correlated with the intensity and number of alliances in those sectors (e.g. Freeman, 1991; Hagedoorn, 1995). These studies, however, were conducted at the industry-level and did not examine any firm-level variables, and hence, remain speculative when it comes to corroborating the above argument. To my knowledge, no firm-level study has thus far examined how a firm's potential resource offerings and its resource needs simultaneously affect its likelihood of forming alliances.

The Structural - Sociological Explanation

Whereas the first set of explanations for alliance formation focuses on existing resources (or lack thereof) and other motivations that may propel firms to enter into new alliances, the second set of explanations comes from a structural sociological perspective and focuses on firms' opportunities to collaborate (Gulati, 1995a; Gulati and Gargiulo,

1999). It complements the motivational explanation by arguing that a firm's ability to form an alliance that can answer its strategic needs is a cumulative function of its prior alliances (Gulati, 1995a; Ahuja, 2000). This occurs for two reasons. First, prior to forming an alliance, firms must be aware of the existence of potential partners and have an idea of their needs and requirements as well as the resources they can offer. Second, firms entering alliances face considerable risk due to the unpredictability of the behavior of partners and the likely costs of opportunistic behavior by a partner. Firms therefore need to know about the reliability of potential partners. Alliances, which accumulate over time to form a rich information exchange network, answer both requirements. Through their networks of alliances, firms learn about each other's needs, capabilities, and requirements, which tend to facilitate further collaboration (Gulati, 1995a; Powell et al. 1996; Doz, Olk and Ring, 2000). Through their partners, firms identify new alliance opportunities with other firms with whom their partners have been collaborating. Likewise, such networks can enhance trust by providing information to potential partners about each other's reliability and by reinforcing a concern for reputation (Gulati, 1995b).

Accordingly, it has been shown that the greater the accumulated number of a firm's prior alliances, the greater its likelihood of entering new ones (Gulati, 1995a; Ahuja, 2000). Specifically, Gulati (1995b) has shown that the higher the number of alliances between two firms, the more likely they are to form new alliances with each other. Gulati and Gargiulo (1999) have found that the probability of a new alliance between two organizations increases with the number of prior indirect alliances between those organizations, and with their combined alliance network centrality. Gulati (1999) has

shown that a firm's likelihood of entering a new alliance increases as a function of its centrality in the network in the preceding year. Centrality has been measured as the number of cliques to which the firm belonged and the breadth of its relationships. Ahuja (2000) has found that the number of new linkages established by a firm in any year is positively related to its prior embeddedness in the industry network, measured as the number of linkages it had in the prior year.

While the above studies find clear evidence that a firm's likelihood of forming alliances increases with the number of its prior alliances, they have failed to empirically examine which firms are more likely to seek alliances in the first place? Although it seems sensible to assume that older and larger firms are more likely to have accumulated a greater number of alliances since they posses greater resources and had more time to do so, this question is yet to be empirically examined.

Others have drawn less on a particular theoretical lens, and instead used a mix of perspectives to develop and test attribute-based explanations for the formation of alliances. Focusing more on the empirics and less on the theoretical rational for alliance formation, researchers have investigated whether a variety of firm attributes, including size, age, and prior success affect firms' propensity to enter alliances. This research, however, has yielded inconsistent findings.

The characteristic that has been examined the most is firm size. Ghemawat, Porter, and Rawlinson (1986), for example, provide descriptive statistics on all the international alliances formed between 1970 and 1982 that were reported in *The Wall Street Journal*, showing that U.S. companies that form international alliances tend to be larger than those

that do not. Examining the type and number of interorganizational relationships pursued by new biotechnology firms (NBFs), Powell and Brantley (1992: 378) argued that larger corporations, which "can better withstand questions about their reputation", are more likely to engage in interfirm agreements. An analysis of 129 firms and 765 agreements confirmed this hypothesis. Shan, Walker, and Kogut (1994: 389) maintained that size "measures the firm's capacity to form relationships," and as expected, found that larger startup firms in the biotechnology industry had more relationships than their smaller competitors. In a study of nearly 10,000 cooperative agreements involving 3500 different parent firms Hagedoorn and Schakeraad (1994: 297) found that the size of the firm had a positive effect on JV participation, which they attributed to "better and more opportunities to seek external linkages." Ahuja (2000) used size as a proxy for "commercial capital," which represented assets that support or complement the firm's technical capital, such as manufacturing facilities and service and distribution networks that the firm needs to commercialize new technologies and obtain rents from them. He argued that the higher a firm's commercial capital, the greater its attractiveness to partners, and hence, the greater the firm's collaborative opportunities and the number of linkages it forms. As predicted, an analysis of 469 collaborative linkages in the global chemicals industry found a positive relationship between a firm's size and the number of linkages formed by the firm. A similar result was also observed by Gulati (1999) who controlled for firm size in a study on the role of network resources in determining alliance formation.

In contrast to the above studies, which found that size increases a firm's likelihood of entering interfirm alliances, Shan (1990) and Gulati (1995a) found a negative relationship between size and cooperation. Drawing on the idea that firms form cooperative arrangements to overcome resource deficiencies, Shan (1990) argued that firms whose internal capabilities are relatively under-developed are more likely to enter alliances than firms that possess in-house capabilities, and since firms' in-house capacities expand as they grow, larger firms were expected to be less motivated to form cooperative ventures. A study of 278 NBFs has corroborated this hypothesis empirically. Likewise, in a study of 166 firms in new materials, industrial automoization, and automotive products, Gulati (1995a) used size to control for a firm's financial and managerial resource endowment as well as its level of economies of scale and scope, and found it to reduce a firm's likelihood of entering an alliance.

Burgers, Hill and Kim (1993) found a curvilinear relationship between a firm's size and the number of alliances it is engaged in, which coincided with their IO based argument that the incentive to enter alliances is greatest for intermediate sized firms and least for the smallest and largest firms in an industry, since the former's small market share limits their ability to exert market power, and the latter are likely to come under close antitrust scrutiny. Testing a model predicting how many new interorganizational relationships NBFs establish over time, Kogut, Shan, and Walker (1992) found that firm size increased the number of relationships NBFs formed during the industry's early years but lost its significance later on. Mixed results were also reported by Hagedoorn (1995) who found positive and marginally significant associations between firm size and

participation in interorganizational partnerships only in two out of the seven industries he studied.

As for firm age and prior success, Powell and Brantley (1992), Kogut, Shan, and Walker (1992), and Shan, Walker, and Kogut (1994) found little or no association between firm age and the number of relationships it has. Burgers et al. (1993) found that the number of alliances a firm enters is negatively related to its performance. They explained this finding by arguing that insofar as firm performance is an indicator of firm efficiency, poorly performing firms are less able to deal with their environment and thus, their incentive for entering alliances is likely to be greater than the incentive that high performing firms have. An empirical test using data from the global auto industry confirmed this hypothesis. Conversely, in an analysis of factors that affect firms' proclivity to form alliances, Gulati (1995a, 1999) and Ahuja (2000) controlled for prior performance but found no association between firm performance and alliance formation.

To summarize, despite the large volume of empirical research that has been conducted to explore the formation of interfirm alliances, and the different theoretical perspectives used, results have been inconsistent as to how a firm's age, size, and prior performance affect its likelihood of entering an alliance.

Joint Venture Performance

Whereas studies concerning firms' propensity to ally generally do not set JVs apart from other kinds of alliances, studies examining alliance performance do. In fact, research examining alliance performance seems to be dominated by studies devoted

exclusively to JVs. This research splits into two broad areas of inquiry. The first focuses on parents' features, assessing JV performance according to its parents' compatibility and their resource complementarity. The second focuses on JVs' internal structure, evaluating how its control and design affects performance. Studies in both areas, however, vary widely in the how they measure JV performance. This section reviews these two streams of inquiry, and the controversy surrounding JV performance measures.

Parental compatibility

A consistent theme in the alliance literature has been that a JV's performance depends on the compatibility of its parents. The underlying argument is that the more dissimilar two firms are in their organizational structures, processes, cultures, and interpretation of and response to strategic issues, the more likely they are to have communication problems and mutual distrust (Pearce, 1997; Schneider and De Meyer, 1991; Brown, Rugman, and Verbeke, 1989). In turn, poor communication and mutual distrust generate coordination problems, leaving such JVs vulnerable to managerial conflicts, poor performance, and early dissolution because they cannot respond well to environmental change and major internal developments (Camerer and Vepsalainen, 1988; Lane and Beamish, 1990; Park and Ungson, 1997).

To test this premise, Pothukuchi, Damanpour, Choi, Chen, and Park (2002) used Hofstede's (1980) four cultural dimensions to examine how national and organizational culture differences affect international JV performance. Their study of 127 JVs between Indian firms and partners from 21 other countries suggests that the greater the distance

between the partners, the lower the success of the JV. This result is consistent with Sim and Ali's (1998) study of 59 JVs in Bangladesh, and Hu and Chen's (1996) examination of 2442 Sino-foreign JVs, who found that the degree of similarity between parents' cultural attitudes and business practices positively affected their JVs' performance.

Probably the most comprehensive study to date, which examined the relationship between parents' compatibility and JVs' performance, is by Park and Ungson (1997), who examined how cultural distance and organizational dissimilarity affected venture dissolution. Cultural distance effects were examined by comparing U.S.-Japanese JVs and those between the U.S. and other cultural clusters (e.g. Far East, Northern Europe) with U.S.-U.S. JVs. Differences in partners' strategic diversity (i.e. operational breadth and scope), size, and age were used to examine organizational dissimilarity effects.

Their analysis of 186 JVs, however, contradicted prior studies, as it found that U.S.-Japanese JVs lasted longer than domestic (U.S.-U.S) JVs, suggesting that larger cultural distances lowered JV dissolution, and found no effect of differences in partners' organizational contexts. The authors explained the former result by suggesting that U.S.–Japanese JVs are less likely to dissolve than those between US firms thanks to Japanese values which engender trust, learning and long-term horizons, and since partners in a U.S.-Japanese JV may enter the relationship with more caution, deliberation, and purposefulness than those entering a venture restricted to domestic operations. The lack of effects for organizational context was ascribed to restricted variation in partners' sizes, to the possibility that difficulties between asymmetric partners may be overcome by an a priori understanding that the dominant partner is likely to take the initiative in defining

substantive issues and may take greater responsibility for their outcomes (Killing, 1983; Doz, 1988; Harrigan, 1988; Kogut, 1988b), and to the possibility that the period of the study was too short for the effects of these organizational variables to emerge.

Others have paid less attention to the parents' organizational and cultural compatibility, and concentrated on their resources, arguing that the potential of partners to contribute to each other's value is contingent on the compatibility of their resources (e.g. Richardson, 1972; Hamel, 1991; Hill and Helliriegel, 1994; Shan, Walker and Kogut, 1994; Teece, 1986). Resource compatibility, namely the possession of resources that match those of the other firm, is a necessary condition for a beneficial pairing (Shenkar and Li, 1999). For example, in their study of partner choice in JV, Mowery et al. (1996) demonstrated that partner selection can be predicted by measures of technological overlap, and Shenkar and Li (1999) have found that when seeking foreign partners, local firms are likely to seek the transfer of knowledge that is similar to their existing knowledge base.

Several other studies have reached similar conclusions by drawing on Cohen and Levinthal's (1989; 1990) theory of absorptive capacity. A firm's absorptive capacity, defined as the ability "to recognize the value of new external knowledge, assimilate it, and apply it to commercial ends" (Cohen and Levinthal, 1990: 128), has been argued to critically influence its capacity to learn from external relationships (Lane and Lubatkin, 1998; Kamien and Zang, 2000; George, Zahra, Wheatley, and Khan, 2001). In technology intensive industries, where knowledge is a key to competing effectively

(Grant, 1996), alliances are a potential source of such knowledge (Deeds and Hill, 1996; Zahra and Bogner, 2000), if a firm has the capacity to learn from its partner.

A firm, however, does not have an equal capacity to learn from all other firms. Instead, a firm's ability to recognize, value, assimilate and commercialize new external knowledge depends on the similarity of both firms' knowledge bases, and their organizational structures. Without such similarities, partners would lack basic understandings needed to recognize and value the other firm's knowledge, the communication channels and information filters needed to receive it, the organizational subunits and routines needed to store it, and the problem-solving strategies needed to invoke and utilize it (Stern and Henderson, 2002). Drawing on this line of argument, Lane and Lubatkin (1998) used a sample of pharmaceutical-biotechnology R&D alliances and found that the similarity of the partners' basic knowledge and knowledge processing systems were positively related to interorganizational learning.

Others have argued that the potential of partners to contribute to each other's value is contingent on the complementarity of their resources. Complementarity exists between two sets of resources when their joint use is not only feasible but can potentially yield a higher total return than the sum of returns that can be earned if each set of resources is used independently (Chi, 1994; Geringer, 1988). Put differently, added value can be created only when the partners bring competencies that are compatible enough to be used in tandem, but are not completely overlapping, yet different enough that the two firms still have much to learn and gain from each other. Sinha and Cusumano (1991) have used a game-theoretic model to argue that complementary skills and resources are the most

important factor influencing a firm's decision to participate in a research JV. In a study of 74 domestic dyadic JVs, Wolff and Reed (2000) found a positive relationship between resource complementarity and parent-firm performance. Specifically, they used content analysis of information contained in the JV's parents' annual reports to measure for the presence and relative importance of physical, financial, human, organizational and technological resources. They showed that when one parent had at least twice as much tangible resources (i.e. physical and financial resources) as the other, while the other had at least twice as much intangible resources (i.e. organizational, human, and technological resources), the parents' stock prices were more likely to experience abnormal returns during the 2 days following the announcement of the JV.

Governance, Relationships, and Designs

A second path taken to explain JV performance focuses less on the JV's parents per se, and more on the JV's internal structure, evaluating how its control design affects its performance. An appropriate control structure can have profound effects on JV performance since it can protect against opportunistic behavior (Geringer and Hebert, 1989; Hamel, 1991), ensure effective use of strategic resources shared by partner firms (Zhang and Haiyang, 2001; Mjoen and Tallman, 1997), facilitate coordination, reduce bargaining and other costs arising from political activities (Milgrom and Robert, 1990; Pearce, 1997; Inkpen and Beamish, 1997), and allow JV parents to integrate the venture's activities with their overall strategies (Gullander, 1976).

Parental control over the JV has been examined in two ways. Some studies have looked at partner firms' equity share in the JV as an indicator of parents' control (Blodgett, 1991; Hennart, 1988; Fagre and Wells 1982). The argument is that equity ownership in the JV determines the composition of the board of directors, and the partner with the dominant equity share has the ability to exercise more control (Blodgett, 1991). Several researchers, however, have argued that equity ownership and control are conceptually different constructs, and equity share is but one input to the control of the JV (Mjoen and Tallman, 1997; Yan and Gray, 1994). Hence, others have used more qualitative measures of control, which were usually obtained from surveys. Killing (1983), for example, asked respondents to classify their JV's control structure into one of three categories according to which partner is the main decision maker: (1) dominant parent JV (where only one parent is heavily involved in decision making); (3) shared management JV (where both parents make decisions); and (3) independent JV (where the JV's management has substantial decision power and none of the partner firms are actively involved in decision making). This classification has been adopted and validated by several studies (Lecraw, 1984; Yan and Gray, 1994)

Regrettably, both the equity share method and the three-category scheme have yielded inconsistent results. In a sample of 37 joint ventures, Killing found that 13 dominant parent JVs and 4 independent JVs outperformed the 20 shared management firms in terms of perceived success by the JV managers. The underlying argument is that shared management creates more difficulties and increases bargaining costs because both partners play active roles in the decision-making. In support of this, in a sample of JVs in

five Asian countries, Lecraw (1984) investigated the relationship between parent control and performance from the perspective of multinational corporations (MNCs) and found that the success rate was low when overall control was roughly divided between the MNC and the local parents. In a similar vein, Osland's (1994) study of eight Sino-U.S. JVs, Lee and Beamish's (1995) sample of 108 Korean JVs in less developed countries, Ding's (1997) examination of 261 Sino-U.S. JVs, Wang, Wee, Koh's (1999) sample of 132 Sino-Singaporean JVs, and Calantone and Zhao's (2000) study of 312 JVs in China, all indicate that the more control the foreign parents have over the JV, the more satisfied they are with its performance.

Other studies, however, have produced contradictory results, finding the dominance of one partner to be a destabilizing force. Beamish (1985) utilized Killing's design and performance measures on 12 JVs in the Caribbean and found that dominant control by foreign firms is negatively related to JV performance. In a comparative case study of four JVs operating in China, Yan and Gray (1994) found that shared management JVs demonstrated better performance than the dominant and independent ones. Similarly, Blodgett (1992) examined how parents' equity share affects JV instability and found that 50%-50% shared-management arrangements had a greater chance for long life than dominant-partner joint ventures. One possible reason for these studies' conflicting findings is their use of different performance measures. The controversy surrounding JV performance measures is reviewed next.

Performance measurement

A prominent feature of the JV literature is a lack of consensuses regarding a measure for JV performance (Park and Ungson, 1997; Parkhe, 1993; Anderson, 1990; Geringer and Hebert, 1990). There are two areas in which major inconsistencies occur: (1) whose perspective (that of one parent, two parents, or the joint venture's management) is used to assess performance, and (2) differences in performance measures, which range from subjective judgments (goal attainment, satisfaction, etc.) to more objective indicators (termination, duration, financial gains, and so forth).

Numerous studies have examined JV performance taking only one partner's perspective. Lecraw (1984), Osland (1994), Lee and Beamish (1995), Ding (1997), Wang et al. (1999), and Calantone and Zhao (2000), for example, have all investigated the relationship between parent control and performance in international JVs solely from the perspective of the foreign firm. Studies based on a single perspective, however, implicitly assume that parents tend to see eye to eye about their JV's performance, a hypothesis that has been seriously questioned (Beamish, 1993). For example, Buchel and Thuy (2001) analyzed differences in perception about JV performance between foreign and Vietnamese JV managers. Their findings indicate that while there were no differences regarding economic indicators of performance, such as return on investment or increase in shareholder value, there were significant differences in perception in various other indicators such as effective communication or mutual learning, which may influence parents' willingness to keep committing to the relationship (Arino and Torre, 1998). In fact, it may very well be that one partner is in a 'race to learn', stripping the other of its

valuable skills without giving much in return (Hamel, 1991). In such a case, the learning partner may be successfully fulfilling its goals, whereas the other is very likely to become antagonistic towards the partnership.

It has therefore been argued that significant biases can occur when performance is assessed from only one partner's perspective, prompting scholars to take account of both parents' perspectives. Following this advice, Yan and Gray (1994) interviewed executives of both partner firms, and Hill and Hellriegel (1994) measured partner-firm managers' subjective performance assessments using a seven-point Likert scale. Unsurprisingly, these studies reveal significant differences between the partners' assessments, which raises the question, what do these assessments tell us about the JV's performance? Is it, for example, an average of the different assessments? Or, maybe a function of the difference between them? To address some of this complexity, it has been suggested that JVs' should be evaluated primarily as stand alone entities, seeking to maximize their own performance, not their parents' (Anderson, 1990; Killing, 1983). Several studies have adopted this suggestion, and equated JV performance with the venture's financial performance (Luo, 1997), dissolution (Park and Ungson, 1997), or instability (Blodgett, 1992), which are defined and discussed below.

Prior studies also vary greatly in the specific indicators they use to measure performance. Some studies have employed subjective judgments, asking managers to rate how satisfied they are with the JV's performance and how well their objectives had been met (Hill and Hellriegel, 1994; Yan and Gray, 1994; Lee and Beamish', 1995, Mjoen and Tallman, 1997). Partners' judgments, however, have been found to strongly

correlate with their national culture (Luo, Shenkar, and Nyaw, 2001; Buchel and Thuy, 2001; Beamish, 1993; Geringer and Hebert, 1991), and to vary across the JV's life cycle stages (Reuer, 2000), prompting the use of more objective indicators, such as the reactions of parent firms' share prices to announcements of JV formation (Koh and Venkatraman, 1991) or financial profitability measures, such as the JV's return on investment (Luo, 1997). Yet, financial criteria may also be a misguiding measure, since JVs are especially likely to be used in risky, uncertain settings, where profit is at best a long-term proposition. Moreover, many JVs are not intended to fill standard business objectives, such as making profits, but are rather created to learn a technology, open a market, "keep a window" on an opportunity, or block a competitor. So while current financial results may suggest poor performance, the venture may be making satisfactory progress toward longer-term goals, or meeting current goals that are not financial in nature (Anderson, 1990).

JVs' performance has also been studied by examining their instability, which has been conceptualized and operationalized in two ways: a process-oriented approach, and an outcome-oriented approach (Yan and Zeng, 1999). A process-oriented approach defines instability as major reorganizations or contractual renegotiations. Killing (1983), for example, has classified JVs as unstable when they experience a drastic shift in the venture's parent control structure, and Blodgett (1992) investigated instability by focusing on inter-partner renegotiations of a prior contract. The dominant approach in the literature, though, is outcome-oriented. It focuses on the JV's end consequence, treating instability as termination of the JV or change in its ownership structure. This approach

was originated by Franko (1971), who defined three categories of instability: 1) one partner increased its ownership to more than 95%, thus converting it to a wholly owned subsidiary, 2) one partner increased its equity holding from a minority or 50-50 split to a majority under 95%, and 3) the JV was sold out or liquidated by mutual consent. While several scholars have adopted Franko's classification (e.g. Gomes–Casseres, 1987; Lee and Beamish, 1995), the majority of scholars following this approach have defined instability more narrowly, operationalizing it as termination through dissolution, sale or acquisition (Harrigan, 1988; Kogut, 1989, 1991; Bleeke and Ernst, 1991; Park and Russo, 1996; Park and Ungson, 1997; Hennart, Kim, and Zeng, 1998).

Other researchers, however, have questioned the validity of equating JV termination with poor performance and failure. Gomes-Casseres (1987), for example, has argued that JVs may be terminated because they successfully accomplished their initial objectives. Ventures may also be terminated as a matter of policy when there is a change in the ownership or management of the parent (Inkpen and Beamish, 1997). Yet, the significant number of terminations observed in JVs' early years (Bleeke and Ernst, 1991; Kogut, 1988; Porter, 1987; Harrigan, 1988; Berg and Friedman, 1978), suggests that many are a result of business failure or a fundamental instability in governance (Kogut, 1989). Porter (1987) contended that dissolution is significant because companies generally do not divest or shut down a successful JV; dissolution happens only when the venture is not financially viable. Harrigan (1988) noted that "partners will stay together as long as they need each other and their venture remains successful". Dissolution is also associated with less tangible adverse outcomes, such as loss of reputation because the parties involved in

JV dissolution might not be viewed as desirable alliance partners for the future (Park and Ungson, 1997).

In a more recent study, Ring and Van de Ven argued that "in addition to economic considerations, there are powerful social-psychological motivations for preserving relationships that entail transaction-specific investments" (1994: 106). Investments in interfirm cooperation include not only economic and technological resources of participating firms, but also social commitments and entanglements of individual agents (Ring and Van de Ven, 1994). Therefore, those authors concluded that "it is not only in the economic but also in the psychological best interests of the organizational parties to find ways to preserve their socially embedded relationship" (Ring and Van de Ven, 1994: 107). In their view, the dissolution of a cooperative partnership, such as a JV, represents an organizational failure. From a field study of several cross-border JVs, Lane and Beamish (1990) concluded that a successful JV indicates a stable business relationship that meets the needs of both partners over the long term. Geringer and Hebert (1991) examined the reliability of alternative measures of JV performance. In JVs that included at least one U.S. partner, dissolution was highly correlated with parent firms' reported dissatisfaction with the ventures and their perceptions of how the ventures performed relative to their initial objectives. JVs perceived by their parents as performing more successfully were more likely to remain in operation than JVs that were evaluated as being less successful. In comparison to Geringer and Hebert's (1991) subjective measures of performance, to my knowledge, no study has examined how the financial performance of either the JV itself, or of the JV's parent-firms, affect JV termination.

In sum, while termination is not synonymous with failure to achieve objectives or poor performance, studying JV survival allows one to make strong inferences about the factors affecting firms' ability to successfully pool their resources and constitute a mutually beneficial partnership. Accordingly, in this study, I follow Kogut (1988b, 1989), Park and Russo, (1996), and Park and Ungson, (1997) by using JV termination to examine how its parents' characteristics affect its performance.

Conclusions

Interest in interfirm alliances and its impact on firm performance has surged in recent years, yielding a substantial body of knowledge on the subject (Gulati, 1999; Anand and Khanna, 2000). This chapter has reviewed this literature and broadly categorized it into two groups. One group focused on the motivations to joint venture. A variety of theoretical perspectives have been used to explain what motivates firms to cooperate, yet as the preceding review suggests, empirical tests that draw on those theories to simultaneously predict both firms' proclivity to form alliances are scarce, and studies that reconcile predictions across several theories are even scarcer.

Moreover, studies in this group have generally examined firms' propensity to align from a single firm's perspective. For example, several studies have argued that the number of alliances a firm enters is a function of its ability to attract potential partners by offering them valuable resources (e.g. Ahuja, 2000; Stuart, 1998). But a firm's likelihood to cooperate is not just a function of its own offerings, but also of its needs, as well as the needs and offerings of its potential partners. That calls for a perspective that considers the

capacity of potential partners to complement each other and work together. An example is Stuart's (1990) analysis of the semiconductor industry in which he showed that firms in crowded technological positions (i.e. when many other firms concentrate in their areas of technological specialty and share the same technological focus) form alliances at the highest rates because a larger number of firms are able to (a) evaluate and internalize their know-how, (b) share their understanding of technologies and markets, and (c) exchange or jointly develop new technologies.

Firms' compatibility and complementarity, on the other hand, has been front and center in a second group of studies, which has examined factors that enhance or impede the performance of either the alliance itself or the alliance's parent-firms. In fact, studies in this group have centered so much on the fit between partners' characteristics that they have lost sight of the main effects of those characteristics. That is, they have failed to ask how each parent's intrinsic characteristics affect its ability to form successful alliances, independent of their interaction or fit with the other parent's characteristics. For example, Park and Ungson (1997) have examined how dissimilarities in parents' organizational structures and processes, measured, for instance, by the ratio of their sizes, affected the dissolution of their JVs. Yet Park and Ungson's model did not include the main effect of parents' sizes, and as I argue in the next chapter, such variables can independently affect a parent's capacity to joint venture.

In short, studies examining firms' propensity to align have generally focused on a firm's characteristics in isolation from its potential partners' characteristics, whereas studies that analyzed alliance performance have examined how the relation between a

venture's parents' characteristics affect its performance, but failed to account for their independent effects. In the next chapter I start to fill these gaps in the literature by proposing four sets of hypotheses. The first reexamines how the critical traits of age, size, and prior performance affect a firm's propensity to joint venture. The second set analyzes how the interaction between these traits and those of a firm's potential partners affect their likelihood of joint venturing. The last two sets of hypotheses examine how a firm's age, size, and prior success affect its JV performance and how interactions between those traits and those of its partner affect the success of their JV. I develop these hypotheses by drawing on the four theoretical perspectives that were reviewed in this chapter, i.e. (1) the resource-Based View of the firm, (2) Transaction Cost Economies, (3) Industrial Organization Economics (IO), and (4) Institutional Theory.

Chapter III – Theory Development and Hypotheses

As the previous chapter suggests, prior research has focused either on factors that influence a firm's likelihood of joint venturing, or on factors that affect JV performance, but not on both simultaneously. Consequently, prior research has overlooked the possibility that some of the same factors that increase a firm's likelihood of joint venturing may decrease the JV's performance. Moreover, studies have generally examined the effect of certain characteristics on a firm's propensity to joint venture without regard to its potential partners' characteristics. Conversely, studies analyzing JVs' performance have focused on how the fit between the parent-firms' characteristics affect the venture's performance but have failed to account for the main effects of the parent firms' individual characteristics.

In this chapter I begin bridging these gaps in the literature by developing a two-stage model. In the first stage, in addition to reexamining how the critical traits of age, size, and prior performance affect a firm's propensity to joint venture, which has been done in prior research, I also analyze how the interaction between these traits and those of the firm's potential partners affect their likelihood of joint venturing. The hypothesized relationships are depicted in Figure 1.

In the second stage, I examine how the fit between a JV's parents' ages, sizes, and prior success affect the JV performance, which is similar to prior research. Yet, in contrast to prior studies that have done so by looking at the ratio between a JV's parents' attributes (e.g. the size of one partner divided by the size

of the other) (Park and Ungson, 1997), or by looking at the difference between their attributes (e.g. the absolute difference in their numbers of employees) (Merchant and Schendel, 2000), I examine the interaction between a JV's parents' attributes. Using an interaction allows me to simultaneously examine how the parent-firms' individual characteristics, and the fit between these characteristics affect the venture's performance. These hypothesized relationships are depicted in Figure 2.

Joint Venture Formation

As suggested in the literature review, among the different theoretical perspectives that have been used to explain JV formation, the most germane to my focus on technology intensive industries is the RBV. In technology intensive industries, a prime reason why firms form JVs is to obtain resources and capabilities they need to stay abreast of their competitors (Galaskiewicz and Zaheer, 1999; Kogut, 1988a). Accordingly, it has been shown that firms that can offer potential partners resources that they can use to produce a competitive advantage are more attractive as JV partners, and therefore have more opportunities to collaborate (Ahuja, 2000; Das and Teng, 2000). The question then becomes, which firms are more likely to possess attractive resources?

Resources that attract potential partners have two distinct characteristics. First, they are predicted to create value for a partner, contingent, of course, on their compatibility with the partner's resources (e.g. Richardson, 1972; Hamel, 1991; Hill and Helliriegel, 1994; Shan, Walker and Kogut, 1994; Teece, 1986). Hence, firms possessing

resources, that although rare, are compatible with the resources of numerous firms would have more opportunities to collaborate and better prospects of generating value by working with other firms. The potential number of such combinations correlates positively with the number of domains in which a firm competes. Joint ventures are therefore more likely to involve large diversified firms, which are simultaneously active in many businesses (Stopford and Wells, 1972; Kogut et al., 1992).

Second, to attract potential partners, a firm's resources should be imperfectly imitable and imperfectly mobile. A resource is imperfectly imitable if other firms face uncertainty in replicating the resource on their own (Lippman and Rumelt, 1982), and it is imperfectly mobile if other firms encounter difficulty in efficiently acquiring the resource from its present possessor (Peteraf, 1993; Chi, 1994). Despite their attractiveness, cooperative relationships can be problematic, as they can have high transaction costs (e.g. Hennart, 1991; Williamson, 1991), can reduce rents by forcing firms to share profits (e.g. Shan, 1990), and can be conduits by which core competencies are siphoned from the firm (e.g. Hamel et al., 1989), all causing firms to form JVs only if they cannot develop or purchase desired resources (Das and Teng, 2000). If a resource can be easily imitated, a firm will therefore attempt to develop it internally, and if it is mobile, it will tend to acquire it rather than obtain it via a JV. Several factors have been identified in the literature as sources of imperfect imitability and mobility.

Dierickx and Cool (1989) advanced the idea that the development of critical assets requires time and other supporting assets. Inimitable assets are thus more likely to be offered by older and larger firms, who have had the necessary time and supporting

assets to develop them. Collaboration with older and larger firms gives firms access to resources that would otherwise require substantial investments and long periods of time to develop. In fact, it has been shown that in high velocity environments, where time is of the essence, "larger firms enjoy ample choice of collaborative partners [and] can…have their pick of the best small firms" (Powell and Brantley, 1991, p. 368). It follows that in fast moving environments, age and size are attractive features that increase a firm's likelihood of cooperating.

Imperfect imitability and mobility have also been ascribed to *causal ambiguity*, which refers to uncertainty about the causal connections between managerial actions and economic results (Lippman and Rumelt, 1982). Such uncertainty defies imitation because it prevents would-be-imitators from knowing exactly what to imitate or how to go about it. This is likely to be the case when resources are organizationally embedded and have a strong tacit dimension (Winter, 1987), which typically characterizes a firm's intangible resources. Such resources cannot be written down in a set of blueprints or equations, and thus, cannot be traded on open markets, so a firm would obtain such resources by forming alliances with their possessors.

By their very nature, intangible resources are difficult to observe, describe, and value (Itami, 1987). Since firms are hampered from evaluating others' resources directly, they would evaluate potential partners using more easily observed proxies, such as age, size and financial performance. For example, Baldi (1997) has shown that when people were asked to rate the quality of academic departments, a fuzzy and contentious construct (Roush, 1995), departmental size and age were the strongest predictors of their ratings. In

fact, Baldi (1997) argues that size and age increase departmental visibility, which in turn, increases a department's likelihood of receiving high quality ratings.

When it comes to firms' propensity to form JVs, however, visibility is perhaps even more influential than in Baldi's study. For firms to build alliances that effectively address their needs they must first be aware of the existence of potential partners. Thus, in a world of incomplete and ambiguous information, increased visibility would positively affect a firm's opportunities to collaborate. It has long been recognized that larger and more successful firms tend to receive more public scrutiny (Haveman, 1993; Fombrun and Shanley, 1990). Hence, due to inflated familiarity with their activities, collaborative opportunities may be greater for larger and more successful firms (Tversky and Kahenman, 1974). For example, a recent survey of innovative interfirm linkages in Europe finds that a firm's likelihood of being recognized by potential partners, and of subsequently forming linkages, increases with the firm's size (Koschatzky and Sternberg, 2000). Likewise, in their study of the search process used by international firms in identifying trading partners, Nijssen, Douglas and Calis (1999) found organizational size to be the most significant factor relating to finding a suitable partner, since "large companies…have greater visibility" (Nijssen et al., 1999, p. 155).

High visibility is also likely to mitigate uncertainty about the firm's reliability. Collaborating firms face considerable risk due to the unpredictability of the behavior of partners, particularly when partners may be opportunistic. Hence, a firm that can reduce this uncertainty and signal its reliability as a partner would be more desirable (Stuart, Hoang, and Hybels, 1999). The high visibility enjoyed by large, old, and more successful

firms is also associated with increased scrutiny and monitoring of firm activities by, for example, analysts and the press (Fombrun and Shanley, 1990). This visibility leads to the ready availability of information about firm activities and thus mitigates some of the uncertainty potential partners face when considering a partnership. Firms may also be less worried about joint venturing with large, old, and successful firms, due to the belief that highly visible firms cannot afford to act opportunistically, since the market is more likely to detect their opportunistic behavior and impose a reputation cost (Dewenter, Novaes, Pettway, 1999).

In technology intensive industries with short product cycles and rapidly shifting competitive landscapes, the ability to innovate continuously is a critical factor in the success of firms (Brown and Eisenhardt, 1997). Yet, research breakthroughs in such industries also demand a range of intellectual and scientific skills that far exceed the capabilities of any single firm (Powell, Koput and Smith-Doerr, 1996). This in turn, causes firms to establish JVs aimed at joint innovative efforts and technology transfer (Hagedoorn and Schakenraad, 1994). Therefore, by arguing that the possession of resources that took time and other supporting assets to develop makes older firms attractive partners, the preceding discussion assumes that technological innovation builds on existing know-how. While it usually does (Powell and Brantley, 1992), in some cases innovation constitutes a radical break from previously dominant technologies (Schumpeter, 1934). Since such disruption reduces the value of existing competencies (Abernathy and Clark, 1985; Tushman and Anderson, 1986), it is likely to originate with newer entrants rather than incumbents (Cooper and Schendel, 1976). This might seem to

suggest that JVs between incumbents and entrants would be common as incumbents would try to obtain access to entrants' know-how and skills, which contradicts the idea that JVs are most likely to be formed by older and larger firms. However, a TCE rationale suggests that incumbents are more likely to access entrants' know-how via acquisitions rather than JVs. That occurs because the decision whether to acquire or ally depends on the expected integration costs, which are a function of how many non-desired assets are commingled with the desired ones (Hennart, 1988b; Reuer and Koza, 2000; Hennart and Reddy. 1997). Non-desired assets make acquisitions an expensive option and JVs an attractive solution since they better enable firms to attain the desired assets without the unwanted ones (Kogut, 1988a). Since 'indigestibility' problems tend to increase with firm size, large firms are likely to be joint-ventured with, while new entrants, who are typically small, are more likely to be acquired.

As the previous chapter suggested, JVs not only facilitate the flow of resources among partners, but also help firms demonstrate or improve their reputation, image, and status (Scott, 1995; Powell and DiMaggio, 1991). Reputational considerations are particularly important in technology intensive industries, which are characterized by pervasive uncertainty surrounding the technical and commercial future of new products (Tushman and Rosenkopf, 1992). High-prestige organizations that have previously sponsored successful products therefore enjoy a significant advantage in gaining acceptance of their new products and processes, and hence, are more likely to attract partners who want to be associated with high status, successful others (Rao, 1994;

Podolny, 1993, 1994; Podolny and Stuart, 1995; Stuart, 1998; Stuart, Hoang, and Hybels, 1999).

Fomburn and Shanley (1990) observe several factors that affect a corporation's status, including total assets and market share. Since both correlate positively with firm size, a firm's attractiveness to potential partners, and hence, its opportunities to collaborate, are likely to vary positively with its size. This assertion is also supported by IO economics, which views interfirm alliances as a means to exert market power and mold industry structure (Porter and Fuller, 1986; Contractor and Lorange, 1988, Kogut, 1988a). IO arguments therefore suggest a positive relationship between a firm's size and its attractiveness to potential partners since a firm's ability to exert power increases with its size (Hagedoorn, 1993).

To summarize, an older, larger, and more successful firm is likely to be more attractive to potential partners due to its possession of valuable resources, its visibility, its perceived reliability, and market power. However, in contrast to age and size, which have relatively straight forward measures, firm performance is a multifaceted concept, and it has been operationalized in numerous ways (Venkatraman and Ramanujam, 1986). Although several scholars have employed the construct of firm performance to examine its effect on a firm's propensity to enter alliances, they have typically chosen an available or convenient performance measure and performed statistical tests without examining the validity of their choice. For example, Gulati (1999) and Ahuja (2000) used a financial measure (return on assets) while Burgers et al. (1993) assessed performance as change in market share. Since research results may be sensitive to this choice, results cannot be

generalized across studies. Moreover, while firms may prefer to ally with successful partners, since performance was operationalized differently across studies and no study has analyzed multiple measures simultaneously, it has yet to be determined which elements of a firm's performance are most salient to the JV's partner. Consequently, I examine multiple measures of performance, including return on assets, which measures firm financial performance and the total number of patents obtained by the firms in the prior year, which measure its technical performance (Gulati, 1999; Stuart, Hoang and Hyblels, 1999). These multiple measures permit me to compare the effects of different performance dimensions on a firm's propensity to joint venture.

Thus far, the discussion has considered JV formation from the perspective of only one firm. Yet, by definition, a JV involves at least two parties. Each of a JV's parents needs to identify and be identified by the other parent and seek access to the other parent's capabilities while being able to offer something of value in return. Hence, a JV's likelihood of being formed is a function of the attributes of both parents. The larger, older, and more successful each firm in a dyad is, the more likely it is to identify and be identified by the other parent, offer and be offered valuable resources, and the more likely the firms are to joint venture. It can therefore be hypothesized that:

Hypothesis 1a: The likelihood of two firms forming a JV with each other increases with the size of each firm independently. Thus, the size of Firm A increases the odds of a JV between firm A and Firm B, <u>and</u> the size of Firm B increases the odds of a JV between them.

Hypothesis 1b: The likelihood of two firms forming a JV with each other increases with the age of each firm independently. Thus, the age of Firm A increases the odds of a JV between firm A and Firm B, <u>and</u> the age of Firm B increases the odds of a JV between them.

Hypothesis 1c: The likelihood of two firms forming a JV with each other increases with the level of performance of each firm independently. Thus, the level of performance of Firm A increases the odds of a JV between firm A and Firm B, <u>and</u> the level of performance of Firm B increases the odds of a JV between them.

Again, these hypothesized relationships are depicted in Figure 1.

The likelihood of two firms forming a JV, however, is not only a function of each of the firms' attributes, but also of the relationship between their attributes. If size, age, and prior success render a firm more attractive, all firms will aspire to joint venture with such organizations. Yet there is no reason for an attractive firm to collaborate if its partner cannot deliver equal or greater benefits. Thus, the greater the benefits a firm offers, the greater the benefits it would expect to attain in return.

At first glance this may seem to suggest that if size, age and prior success indicate greater potential benefits then firms would tend to joint venture with partners of similar size, age and performance. While that might be the case for large, old, and successful firms who can offer each other valuable resources, there is little reason to expect that a firm that offers few benefits will readily attract partners. A JV is created in anticipation of economic gains that can result from the fusing of the resources of its parents. Hence, only

when managers believe that two firms can create more value by forming a JV than they can by remaining separate or merging will a JV be created. Two small, young, and unsuccessful firms that cannot offer each other much are therefore unlikely to create a JV although they might be highly similar.

While a small, young, and unsuccessful firm's likelihood of joint venturing is low regardless of the attributes of a potential partner, the odds of joint venturing increase as a firm becomes larger, older, or more successful. How much those odds increase, however, depends on the potential partner's attributes. Although the odds will increase for all potential partners since the focal firm becomes more attractive, the focal firm will seek large, old and successful partners, while avoiding small young and unsuccessful ones. Hence, as a focal firm becomes larger, older, and more successful, its likelihood of forming a JV with a small, young, and unsuccessful firm is prone to change much less than its likelihood of forming a JV with a large, old, or successful firm. Succinctly put, the impact that a focal firm's age, size, and prior success has on its likelihood of joint venturing interacts positively with the corresponding attributes of its potential partner. The form of these interactions is graphed in Figure 3. For simplicity, that Figure depicts the relationship between two firms' sizes though the relationship is similar for age and prior performance.

Hypothesis 2a: The interaction between two firms' sizes has a positive impact on their likelihood of joint venturing.

Hypothesis 2b: The interaction between two firms' ages has a positive impact on their likelihood of joint venturing.

Hypothesis 2c: The interaction between two firms' levels of prior success has a positive impact on their likelihood of joint venturing.

Whereas the foregoing discussion considers how parents' attributes affect their likelihood of forming a JV, the same attributes also affect JV performance. Drawing on the organizational ecology and the learning literatures, the next section addresses this void and predicts how parents' size, age and prior success influence their capacity to joint venture successfully.

Joint Venture Performance

As explained in chapter 2, previous research has predicted a JV's performance based on its parents' compatibility, resource similarity, and the venture's internal structure. Resource complementarities reflect potential synergies that the JV's parents hope to realize by fusing their resources, while their compatibility and the JV's internal structure determines their ability to bring these synergies to fruition (Hill and Hellriegel, 1994). Although this research has advanced our understanding of the determinants of JV performance, it overlooks three important issues.

First, however complementary two firms' resources might potentially be, unless they are successfully migrated to the JV, no synergies will be realized. In arguing that JVs allow parent firms to share resources and competencies, prior studies have implicitly

assumed that valuable skills and resources can be easily migrated to the new venture, an idea called into question by other research (Szulanski, 1996). In an in-depth study of 1572 alliances Dyer, Kale and Singh (2001) showed that a major reason for alliance failure was parents' inability to transfer resources to the venture. That finding highlights the importance of accounting for parents' ability to actually transfer resources, a point that has been under-appreciated in JV research.

Second, while it is intuitively logical that similar firms are better equipped than dissimilar ones to integrate and jointly develop new resources, two firms will seldom be identical. In fact, a key motive for the formation of JVs is the desire of participants to acquire capabilities they cannot develop internally, so parents seek partners who offer competencies different from their own. Such capabilities are often embedded within a firm's structure and processes (Das and Teng, 2000: Chi, 1994), which suggests two opposing forces: (1) some degree of organizational similarity is necessary to support resource integration, yet (2) a very high degree of similarity is likely to offer little benefit since neither firm would have much to gain from the other. Consequently, successful resource integration will always necessitate some level of mutual adaptation among partners that are dissimilar in important ways[1].

A final issue that prior research overlooks is that even if the partner-firms have successfully migrated and integrated their resources, the JV still has to develop new routines to deal with its own environment, which is likely to differ from both of its

[1] As the literature review suggests, firms may also ally to enhance collusion or pool risk, in which case they could be identical. Note, however, that (1) I focus in this paper on technology-intensive industries in which collusion is a secondary motive for joint venturing, and (2) since two firms are never identical, even when firms joint venture to enhance collusion or pool risk they still need to mutually adapt to be able to work together.

parents' environments. Moreover, in technology-intensive settings, all firms are forced to adapt their routines to evolving external conditions, and that imperative applies to JVs as well as firms without parents.

On the whole, transferring resources to the JV, adjusting them to complement the other parent's capabilities, and then developing new skills will challenge a parent's existing routines, behaviors, values, beliefs, and will necessitate changes in its internal distribution of resources (Szulanski, 1996). Prior work indicates that firms differ significantly in their ability to execute such changes, which raises an interesting possibility. Imagine, for example, two firms who are highly compatible and possess complementary resources, yet are so rigid that they are incapable of making the adaptations necessary to integrate their resources. Surprisingly, then their ability to form a successful JV may be less than that of two firms who are less compatible but whose resources are relatively flexible.

As this suggests, the ability of two firms to joint venture successfully may depend on each firm's ability to change and adapt to the other and to their venture's external environment, which is dynamic in technology-intensive industries. Since prior research indicates that firms differ significantly in their adaptive capabilities, we need to examine how the factors that affect a firm's likelihood of joint venturing successfully influence its ability to adapt. In fact, three major factors that have been found to affect organizations' adaptive abilities are age, size, and prior performance.

How do age and size affect organizations' adaptability?

A consistent theme in the organizational literature is that size and age increase organizational inertia, causing firms to experience difficulty in implementing changes to their evolutionary trajectories (Hannan and Freeman, 1984, 1989; Gresov, Haveman, and Oliva, 1993). As organizations grow they become more complex since they must deal with a growing number of interdependencies, and they develop specialized subunits and routines to resolve them (Blau, 1970; Child and Kieser, 1981). Accordingly, larger organizations adopt more formal control and coordination mechanisms such as codification of organizational procedures, which smooth their operations yet also create strong inertial tendencies and resistance to change (Selznick, 1948; Pfeffer, 1981; Scot, 1998; Huber, Sutcliffe, Miller, and Glick, 1993). As organizations regulate and departmentalize their activities, patterns of behavior stabilize, individuals settle into characteristic roles, structures and routines are institutionalized, and altering them becomes difficult (Berger and Luckman, 1966; Zucker, 1977; Miller and Friesen, 1980; Aldrich and Auster, 1986). The increased differentiation and specialization of subunits also breeds internal competition, conflict, and self-interested political bargaining among departments, generating resistance to any suggestions that might disturb existing distributions of resources and privileges (Pfeffer, 1981; Tushman and Romanelli, 1986; Ranger-Moore, 1997, Aldrich and Auster, 1986).

Similarly, as organizations age and learn from experience, they refine their routines. Over time, as routines are refined and their returns become more certain, organizations become less inclined to modify them (Levitt and March, 1988; March,

1991). These arguments have been empirically substantiated by numerous studies in various industries (e.g. Fombrun and Ginsberg, 1990; Ginsberg and Buchholtz, 1990; Halliday and Powell, 1993).

How does performance affect organizations' adaptability?

In addition to age and size, another factor that has received much scrutiny as affecting a firm's propensity to change is its prior performance. Specifically, prior success can cause firms to become risk averse, complacent, and overconfident, which mitigates against change (Greve, 1998; Miller, 1993; Milliken and Lant, 1991). Further, organizations tend to repeat actions that are associated with positive outcomes (Cyert and March, 1963; Prahalad and Bettis, 1986), and firms become committed to retaining proven competencies, because doing so is more efficient than trying to develop new ones (Levitt and March, 1988). Following success, managers become more confident about the effectiveness of their actions. As their beliefs about cause–effect relationships solidify, they persist with strategies that were successful in the past and overlook alternatives, a concept well supported by empirical evidence (e.g. Lant, Milliken and Batra, 1992; Meyer, Goes, and Brooks, 1993; Miller and Chen, 1994; Boeker, 1997a, 1997b; Greve, 1998; Audia, Locke and Smith, 2000)

As the arguments in the two previous subsections indicate, larger, older and more successful firms have greater inertia. In turn, inertial organizations can be expected to face major hurdles in transferring resources to a JV and difficulties in mutually adjusting their routines to their partners'. If a prime motive for the formation of JVs is the fusion of

their parents' resources, then the question is: Can parents with valuable internal capabilities readily transfer them to their JVs? An examination of the inertial nature of a firm's core capabilities suggests that the answer is no.

Parental imprinting and JV inertia

Core capabilities consist of a set of differentiated skills, complementary assets, and routines that provide the basis for a firm's competitive capacities (Teece, Pisano and Shuen, 1997). Leonard-Barton (1992) identifies four interrelated, interdependent dimensions of a core capability – skills and knowledge, technical systems, managerial systems, and values and norms, arguing that it is their interrelationships that generate a firm's competitive advantage. Hence, replicating only a part of what a parent does may not provide a similar advantage. Instead, a sufficient transfer of parental capabilities requires a redeployment of the whole package. And transferring competencies from the parent to the JV cannot be accomplished through words alone, as it has been argued that resource replication and transfer is often impossible absent the movment of people and routines (Teece, 1998).

Following their transfer to the JV, resources that served the parent well in the past may have to be modified to fit the JV's environment. A JV's ability to do so depends on (1) how much the routines it acquires at founding fit its own environment, and (2) how deeply these routines have been institutionalized in its managerial and technical systems. Although these arguments have never been examined directly in a JV setting, a number

of studies have considered how an organization's heritage affects its destiny, and some comparisons can be made.

Carroll, Bigelow, Seidel and Tsai, (1996), found that diversifying firms who entered the U.S.A automobile industry had lower initial death rates than new startups entrants within the industry. The authors ascribed these differences to the financial and technical backing that the former received from their parent-firms. However, those authors also found that new ventures established by corporations were more inertial, which caused their initial advantages to diminish with organizational age and eventually become liabilities. Similarly, in a study of the Manhattan hotel industry, Ingram and Baum (1997) found that chain affiliation significantly affected hotels' likelihood of failure. Their results indicate that in comparison to independent hotels, affiliation with a chain can serve as a source of operating knowledge and economies of scale, which under most circumstances improved the survival chances of component hotels. Chain affiliation, however, is not an unmixed blessing. The failure rates of hotels founded by chains increased with the accumulation of non-local experience by the chain during the affiliation, suggesting that an affiliation with a chain is also a source of strategic constraint. Since a chain's strategy is "designed to derive maximum benefit for the collective, without special regard to any particular component" (Ingram and Baum, 1997: 96), it might force inappropriate knowledge on its units, constraint them from developing local expertise and reduce the degrees of freedom that managers of component hotels have to respond to their local environments.

Another reason for the observed differences between the mortality hazards of firms that are offspring of other organizations and those who are not is that the latter have to learn new roles and routines from scratch, while the former inherit them from their parents (Stinchcombe, 1965; Hannan and Freeman, 1984; Carroll et al., 1996). While new startups' high probability of failure in their early years is the consequence of factors such as the need to train employees, accrue assets, gather experience, and establish credible exchange relationships (Stinchcombe, 1965; Hannan and Freeman, 1984; Baum, 1996), new ventures created by corporations potentially draw on capabilities and skills developed and refined by their parents. Therefore, when forming a JV firms typically pass on routines and knowledge to their offspring. A parent's routines and knowledge, however, are developed, shaped, and applied in response to its own environment (Lawrence and Lorsch, 1967). Thus, the potential value of parental resources transferred to the JV is contingent on the level of the parent-firm's relatedness to the JV. Merchant and Schendel (2000), for example, argued that greater similarity between the businesses of the parents and the JV confers opportunities for learning, scale and/or scope economies, and it enables parents to better anticipate, comprehend and adapt to emerging environmental threats.

Firms' routines, however, vary in their fit to the environment. One reason is that organizations are formed to fit their surrondings at founding, and while the environment continues to change, firms tend to retain the characteristics they acquired at birth (Stinchcombe, 1965). Consequently, the older an organization, the more its competencies may grow out of step with the environment (Kimberly, 1975, 1979; Tucker, Singh, and

Meinhard, 1990; Carroll and Hannan, 2000). Similarly, since the characteristics a JV's parent transfers to the JV are a product of the conditions surrounding the parent's founding, not the JV's, the older the parent when it forms the JV, the more likely it is to pass on obsolete tools and resources. Further, organizational structures change as firms grow (Nadler and Tushman, 1988). Since JVs generally start small, structures, processes, and other skills that have served a large parent well may not be appropriate for a small JV. Hence, the larger the parent, the less likely that its resources and processes will fit the JV. This argument may seem to suggest that a JV's likelihood of failure is always higher than the typical startup's, which contradicts the idea that young organizations fail because they lack reproducibility. Instead, I argue that parent-firms exert two contradictory influences on a JV's likelihood of failure. On the one hand, they provide a JV with social roles, routines, relationships, and legitimacy, which decrease the JV likelihood of failure. On the other hand, they may force inappropriate knowledge and routines on the JV, and constrain its ability to respond to its own environment. Taken together, these two contradictory influences suggest a U-shaped relationship between parent size and JV failure. That is, parents' size may confer routines and legitimacy that may reduce a JV's likelihood of failure up to a point, after which parent size becomes a liability, and the JV's likelihood of failure starts to rise. However, given the relatively large size of firms in my sample, and the dynamism of the industries studied, which renders change absolutely necessary and flexibility more important than reproducibility, I expect a monotonic relationship between parents' size and JV failure.

Finally, a JV's predisposition to modify its inherited routines and develop new ones depends on how deeply they are rooted in its managerial and technical systems, and in its set of beliefs and values. Since internal roles and formal structures are more thoroughly established in older organizations, and their routines are more routinized, their JVs are likely to inherent a more structured and standardized set of routines. The more structured and standardized a JV's inherited routines, the less motivated its managers will be to change them and the less authority they will have to make such changes, and the more likely they are to continue their parent's ways (Goodrick and Salancik, 1996). JVs are especially likely to adhere to their inherited routines when those routines have been more thoroughly refined by the parent (March, 1991). In this way, the inheritance process may develop into what Levitt and March (1988: 322-323) call a competency trap, in which new ventures cling to their parents' ways even when other actions may fit their own environment better.

In sum, three factors decrease the ability of older, larger, and more successful firms to successfully joint venture: (1) such firms are likely to face greater obstacles transferring their resources to the JV, (2) such firms are more likely to force onto the JV resources and skills that do not fit the JV's environment, and (3) such firms' JVs are less inclined to adapt those skills and resources to their situation. Consequently, the older, larger and more successful a JV's parents were when they formed the JV, the greater the JV's likelihood of failure.

Hypothesis 3a: the larger each of a JV's parent-firms was when it formed the JV, the greater the JV's likelihood of failure.

Hypothesis 3b: the older each of a JV's parent-firms was when it formed the JV, the greater the JV's likelihood of failure.

Hypothesis 3c: the more successful each of a JV's parent-firms was when it formed the JV, the greater the JV's likelihood of failure.

As noted earlier, these hypothesized relationships are depicted in Figure 2. While the likelihood of JV success is increased by a parent's ability to adjust its capabilities to fit the other parent and the JV's environment, this process is enhanced when both parents are flexible. That occurs for two reasons. First, JVs usually require mutual adaptation. While unequal adaptation may enable parents to achieve a reasonable level of compatibility, it can create political tensions, and render the adaptive parent resentful. This, in turn, gives the parents more opportunities to question their relationship, especially when one parent feels it is bearing most of the effort. Such JVs are therefore more likely to fail than JVs between two adaptive parents.

Second, while resource synthesis is a reciprocal process that does not necessarily require parents to adapt equally, how much each parent must adapt is intertwined with the other parent's efforts. Therefore, combinations of two large, old, or successful parents are especially problematic because neither is motivated to change or particularly able to change. Moreover, each parent probably assumes that the other should change because its own way is institutionalized and/or proven right by prior outcomes and the test of time, which undermines the partners' ability to achieve a reasonable level of compatibility.

Taken together, two large, old, or successful parents are least likely to successfully adjust their capabilities to each other's and/or the JV's environment. In comparison, a

partnership between a large parent and a small parent (or an old and an young parent, or a more successful and a less successful parent) is more likely to succeed since at least one parent is capable of adjusting. Yet, such a partnership is less likely to succeed than one between two small, young, or less successful partners who are both flexible. These interaction effects are depicted in Figure 4. For simplicity the figure depicts the relationship between two firms' sizes though the relationship is similar for age and prior performance.

As the more positive slope of the top line in Figure 4 suggests, while a JV's parent's size increases the JV's likelihood of failure, the strength of this relationship is different depending on the size of the other parent. If parent A in Figure 4 grows and moves from point 1 to point 2, for example, the amount this increase in size increases the JV's likelihood of failure depends on the other parent's size. If the other parent (parent B) is small, and hence adaptive, it is capable of undergoing additional adjustments that can counterbalance parent A's lost adaptability, and the two parents can still reach a level of compatibility that will allow them to joint venture successfully. On the other hand, if parent B is large, it is less able to change and adapt, the parents are less likely to reach a reasonable level of compatibility, and the more likely the JV to fail. Accordingly, I hypothesize that:

Hypothesis 4a: The interaction between a JV's parents' sizes has a positive impact on the JV's likelihood of failure.

Hypothesis 4b: The interaction between a JV's parents' ages has a positive impact on the JV's likelihood of failure.

Hypothesis 4c: The interaction between a JV's parents' levels of prior success has a positive impact on the JV's likelihood of failure.

Environmental Conditions

The above hypotheses predict that while the likelihood of two firms forming a JV will increase with each firm's size, age and prior performance, those will also increase the JV's likelihood of failure. While these firm-level factors are the main focus of this study, there are population-level factors that may produce similar paradoxical outcomes. Just as managers look at organizational characteristics in choosing JV partners, they also look to the external environment for clues as how to behave. This is especially true in technology intensive industries where uncertainty is high, because in the face of uncertainty, decision makers look to others for leads about how to act (Rao, Greve, and Davis, 2001). While managers' tendency to mimic others has been well documented (Haunschild and Miner, 1997), its outcomes have received much less scholarly attention. Several studies, for example, have shown that a firm's likelihood of forming alliances increases with the aggregate number of alliances created by other firms in prior years (Venkatraman, Loh, and Koh, 1994; Garcia-Pont and Nohria, 2002). But these studies stopped short of examining if alliances that were created in response to social cues performed differently than those that their creation was not based on imitation.

In contrast to prior research which for the most part, has examined factors that influence a firm's likelihood of mimicking others but did not examine how those factors affect the outcome of the practice adopted, I examine how certain population level factors affect firms' likelihood of creating a JV and also how subsequently those factors affect the JV's performance. I argue that similar to the effects of the firm level factors discussed above, some population level factors increase not only a firm's likelihood of forming a JV but also increase the JV's likelihood of failure. Hence, to better understand the paradox hypothesized in this study it is important to consider those factors.

The dominant explanation as to why executives are so influenced by the observed actions of others and why they tend to adapt practices that are widely used by other comes from institutional theory. As mentioned earlier, alliances, and particularly JVs, have become a popular organizational practice in the last two decades (Thompson Financials, 2002). Institutional theorists argue that increases in the number of organizations adopting a practice render that practice more legitimate, endowing it with a taken for granted status (Tolbert and Zucker, 1983; Haunschild and Miner, 1997). Since organizations that do not use a widespread and legitimate practice may raise doubts among their stakeholders, increases in the number of organizations using a particular practice generate pressures on other organizations to follow suit in order to prevent loss of stakeholder support, regardless of the practice's effectiveness (Abrahamson and Rosenkopf, 1993).

With respect to JVs, their growing popularity in recent years is likely to foster the belief that firms are better off developing highly complex technologies with partners than

developing them alone. Consequently, as the number of firms forming JVs increases and stakeholders increasingly believe that it is ill-advised for firms to invent everything by themselves, the threat of lost legitimacy and lost stakeholder support if a firm consistently tries to create new technology independently is likely to increase firms' propensity to conform to popular beliefs by engaging in JVs.

Others have argued that organizations are predisposed to adapt widely used practices not because they fear losing stakeholder support, but because they interpret a practice's frequent use as an indicator of its economic value. The greater the number of other firms adopting a practice, the more likely a boundedly rational manger is to conclude that others have superior information about the practice's utility. In turn, that increases their likelihood of jumping on the bandwagon (Banerjee, 1992; Bikhchandani, Hirshleifer, and Welch, 1992). This tendency is intensified by the fear of being locked-out of an emerging practice with valuable attributes. For example, observing a growing number of competitors creating JVs may cause managers to act mimetically in order to avoid the possibility that their competitors sign up all desirable partners, leaving the managers stranded (Gomes-Cassares, 1994).

Whether an organization follows the herd to prevent the loss of stakeholder support or the possibility of being locked-out of a valuable emerging practice, the result is the same: an organization's likelihood of using a practice increases with the number of other organizations already using it. This phenomenon, often called "frequency based imitation" (Haunschild and Miner, 1997), has been studied at several levels of analysis. Fligstein (1985) found that firms were more likely to adopt the multidivisional form (M-

Form) to the extent that others in their industry had already adopted. This result was later replicated by Palmer, Jennings, and Zhou (1993) in a multi-industry sample of M-Form adaptors. Similarly, Venkatraman et al. (1994) examined the diffusion of JVs in the information technology industry, and found that firms' likelihood of forming JVs is a function of the number of JVs already created in the industry, a result replicated using a multi-sector dataset. Haunschild and Miner (1997) found that the likelihood that a U.S-based, publicly held company will use a particular investment-banking firm was a function of the frequency with which other U.S-based, publicly held companies used that company, and Williamson and Cable (2003) showed that the likelihood that a *Fortune 500* firm will hire top management team members (TMT) from a particular source increased with the number of other *Fortune 500* that have hired TMT members from that source in the past.

Along similar lines, others have advanced the idea that managers are especially likely to mimic the behavior of organizations to which they have network ties. Some scholars restricted their analysis to ties between firms from the same industry (e.g. Davis, 1991; Burns and Wholey, 1993; Westphal, Gulati, and Shortell, 1997; Kraatz, 1998), while others have examined ties among organizations from different industries (e.g. Galaskiewicz and Wasserman, 1989; Haunschild, 1993).

Different levels of analysis indicate different assumptions as to whom mangers observe and imitate. In this study, I examine how the likelihood that two firms will form a JV in a technology intensive industry relates to the aggregate number of JVs created in technology intensive industries in the prior year. I chose to aggregate the number of JVs

created across all technology intensive industries for several reasons. First, since my sample consists of U.S-based public firms that operate in more than one industry and are typically tied to firms in multiple industries, they are likely to observe and imitate firms from multiple sectors. Second, certain organizational practices (e.g. acquisitions, quality circles, charitable contributions, etc.) diffuse broadly among publicly owned firms (Galaskiewicz and Wasserman, 1989; Haunschild, 1993; Abrahamson and Fairchild, 1999). This seems especially likely when a practice addresses a generic issue common to many organizations, such as improving performance through quality circles, or overcoming competitive resource deficiencies, as in the case of JVs. Third, JVs are often created when two firms from different industries seek to enter a third industry in which neither of the two firms has a presence. Since JV formation is often a cross-industry phenomenon, institutional pressures that span across industries are likely to influence it. Fourth, antitrust restrictions prevent firms from recruiting outside directors from their own major industries, so directors often come instead from industries facing similar environments and challenges (Haunschild, 1993; Westphal**,** Seidel, and Stewart, 2001). For example, IBM's board includes a former CEO of Emerson Electric, whose products face competitive and technological challenges similar to those confronting IBM. Similarly, Merck's board includes a former CEO of Honeywell International Inc., which although not a pharmaceutical company, is similar to Merck, since both are research-driven companies that develop, manufacture and market a broad range of innovative products. Taken together, I hypothesize that:

Hypothesis 5a: In technology intensive industries, the likelihood of two firms forming a JV increases with the number of JVs created in those industries in the prior year.

Although several studies have examined how institutional pressures affect a firm's likelihood of forming alliances (e.g. Venkatraman, Loh, and Koh, 1994; Garcia-Pont and Nohria, 2002), these studies stop short of considering how institutional conditions at an alliance's founding affect its subsequent performance. Other research, however, has argued that since mimetic adoptions of organizational practices are based on popularity rather than a thorough examination of the practice's potential value, the decision to adopt a popular practice often brings disappointing results (Strang and Macy, 1994; Rao, Greve, and Davis, 2001). The greater the number of JVs created in a firm's environment, the greater the pressure it faces to follow suit and thus, the less rigorous its due-diligence process is likely to be prior to forming a JV. In turn, a firm may be willing to accept weaker partners. Hence, while hypothesis 5a predicts that the aggregate number of JVs created in technology intensive industries in prior years will increase a firm's likelihood of forming a new JV, ventures formed in response to those bandwagon pressures are particularly likely to fail. This leads me to the following hypothesis:

Hypothesis 5b: A JV's likelihood of failure increases with the number of JV's created in technology intensive industries in the year prior to its formation.

Making the right decisions

As prior research suggests, firms' selection of partners is far from random. A variety of factors determine which JVs get formed and which do not. This has two critical implications for JV research. First, if certain factors, such as parent-firms' age, size and prior success increase a JV's likelihood of being formed but decrease its performance, firms' preferred choices may often yield substandard results. Remember though, that while statistically we can tease out the effects of each parent-firm's characteristic on JV performance, in reality when a firm selects a partner, it cannot tailor it to its own needs by choosing specific traits and excluding others. Instead, it has to select a 'ready made' partner, embodying an ensemble of characteristics, some of which may increase the odds of a successful venture, while others may decrease them. Therefore, while I have focused on age, size, and prior performance, there are numerous other factors that also affect JVs' performance, and hence, to draw general conclusions on firms' selection of partners and to better understand the paradox hypothesized in this study it is important to examine the overall effects of such factors. Accordingly, in this section I ask: How, after accounting for age, size, prior performance, and mimetic pressures, does a firm's selection of partners affect its likelihood of cooperating successfully?

This question is depicted in Figure 5. In addition to parent-firms' sizes, ages, and prior performance, and mimetic pressures in their environment, there are numerous other factors that affect a JV's likelihood of formation, and thus, the total effect that a JV's likelihood of formation has on the JV's performance is a joint function of all these factors (path E). Moreover, as this figure indicates, a given predictor has both direct (paths B, D)

and indirect effects (paths A, C, E) on JV performance. For example, if age signals inertia that robs a firm of its ability to flexibly adapt, that would decrease JV performance, a direct effect, as shown in path B. At the same time, age may also trigger an adverse selection process in which a firm is not only inflexible itself, but its age also causes it to pick especially bad partners. In that case, path A would be positive, and path B would be negative. More generally, if the likelihood of formation decreases JV performance, then executives would be a bit like the parachutists in the earlier analogy, in that those who choose to make the leap into a new venture are the same ones who are least likely to diligently assess their landing site and jump partners before they begin.

Although I do not offer any specific hypotheses about these questions (i.e. I do not hypothesize about the question mark in Figure 5), the two-stage model I use in this study enables me to empirically examine them. I do so by using a Heckman model that was originally developed and conventionally applied as a methodological tool to correct for sample selection biases (Heckman, 1979), yet also conveys theoretical insights relevant to my research. The Heckman model is a two-stage procedure that estimates a JV's likelihood of being formed in the first step, and then incorporates estimates of parameters from that model into the second stage model to predict a JV's performance. Thus, I use estimates of parameters from the first model to calculate each JV's likelihood of being formed. Then, by including this estimate in the second model, I can examine how the likelihood that a JV's parents' will form a venture with each other affect that JV's likelihood of success. If, out of all possible JVs, firms form the ones that overall were more likely to succeed, I would expect to find a positive relationship between a JV's

likelihood of being formed and its performance. On the other hand, if out of all possible JVs, firms pick the ones that are less likely to succeed, I would expect to find a negative relationship.

The Heckman model also addresses a second issue raised by the non-random selection of partners. Prior analyses of JV performance were restricted to samples of parents that actually formed JVs, which systematically differ from parents who could have formed JVs but did not, which may create sample selection biases (Heckman, 1979). In turn, that threatens both the internal and external validity of results because it gives a misleading view of what would happen if two randomly selected parents were to form a JV (Berk and Ray, 1982). The Heckman procedure allows me to assess and correct for this potential bias and obtain unbiased estimates of factors that affect JV performance. The following chapter details these two-stage models and the other techniques used to test the hypotheses.

Chapter IV: Research Methodology

Sample

The hypotheses developed in this study were tested on a sample of JVs created in technology intensive industries by publicly traded firms in the United States. The decision to limit the study to domestic firms rests on two key reasons. First, although firms may create international JVs to access other firms' technological capabilities, such resource sharing is secondary to rationales such as overcoming liabilities of foreignness (Zaheer, 1995) or meeting host governments' restrictive policies regarding ownership and control (Tang and Yu, 1990). Likewise, the likelihood that an international JV's parent-firms would successfully migrate their resources to the JV, synthesize them with the other parent's capabilities, and develop new routines required to deal with the JV's environment, involves a more complicated set of factors including cultural differences, geographical distance, and governmental regulations, all of which are beyond the scope of this paper.

Second, restricting the analysis to domestic JVs facilitated obtaining data from publicly available sources. For the same reason, JVs involving private firms were excluded since it is difficult to derive performance measures and other information for those firms. Finally, this study is based on the premise that firms form JVs mainly to access their partner's resources. While this premise has been substantiated in technology intensive industries, resource sharing has been shown to play only a secondary role in medium and low technology industries (Hagedoorn, 1993). I therefore further restricted

the sample to a limited number of technology-intensive industries. The data was compiled in several stages from a number of different sources.

First, a list of technology-intensive industries was identified. While the term technology-intensive seems straightforward, there is no clear definition of exactly what constitutes such an industry. Fortunately, there is fairly wide agreement on the general characteristics of high-technology industries (Hecker, 1999). While the term "high-tech" and "technology-intensive" are not synonymous, most studies have classified industries as high-tech by measuring their level of technological intensiveness, and the same criteria and methods were used in this study.

Measures of technological intensiveness have generally been based on two broad measures of resources used -- employment of scientific and technical personnel, and research and development intensity. In this approach, studies specify thresholds for these measures, such as a specific percent of total employment in scientific and technical occupations and/or research and development spending as a percent of sales or value added. For example, Hecker (1999) considered industries as technology intensive if employment in both research and development and in all technology-oriented occupations accounted for a proportion of employment that was at least twice the average for all industries. Four studies that have followed this approach and that have been frequently referenced to in the literature are Hecker (1999), the Organization for Economic Co-operation and Development (OECD, 1993), The Bureau of the Census, and the Milken Institute's study of "High Tech America" (DeVol and Wong, 1999). I have complied and cross-referenced the lists of industries each study identified as "technology

intensive" according to their Standard Industrial Classification (SIC) codes. Industries that have been identified by at least one of these studies were included in the analysis, producing a list of 26 three-digit SIC codes (see Table 9).

In the second step, a list of U.S-based JVs formed in these industries by publicly traded domestic firms was produced from the Strategic Alliance database of the Securities Data Company (SDC). SDC has been tracking alliances since 1986, providing information that includes contract type (i.e., whether the alliance is a JV, licensing agreement, etc.), the identities and SIC codes of the participating firms, the date of the agreement, and the SIC code of the alliance, which may be different from the SIC codes of the participating firms. SDC obtains information from publicly available sources such as SEC filings, trade publications, and news and wire sources. Although SDC is among the most comprehensive sources of information on JVs, it would clearly not track all deals entered into by U.S. firms owing to inadequate corporate reporting requirements (Anand and Khanna, 2000). This is less of a concern, however, for JVs created by public firms, given public firms' size, visibility, and more stringent reporting requirements, making SDC a sensible starting point for my analysis.

SDC reports a total of 39,097 JVs created worldwide, across all industries, between 1986 and 2001. Of these, 30,259 involved two public firms, 3940 out of the 30,259 were domestic, and 327 out of the 3940 were created in technology intensive industries. These 327 JVs, which compose my sample, were created by a total of 383 parent firms, 80% of which were involved in one JV, 10% in two, and the remaining 10% formed between 3 and 15 JVs with other public firms.

While SDC's information on alliance SIC codes has been found to be very accurate (Anand and Khanna, 2000), dates of JV formation are often misstated in the SDC data. Moreover, data on termination events exist for only 6% of the sample and there is no information regarding a dedicated alliance function. A dedicated alliance function is a central administrative entity created to capture the experience from each alliance, coordinate multiple alliances in which the firm is engaged, and maintain corporate databases and newsletters on alliance activity (Dyer, Kale, and Singh, 2001). Creating a dedicated alliance function with the intent of strategically coordinating alliance activity can help firms mobilize internal resources to support its alliances and build a proficiency to successfully manage them, and thus should be controlled for (Kale, Dyer, and Singh, 2002). To overcome the database's deficiencies, letters were sent to the chief financial officer (CFO), and / or the general counsel, and/or the director of strategic planning, and/or the investor relations department, of each parent-firm in the sample. The first part of letter asked each respondent if its firm has a dedicated alliance function. The second part listed all the JVs that a firm has been involved in, whether they still exist, and if not, when and how each ceased. This procedure required the preparation of a somewhat different letter for each parent-firm.

Identifying whom to mail these letters to was a complicated task since many parent-firms were acquired, merged, or sold part of their businesses after forming the JV. Consequently, I used the Dow Jones interactive and the Nexis-Lexis databases to create an historical file for each parent-firm, detailing the developments each JV went through and its parents' identities for each year since its formation. This procedure was also

necessary for the update of several time-varying measures such as parent-firms' slack resources.

To examine how some of the same factors that determine the formation of a JV affect its later performance, this study began with a model predicting JV formation. To predict JV formation, I supplemented the sample of the 328 JVs that were formed with a random sample of 300 JVs that could have been formed but were not. The risk set from which I sampled these "potential ventures" was created as follows: First, I compiled a list of all the parent-firms of the JVs that were formed and their primary SIC codes. Then, using the COMPUSTAT database, I composed a list of all publicly traded domestic firms in the United States with the same primary SIC codes. This list included both firms that were involved in JVs and all the ones that were not. From this list I randomly sampled 300 dyads in randomly chosen years between 1986 and 2001. To assess whether the results are robust, this procedure was executed four times, each time producing a different sample of potential ventures.

Additionally, it can be argued that since firms in certain industries are especially at risk of joint venturing even if they are yet to do so, I ran the formation models a fifth time, supplementing the sample of JVs that were actually formed with a sample of potential ventures in which the number of firms drawn from a focal industry equals the number in that group that actually formed JVs. Likewise, it can be argued that firms from certain pairs of industries are particularly likely to joint venture with each other. Thus, I ran the formation models a sixth time, supplementing the sample of JVs that were actually formed with a sample of potential ventures in which firms are drawn from pairs

of industries in numbers equal to the number of JVs that were actually formed between a focal industry pair. The results did not change much across the different models. The results reported below were generated with the first constructed database.

Firm specific information including size, age, and various performance measures was obtained from the Center for Research in Security Prices (CRSP) database as well as the COMPUSTAT database. Patent data (see below) was obtained from the U.S. Patents Database. For the JVs that were actually formed, parent data was collected annually, beginning at the year prior to the formation of the JV and continuing until its termination or right censoring in 2002. For JVs that could have potentially been formed but were not, data was collected for both the sampled year, and the previous one.

Measures

Dependent variables. The dependent variables examined here were JV formation (hypotheses 1a-c, 2a-c, 5a) and JV failure rates (hypotheses 3a-c, 4a-c, 5b). In the formation model, each dyad had a dummy variable indicating whether the members of the pair of firms formed a JV with each other in the given year. Each dyad-year sampled included attributes of the parent-firms, the dyad, and the industry in which the JV was created.

In the failure rate models, each JV was followed annually from formation to termination or right censoring. A JV was coded as failing in year t if it was sold to one of its parent-firms, an outsider, or was liquidated in year t (Reuer and Koza, 2000). While all three modes of termination may result from a business failure or irresolvable conflict

among the JV's parents, disagreements exist in the literature about whether the acquisition of a JV implies the failure of its activities (Geringer and Hebert, 1991; Parkhe, 1993). Some argue that acquisition or internalization by one of the parent-firms is not tantamount to failure because it may simply represent the realization of an investment option (Bowman and Hurry, 1993; Kogut, 1991). Conversely, I argue that the sale of a JV occurs when one or both of its parents conclude that the JV's potential ownership benefits are less than the gains from its sale. Hence, the sale of a JV suggests that it failed to meet or sustain its parents' goals. Nevertheless, given the disagreements noted above, I conducted two supplemental analyses to assess whether the type-specific hazard functions are similar across all event types. First, I modeled the different event types as competing risks. The competing risks procedure, however, decreases the number of events in each model and may therefore suffer from low statistical power. Therefore, I also assessed whether the type-specific hazard functions are the same for all event types by coding time-invariant proportionality dummies for each event type, which I then interacted with all the predictors to detect any differences in a variable's effect on the different event types (Allison, 1995). Results were not substantially different from those reported later.

Independent variables. Parent-firm size – The selection of a theoretically relevant size indicator is a topic of debate (Kimberly, 1976; McKinley, 1992; Sutton and D'Aunno, 1992). Given the numerous theoretical aspects and operational definitions of organizational size that have been used in prior research, a theoretical rationale should be

specified for choosing one measure among competing alternatives (Kimberly, 1976). In this study, I use size to proxy control and coordination mechanisms that render organizations rigid. Since formal control and coordination mechanisms generally need to be introduced as the number of an organization's members increases, the number of employees is more germane than other measures of size such as physical capacity or organizational inputs or outputs. Parent-firm **size** was therefore operationalized as the logged number of employees each parent-firm had in the year prior to the formation of the JV. The **age** of the parent-firms was measured as the difference between the year in which the JV was founded and the parent-firms' incorporation dates. Two measures accounted for **prior performance**: Return on Assets (ROA) in the year prior to the formation of the JV, which measured financial performance, and the total number of Patents obtained by a firm in the year prior to the formation of the JV measured its technical performance. In industries in which innovation is one of the pivotal bases of competition, patents represent externally validated measures of success (Narin, Noma, and Perry, 1987; Stuart, Hoang and Hyblels, 1999; Ahuja, 2000). **Institutional Pressures** were measured as the logged number of JVs created in technology intensive industries in the year prior to the formation of the JV.

Parent-firm controls – **Slack Resources** - While parent-firm size and performance in the year prior to the formation of the JV are hypothesized to increase a firm's inertia and thus increase the JV's likelihood of future termination, organizational size and performance also tend to be accompanied by slack resources, which may allow firms to

continue with a JV even when it is not performing well (Bourgeois, 1981). Time-varying measures of parent firm **sales** and **change in sales** were included in the termination model to control for slack resources. Both variables were logged and updated annually and were only moderately correlated with the size at founding measure ($r_{sales,\ size}$ = .48 and .50 and $r_{change\ in\ sales,\ size}$ = -.08 and -.00). **JV experience** - several scholars have advanced the idea that JV parents learn by doing, so experience with JVs may help parents develop a capability to select better partners and successfully manage shared ventures (Delios and Beamish, 2001; Anand and Khanna, 2000; Lyles, 1988). The cumulative number of JVs across a firm's life served as a proxy for the depth of its JV experience. Events that are more distant in time often have less influence than more recent ones due to organizational forgetting, so I used a formula that discounts cumulative experience (Darr, Argote, and Epple, 1995; Ingram and Baum, 1997; Henderson and Stern, 2004):

$$\text{Cumulative JV experiance}_{i,t-1} = \log \{1 + (\sum_{j=1}^{T} \text{JV formations}_{i,j} * \text{discount}^{T+1-j})\},$$

where T is the age of the ith firm in year t-1, $\text{formations}_{i,j}$ is the number of JVs that were formed by the ith firm in the jth year of its life, and discount is a weight that depreciates the value of JV experience across time. This measure was lagged by a year so that it was not confounded with formation events at time t. Some firms did not form any JVs, so the quantity 1 was added to the event summation before logging it.

Following the authors cited above, I selected a discount weight by comparing models with values of 0.1, 0.3, 0.5, 0.7, 0.9, and 1.0, the latter indicating no discounting. In the formation models, goodness of fit was best using a value of 1, which indicates that

experience did not fade appreciably. Those results are reported below. In the termination models, none of the discount weights produced a significant effect for JV experience. Additional experimentation revealed that the number of JVs created by the firm in the year prior to the termination of the JV had a significant effect on JV termination. This measure, however, should be interpreted with caution, since it might proxy factors other than experience, as discussed in the results section. I included only JVs and not alliances in general since the two require different capabilities and yield different lessons (Simonin, 1997). I also included the **Net number of firms met in past alliances**, which is a count of partners a firm had collaborated with, to proxy the extent of the interfirm network the firm formed through its collaborations. This measure tapped into the firm's ability to identify new JV opportunities by learning about other firms' reliability, needs, and resources through historical ties (Gulati, 1995a; Powell et al. 1996; Doz, Olk and Ring, 2000). However, since it was highly correlated with *JV experience*, it was dropped from the formation model. When it was included in place of *JV experience* it yielded similar results.

Dyad level controls – The **compatibility** between a JV's parent-firms was represented as a dummy variable using the parents' three-digit SIC codes. For JVs in which the parent firms' primary operations were in the same 3-digit code, the dummy was set to 1; that variable was coded 0 otherwise. Dummy variables based on 2-digit and 4-digit SIC codes were also computed to check for the sensitivity of the measure to the choice of SIC classifications. The 3-digit code scheme produced the strongest results. **Operational**

overlap, i.e. the relationship of the JV's operations to that of its parent firms', was represented as a dummy variable (1 if the JV's SIC classification is the same as at least one of its parent's primary business, 0 otherwise). **Parent-firms' attachment** – firms that have worked together in the past have a basic understanding about each other's skills and capabilities (Heide and Miner, 1992). The partners may have developed familiarity, trust and commitment to each other because of a relationship that existed prior to forming the JV (Gulati, 1995b). Consequently, firms often form JVs with organizations they have transacted with in the past (Inkpen, 1995; Inkpen and Beamish, 1997). I therefore controlled for the number of prior alliances, which included JVs as well as all other kinds of alliances, such as research and licensing agreements, between the firms in each dyad. **Equity sharing -** reflecting the division of control according to ownership structure has been studied as a critical determinant of the dissolution of JVs (Blodgett, 1992; Kogut, 1988). I used a dummy variable coded 1 for a balanced JV (e.g. a 50-50 equity division) and 0 for unbalanced equity sharing. This measure produced stronger results then those obtained when using the percentage of the larger partner instead.

Industry level controls – **JV popularity** - if firms pursue JVs to increase their legitimacy as hypothesis 5a predicts, then as long as JVs are popular, firms might be less inclined to terminate them even if they are performing poorly. A contemporaneous measure of the logged number of JVs created in technology intensive industries was therefore included in the termination model and updated annually.

Other controls – JV Age - numerous studies have shown that organizational failure rates vary with age (Baum, 1996). Given that a JV is a separate organization, created to carry out its own productive economic activity, I controlled for JV age and its square in the failure analyses by measuring the years since its formation. **Temporal trends -** I estimated a piece-wise model using several dummies to capture the net effect of various time-varying macro-economic factors that may influence the formation or termination of JVs (Amburgey and Miner, 1992). I chose to use a piece-wise model as opposed to 14 dummy variables for the 15-year period covered in the study to limit the overall number of predictors. In the formation models, this process produced 2 statistically significant dummy variables: one was coded 1 for JV formations between 1990 and 1993, and the other for formations between 1994 and 2001. 1986-1989 was the omitted category. In the termination models, one dummy variable was coded 1 for terminations in 1994 and the other for terminations in 1999. The remaining years (1986-1993, 1995-8, 2000-1) were the omitted category.

Additional controls – several other control variables were found to be statistically insignificant and were omitted from the models reported below to maintain adequate statistical power. Their exclusion from the models did not change the results. These variables are: **A dedicated alliance function -** While greater JV experience may be a necessary and important condition for firms to build JV capability, as discussed above, others have argued that it may not be sufficient. Specifically, Kale, Dyer, and Singh (2001, 2002) and Dyer, Kale, and Singh (2001), have argued that (a) alliance capability

rests upon how effectively the firm is able to capture, share, and disseminate the alliance management know-how associated with prior experience, and (b) that is contingent on the existence of a separate, dedicated organizational unit charged with the responsibility to capture prior experience. Data on a **dedicated alliance function** within each parent was obtained from the letters sent to firms and was therefore available only for parent-firms of JV that were actually formed. Hence, unfortunately, while I recognize that the presence of an alliance function may affect a firm's propensity to joint venture, a dummy variable, which was coded 1 when a dedicated alliance function existed, was included only in the model of JV termination. Nevertheless, since JV experience is controlled for in the formation models, I do not expect this omission to have serious implications. **Debt/equity** measured the leverage characteristics of a firm and controlled for financial motivations driving linkage formation in the first model, and in the second model, for the possibility that a parent firm might have to sell its share in the JV due to financial problems apart from the JV itself (Hennart, Roehl and Zietlow, 1999). **Industry R&D intensity** – a key finding from a diverse set of studies is that R&D intensity of industries is positively related with the frequency of alliances in those sectors (C. Freeman, 1991; Hagedoorn, 1995b). **Industry R&D intensity** was defined as R&D investment expressed as a percentage of net sales averaged for each industry in which a JV has been, or could have been created. Figures published by Schonfeld and Associates (2002) were used for this purpose. Since a JV is ultimately a separate entity competing in its own industry, two controls assessed the JV's industry, structure, and its competitive conditions: **Demand Growth** – average annual growth rate of industry shipments, was obtained from the

Department of Commerce, and, **Market Concentration** - Eight-firm concentration ratio (%), as of 1997, was obtained from Census of Manufacturing. **Industry dummies –** eight dummy variables for the JV industry, based on two-digit SIC codes, were included to capture unobserved factors associated with the industry of the JV.

Analysis

Formation and Failure Rate Estimation

While the data from SDC were updated regularly, so the date in which a JV was formed was supposedly known, this data has been found to be somewhat inaccurate in many instances (Anand and Khanna, 2000). Anand and Khanna (2000), who closely examined this issue, found that in most cases the extent of inaccuracy of SDC information is within a few months, so in some cases, the recorded dates approximately match the date on which the agreement was signed, while in others, the date signals when negotiations began. Likewise, although asked to specify the exact date in which a JV was terminated, firms were able to often recall only the year of occurrence. Given that coarseness, coupled with the fact that my predictors were recorded annually, I assessed formation on an annual basis.

These data limitations, however, do not change the fact that JVs were at risk of formation and termination throughout the entire year. The objective therefore was to recover what were actually continuous-time hazard rates. Discrete-time event history models that use a complimentary log-log function accomplish this by accounting for both the discrete nature of the available data, and the continuous nature of actual formation

and failure processes (Allison, 1995). These models were estimated using the LOGISTIC procedure in SAS with the LINK = CLOGLOG option.

Five firm-dyads formed more than one JV in the 15 years sampled, from which I randomly picked one, so repeated events were not a concern at the dyad level. Nevertheless, twenty percent of the parent-firms in my sample were involved in two or more JVs with different partners. Although these recurrences do not constitute a repeated event since my unit of analysis is the dyad, to assess whether they cause any biases in the results due to non-independence and unobserved heterogeneity, the analysis was repeated three times: Once including all JVs, once including only the first JV that each parent was involved in, and once, randomly picking one JV per firm (Allison, 1995).

Finally, the failure analysis would suffer from sample selection bias if the same factors that influence a JV's likelihood of being formed (e.g., parent-firm age, size, and prior success) also affect its subsequent performance. To model this, I used the technique described by Lee (1983) and implemented by Barnett (1994), Henderson (1999) and others. That technique is a generalization of the two-step procedure described by Heckman (1979) and entails the following calculation:

$$\lambda_{i,t} = \frac{\phi[\ \Phi^{-1}(F(t)_{i,t}\ )\ ]}{1\ -F(t)_{i,t}}$$

where $\phi(x)$ is the standard normal density function, $\Phi^{-1}(x)$ is the functional inverse of the standard normal distribution, and F(t) is the cumulative hazard function of the ith dyad at

time t, which was derived from the formation model. Once lambda was calculated, it was included as a control in the failure analyses.

Chapter V: Results

Tables 1 and 2 provide descriptive statistics for all variables involved in the formation and termination models respectively. With few exceptions, correlations among the independent variables are modest. The largest correlations are between parent-firms' sizes, patents, and JV-experiences (r-values range between 0.49 and 0.60), and between the two "temporal trends" dummies in the formation model (r = -0.70). To insure that collinearity did not affect the results, I took two steps. First, for each model, I used matrix decomposition techniques to obtain condition indices (Judge, Hill, Griffiths, Lutkepohl, and Lee, 1988). The highest condition index in any model was 13 and all indices were below the conservative upper threshold of 20 recommended in the literature (Belsley, 1991; Belsley, Kuh, and Welsch, 1980). This strongly indicates that collinearity was not problematic. Second, collinearity's greatest threat in terms of Type I errors is that small changes in the data may create large changes in the parameter estimates (Belsley, 1991). As explained in the methods section, to predict JV formation, I supplemented the sample of the 328 JVs that were formed with a random sample of 300 JVs that could have been formed but were not. To assess whether the results of the formation models are robust, I randomly sampled these "potential ventures" four times, each time producing a different sample of potential ventures. Results were similar across the four samples, which further indicates that collinearity was not an issue. To assess whether the results of the termination models, which included only those JVs that were actually formed, were robust, I randomly excluded 10 percent of the observations and

reran each model, then repeated that process multiple times. All results were robust, which again indicates that the results were not affected by collinearity.

JV formation results. Table 3 reports results of the discrete-time models of JV formation rates. Model 1 contains the controls. Model 2 adds the predicted main effects. Models 3-6 introduce each of the predicted interaction variables individually, and Model 7 includes all of them together. Since results were the same regardless of whether the interactions were modeled separately or together, I use model 7 to assess the hypotheses. As model 7 shows, the results support hypothesis 1a, which predicted that the likelihood of two firms forming a JV with each other would increase with the size of each firm. Hypotheses 1b predicted that the likelihood that two firms will form a JV increases with each firm's age. This hypothesis is not supported. Two performance measures were used to test hypothesis 1c, which stated that the likelihood of two firms forming a JV with each other increases with the level of performance of each firm. As model 7 shows, the likelihood of JV formation increases with the technological performance of each parent-firm, but not with their financial performance. This result suggests that firms form JVs to access their partner's technological capabilities rather than their finances, which is sensible in retrospect, as these firms are large enough to readily attain external financing. Hypotheses 2a-c considered the interactions between two firms' sizes, ages, and performance on their likelihood of joint venturing. As models 3-7 indicate, none of these interactions are significant, and hence hypotheses 2a-c are not supported. Hypothesis 5a predicted that the likelihood of two firms forming a JV would increases with the number

of JVs created in technology intensive industries in the prior year. Model 7 supports that, suggesting that JV formations are subject to mimetic pressures.

JV termination results. Table 4 shows the results of the discrete-time models of JV termination rates. Model 8 contains the controls. Model 9 adds the predicted main effects. Models 10-13 introduce each of the predicted interaction variables individually, and Model 14 includes all of them together. Since results were the same regardless of whether the interactions were modeled separately or together, I use model 14 to assess the hypotheses. As model 14 indicates, a JV's likelihood of termination increases with the size of each of its parent-firms in the year prior to its formation, supporting Hypothesis 3a. As table 4 further shows, the impacts of a JV's parent-firm's age and performance on its likelihood of termination are insignificant, and hence, Hypotheses 3b-c are not supported. Hypotheses 4a-c predicted that the interaction between a JV's parents' sizes, ages and levels of prior success would have a positive impact on the JV's likelihood of failure. These interaction effects are tested in models 10-14, and as table 4 indicates, none of them is significant. Hypotheses 4a-c are therefore not supported. The results do provide, however, strong support for hypothesis 5b, which predicted that a JV's likelihood of failure would increase with the number of JV's created in technology intensive industries in the year prior to its formation. This suggests that the JVs that are formed in response to bandwagon pressures are particularly likely to fail.

Taken together, these results support the premise that some of the same factors that increase a firm's likelihood of forming a JV also increase the JV's likelihood of failure. Table 5 reports a JV's likelihood of formation and termination for three values of parent-firm size: "small" = μ-σ, "average" =μ; and "large" = μ+σ, where μ and σ are the mean and standard deviation of the parent-firm's logged number of employees in the year prior to the formation of the JV, when all other variables are at their average. As Table 5 indicates, "large" firms are 2.5 times more likely to form a JV than "small" firms and 1.4 times more likely to form a JV than "average" firms. Yet a JV that was formed by two "large" parents is 50% more likely to terminate than a JV that was formed by two "small" parents and 23% more likely to terminate than a JV that was formed by two "average" parents. Out of all possible JVs, then, the ones that are especially likely to be formed are also the ones that are most likely to fail.

As discussed in the methods section, a JV was coded as failing in year t if it was sold to one of its parent-firms, an outsider, or was liquidated (Reuer and Koza, 2000). To assess whether the type-specific hazard functions were the same for all event types, I modeled the different event types as competing risks. The competing risks procedure, however, decreased the number of events in each model and hence suffered from low statistical power. Therefore, in models not presented here, I also assessed whether the type-specific hazard functions are the same for all event types by coding time-invariant proportionality dummies for each event type, which I then interacted with each predictor to detect any differences in a variable's effect across the different event types (Allison, 1995).

Interestingly, none of the interactions were significant except for two: the dummy variable that indicated that a JV was sold to one of its parent-firms positively moderated the impact that mimetic pressures at birth and parent-firms' compatibility had on a JV's likelihood of termination. The first interaction suggests that while a JV that is formed in response to bandwagon pressures is generally more likely to terminate, it is especially likely to cease through an acquisition by one of its parents. The second interaction indicates that in comparison to a JV that is formed by parents from different industries, a JV that is formed by two firms from the same industry is less likely to be sold to an outsider or liquidated but is more likely to be acquired by one of its parents. A post-hoc F-test, which examined whether the sum of the coefficients for parent-firms' compatibility and the one for its interaction with the dummy variable is larger than 1 confirmed this interpretation. Possible explanations for these findings are proposed in the discussion section.

Results for several of the control variables provide further insights on JVs performance and longevity. For instance, drawing on the idea that experience with JVs may help parents develop a capability to select better partners and successfully manage shared ventures (Simonin, 1997), JV-experience was expected to decrease JVs' likelihood of termination. Yet, the impact of the number of JVs created by a parent-firm in the year prior on the termination of the JV is positive. This raises an interesting possibility. Survey-based studies have found a positive relationship between a firm's experience with JVs and its JV's financial profitability (Delios and Beamish, 2001), its own financial profitability (Simonin, 1997), and its overall satisfaction with its partners

(Nijssen et al, 1997). Yet, if firms that form more JVs are also more likely to terminate them, as model 9 suggests, the positive relationship previously found between experience and performance might not result from a learning process, in which firms develop a capability to select better partners and successfully manage their ventures, but rather from a selection process, in which firms that create more JVs also terminate them more quickly, retaining only the successful ones. Given that the studies cited above surveyed only existing ventures, these two competing explanations could not be untangled, as they are here. This calls for future studies that test these seemingly contradictory explanations.

To avoid possible selection biases in this study, I used Heckman selection models. As explained in the methods section, the Heckman model is essentially a two-stage procedure that first estimated a JV's likelihood of formation and then incorporated this estimate in a second-stage model to estimate the JV's likelihood of termination. As model 9 indicates, the impact of this estimate is positive and significant. This further supports this study's main premise: The JVs' that are most likely to be formed are also the ones that are most likely to terminate. Furthermore, the result involving the Heckman instrument suggests that this is a rather general phenomena, not one that is limited to effects produced by age, size, and prior success.

A final interesting result is the negative relationship between JV popularity and termination. Whereas JVs formed during times in which JVs are popular appear to be weak and are thus, individually, at a higher risk of termination, as long as JVs remain popular, firms are less likely to terminate their existing JVs. These offsetting effects

suggest that mimetic pressures not only influence executives' decisions to form JVs, but also their decisions to terminate them.

Chapter VI – Discussion and Avenues for Future Research

A popular belief in both academic and business quarters is that a JV is an inherently unstable organizational form, and a large volume of research has sought to explain why (Blodgett, 1992; Parkhe, 1993; Inkpen and Beamish, 1997; Park and Ungson, 1997; Kogut, 1989). The findings of this study start to throw this premise into doubt: Whereas the results of the formation model show that the likelihood that two firms will form a JV increases with each firm's size and with the aggregate number of JVs created in technology intensive industries in the prior year, the termination model indicates that increases in these variables also increase the JV's likelihood of failure. Apparently, by analyzing a JV's performance without considering its likelihood of being formed in the first place, prior research has glossed over the possibility that the high failure rate of JVs occurs because, paradoxically, the JVs that are more likely to be formed are also the ones that are more likely to fail. Conversely, this suggests that less popular or less salient partners may offer the greatest benefits over time. The results of this study substantiate this possibility and therefore undermine the belief that JVs are inherently unstable, suggesting instead that the high failure rate of JVs is the outcome of a selection process in which out of all possible JVs, the ones that managers tend to favor are also the ones that are especially likely to perish.

These findings draw attention to sample selection issues in alliance research in general, raising the possibility that prior estimates of factors that affect the performance of alliances may be biased. An example that illustrates this possibility is provided in Table 6. Model 15 includes the same variables as model 9 in Table 4 but the Heckman

instrument is excluded, so the possibility of a sample selection bias is not controlled for. Model 15 indicates that Equity sharing is positive and significant. This finding is consistent with several studies that found similar results and have accordingly concluded that 50%-50% shared-management arrangements have a greater chance for long life than dominant-partner JVs (e.g. Blodgett, 1992). However, when the Heckman instrument is included in Model 16 (Model 16 is identical to Model 9 in Table 4), Equity sharing becomes statistically insignificant, suggesting that prior studies may have reached misleading or incorrect conclusions regarding ownership.

The results of this study also underscore the need to further explore how mimetic pressures affect JVs performance and longevity. A prevalent theme in the literature is that JVs have the potential to create economic value, but this value is often unrealized (Anand and Khanna, 2000). Yet if firms form JVs in response to mimetic pressures rather than strategic considerations specific to their situations, it is not surprising that their economic payoffs are meager. If JVs are formed to signal a firm's conformity with prevailing norms in its environment, then a JV's utility might be better captured by its effect on perceived legitimacy than on profitability.

Overall, results strongly support the JV paradox hypothesized in this study, yet several specific predictions were not supported. Age affected neither a firm's likelihood of forming a JV nor the JV's likelihood of failure as predicted by hypotheses 1b and 3b. One potential reason for these null results may be that in technology intensive industries, the rapidity with which technology develops decreases the relevancy of a firm's age as a proxy for its underlying resources. Hence age does not bear as much weight in a firm's

selection of partners as other organizational characteristics like size and technological performance. Indeed, some of the most prominent technology intensive firms such as Microsoft, Chiron, and Lucent Technologies are all relatively young companies, but nonetheless are likely to appear to offer potential partners valuable resources, to be easily recognized, and to have a sufficient track record by which they can be evaluated. These conditions are all likely to increase these firms' attractiveness to potential partners despite their young age.

None of the interactions hypothesized in this study were significant. It was hypothesized that size, age, and prior success render a firm more attractive, and that since firms seek partners that are as attractive as they are, the likelihood of two firms forming a JV is not only a function of each of the firms' attributes, but also of the relationship between their attributes. This in turn, would lead to combinations of larger, older and more successful parents, in which neither partner was particularly likely to change. Accordingly, it was predicted that the interaction between two firms' sizes, ages, and level of prior success would have a positive impact (1) on their likelihood of forming a JV, and subsequently (2) on the JV's likelihood of failure. Neither one of these predictions was supported by the data. One possible explanation for these null results may be that although firms always seek attractive partners (i.e. everyone wants to partner with large firms), it is sufficient for one firm to be attractive (i.e. large) for a partnership to emerge, because that will create many suitors, and if enough firms express interest, the firm being wooed will probably partner with someone. If both firms are attractive (i.e., large), that further increases the likelihood of formation, but only in an additive way,

because firms do not show strong preferences to ally exclusively with others that are much like them.

Like all research, this study has its limitations. First, I argued that the paradox, in which the JVs that are especially likely to be formed are also the ones that are most likely to fail, occurs because certain factors, such as a JV's parent-firms' size increase the JV's perceived attractiveness yet also decrease its flexibility. Larger, firms, I argued, are more likely to form JVs because they are seen as offering potential partners access to valuable resources. Yet larger firms also tend to be inertial, which hinders their ability to transfer resources to the JV. In this study, I was unable to directly observe resource transfers between parents and JVs. Therefore, I had to work with the premise that because size increases organizational inertia (Hannan and Freeman, 1984, 1989; Gresov, et al., 1993; Greve, 1998), it also proxies how much difficulty a firm has in adapting to its JV partner and the new organization they have formed. Future research should therefore utilize finer-grained data to examine resource transfers more directly. For example, it has been argued that since human capital is the key producer and accumulator of knowledge within the firm (Farjoun, 1994; Chang, 1996), the replication and transfer of resources are often impossible absent the transfer of people (Teece, 1998). On one hand, a significant transfer of people may assure the transfer of parental resources to the JV. Yet on the other hand, the transfer of too many people may prove harmful since a large, cohesive group is likely to impose parental policies and routines even when other actions may better fit the JV's environment. Future research should therefore examine how the transfer of people from parents to a JV affects the JV's performance, and more specifically whether

personnel transfers mediate or moderate the effects of the inertial factors discussed in this study (i.e., age, size, and prior success).

Regarding a second limitation, while I restricted my theoretical focus to age, size, prior success, and mimetic pressures, other factors might also be fruitfully examined. For example, it has been argued that over time a firm's alliances accumulate into an information exchange network that enables it to learn about new alliance opportunities, thus increasing its likelihood of entering new ones (Kogut et al. 1992; Gulati, 1995b, 1999; Powell et al. 1996; Ahuja, 2000). Under certain circumstances, though, a network of alliances can actually disable the creation of new alliances or even goad a firm into alliances that are not necessarily the best available options. For instance, since there is a natural limit to the time and effort that any firm can devote to managing its alliances, highly embedded firms may be reluctant to form additional alliances (Granovetter, 1985; Uzzi, 1996, 1997). Dense networks can also exert social pressures that may lock the firm into unproductive relationships or preclude partnering with other viable firms (Gulati, Nohria, Zaheer, 2000; Gargiulo and Benassi, 2000). While the impact of a firm's network on its cooperative behavior has been investigated, to my knowledge, how the quality or structure of a firm's network affects the performance of its alliances has yet to be tested in a large-sample empirical study. The two-stage model developed here could be used to that end. Future research should therefore examine how different network characteristics (i.e. density, diversity, size) affect a firm's proclivity to form alliances in the first stage, and how they affect the performance of those alliances in the second.

Third, this study has focused on technology intensive industries where the range of technical know-how and scientific skills needed to stay abreast of rapidly changing developments exceeds the capabilities of even the largest and most successful firms, which makes such firms prime candidates for interfirm collaboration (Hagedoorn, 1993; Powell et al., 1996). In more stable and mature industries, however, larger and more successful firms may have neither the motivation nor the need to share their capabilities with others, since they are likely to have sufficient time and resources to internally develop the capabilities necessary for success. Hence, both the factors affecting a firm's likelihood of forming a JV and the factors affecting JV performance may vary with industry stability. If, for example, size decreases the proclivity to joint venture among firms in more stable settings, then the firms that were more likely to joint venture would be smaller and less inertial. Assuming that inertia impairs a firm's ability to successfully joint venture, the JVs that are more likely to be established in stable environments may actually be the ones that are the more likely to succeed. Therefore, the ideas developed here should be tested in more stable and less technology intensive industries.

Similarly, this study is based on the assumptions that (1) firms form JVs to access, through their partner, technological capabilities that are otherwise difficult to imitate, license, or transfer, and (2) managers have reason to believe that older, larger and more successful partners can offer them such resources. While these premises have been corroborated in high-tech sectors, it has been shown that the sharing of technological capabilities is not a dominant feature of partnering in medium and low-tech sectors, where market access and market power prevail as objectives (Hagedoorn, 1993). Since a

firm's ability to exert market power is a function of its size (Scherer and Ross, 1990), larger parents might actually be an advantage in low-tech industries, which further emphasizes the need to replicate this study's model in other settings.

Interfirm alliances also span a wide spectrum of forms that range from licensing and franchising via equity swaps and JVs, all the way to mergers and acquisitions (Shan, 1990; Gulati, 1998: Powell, 1990). These various forms of alliances differ in the amount and range of resources that need to be transferred and synthesized. For example, associations for certification or political representation do not require the same degree of resource transfer, synthesis, and flexibility as an acquisition of a JV. Hence, age, size, and prior success are likely to have different effects across various forms of alliances. This calls for additional research that will examine the effects of these and other factors on (1) a firm's propensity to form alliances, and (2) alliance performance across different forms of cooperation.

Finally, as explained in detail in chapter 2, although numerous measures of JV performance have been used in prior research, including both objective (termination, financial gains, and so forth) and subjective measures (goal attainment, satisfaction, etc.), data limitations restricted my focus to the dissolution of JVs. Nevertheless, given the numerous purposes JVs serve and the definitions of JV performance they imply, future research should test this study's model using alternative measures of success. One reason why this is important is that larger firms may have systematically higher aspiration levels than smaller firms, and thus, are more likely to terminate or sell off their JVs (Greve 1998, 2002; Gimeno, Folta, Cooper, and Woo, 1997). If this is in fact the case, the higher

failure rates of JVs created by larger parents may also result from higher aspiration levels and not only from parents' failure to transfer and synthesize their resources.

As these calls for future research indicate, it is vital to distinguish between factors that make a partner appear attractive and whether those factors enhance or impede the flexibility that interorganizational alliances demand. The results of this study, however, have theoretical implications beyond the study of alliances. There is a considerable body of organizational literature dealing with different sorts of path dependencies that managers have little control over. Organizational learning theorists, for example, have argued that over time, as organizations refine their routines and their returns become more certain, organizations are less inclined to modify them (Levitt and March, 1988; March, 1991). Organizational ecologists have advanced the idea that firms are highly inertial and hence over time tend to become increasingly misaligned with their environments (Ingram, 1993; Barron, West, and Hannan, 1994; Henderson, 1999). In light of such dependencies, JVs have been argued to be a way through which established firm can, at least potentially, overcome some inertia (e.g. Zajac et al., 1991; Rothaermel, 2001). Yet this study suggests that executives' decisions are influenced by inertial forces even as they attempt to radically change their firms' evolutionary trajectories by forming JVs. Apparently, executives cannot readily intervene to overcome bureaucratic inertia as been suggested by several scholars (Mintzberg, 1978; Tushman and Romanelli, 1985). This idea is pertinent to numerous other, seemingly radical, moves in which executives attempt to change their firms' trajectories, such as mergers and equations and corporate diversification. Future research should therefore examine if such moves are subject to

inertial forces and paradoxical outcomes similar to the ones revealed in this study. Such examinations are likely to enhance our understanding of organizational evolution, strategic change, mergers and equations, and corporate diversification.

Figures and Tables

Figure 1: Hypothesized Relationships Between a JV's Parents Characteristics and JV Formation

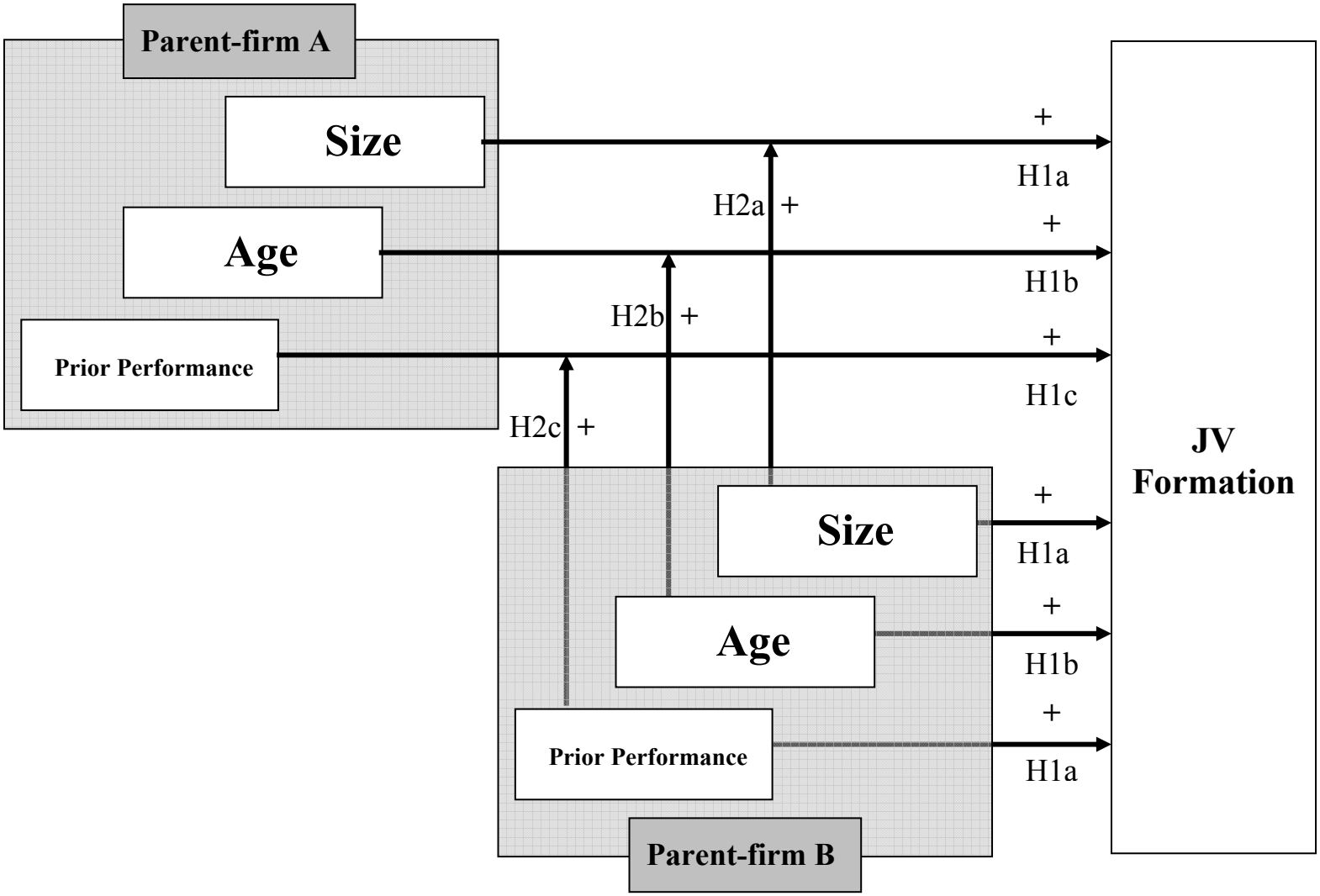

Figure 2: Hypothesized Relationships between a JV's Parents Characteristics and JV Failure Rate

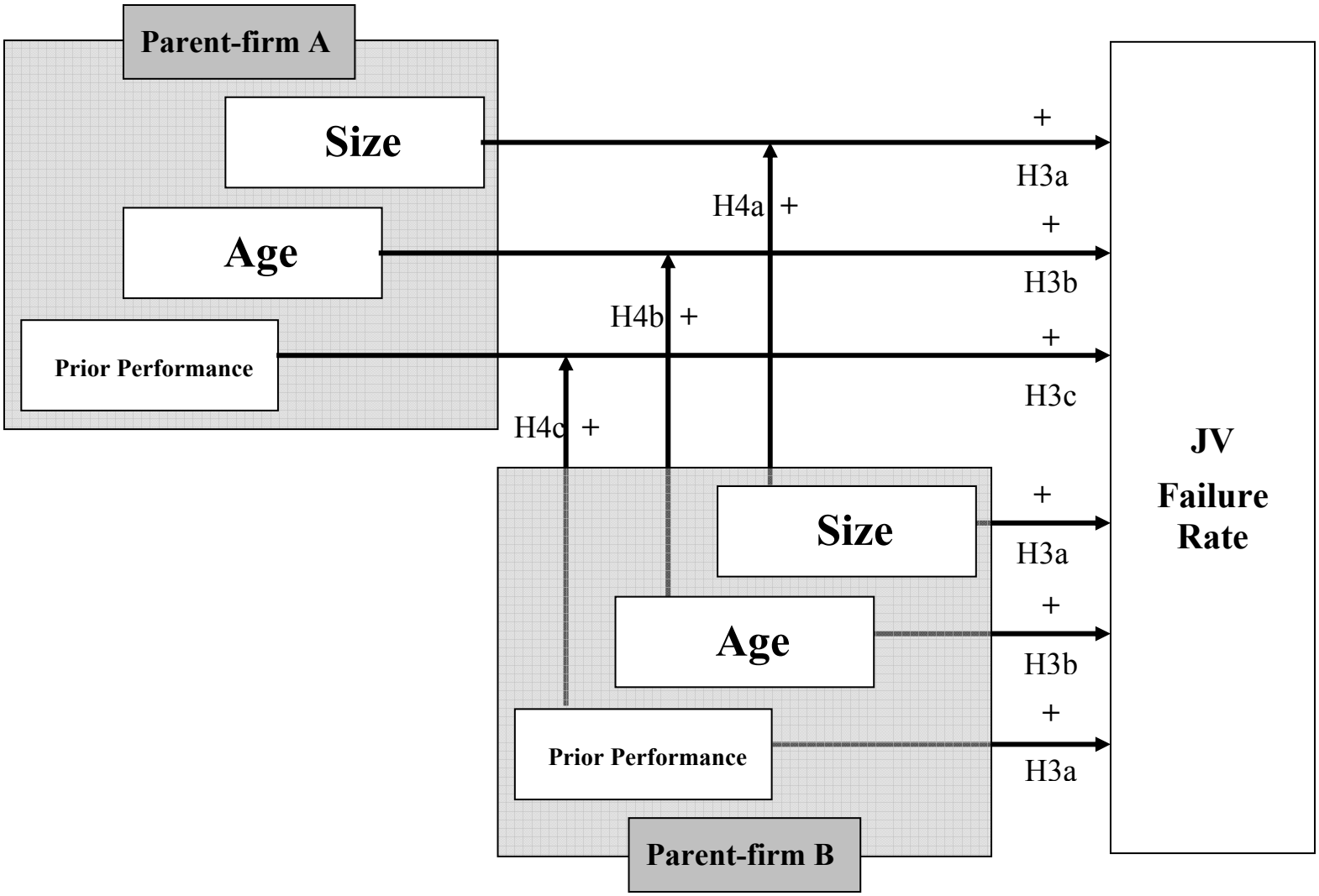

Figure 3: Hypothesized Interaction Effects of a Focal Firm's Size, the Potential Partner's Size, and the Likelihood of the Two Firms Forming a JV

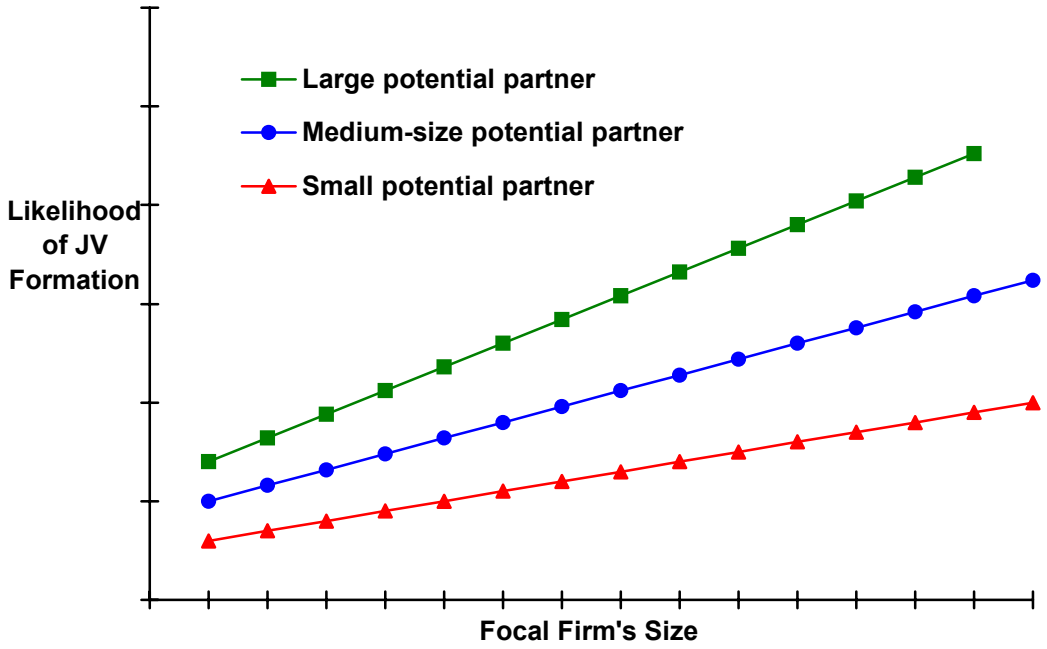

Figure 4: Hypothesized Interaction Effects of a Focal Firm's Size, the Potential Partner's Size, and the Likelihood of JV Failure

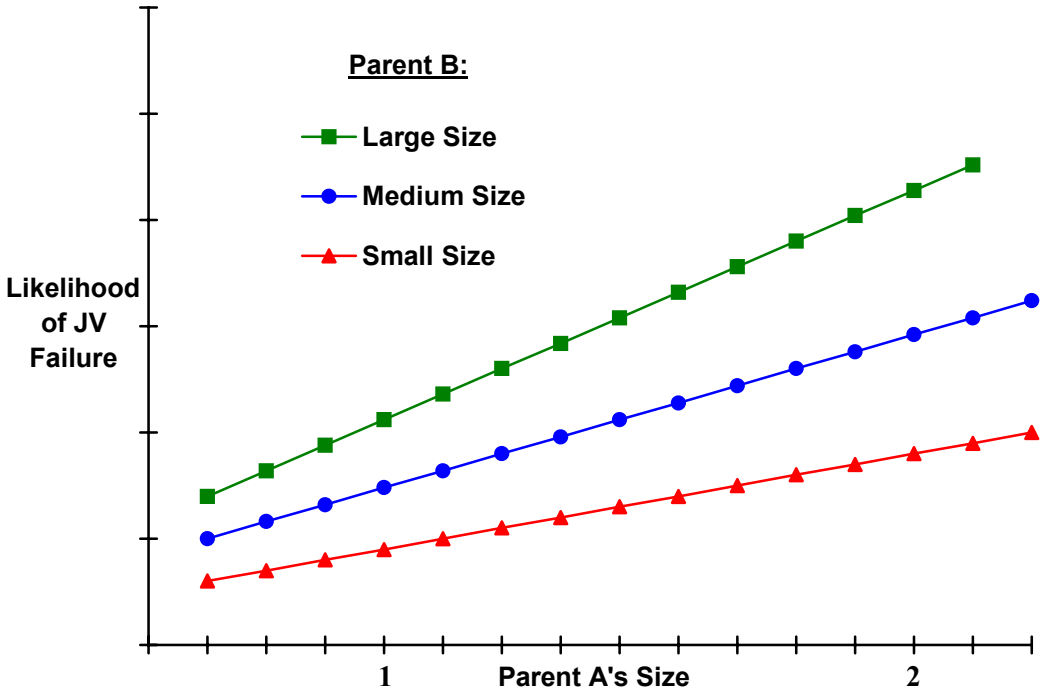

Figure 5: Overall Effects of a JV's Parent-firms' Characteristics, Institutional Pressures, and JV Formation on JV Performance

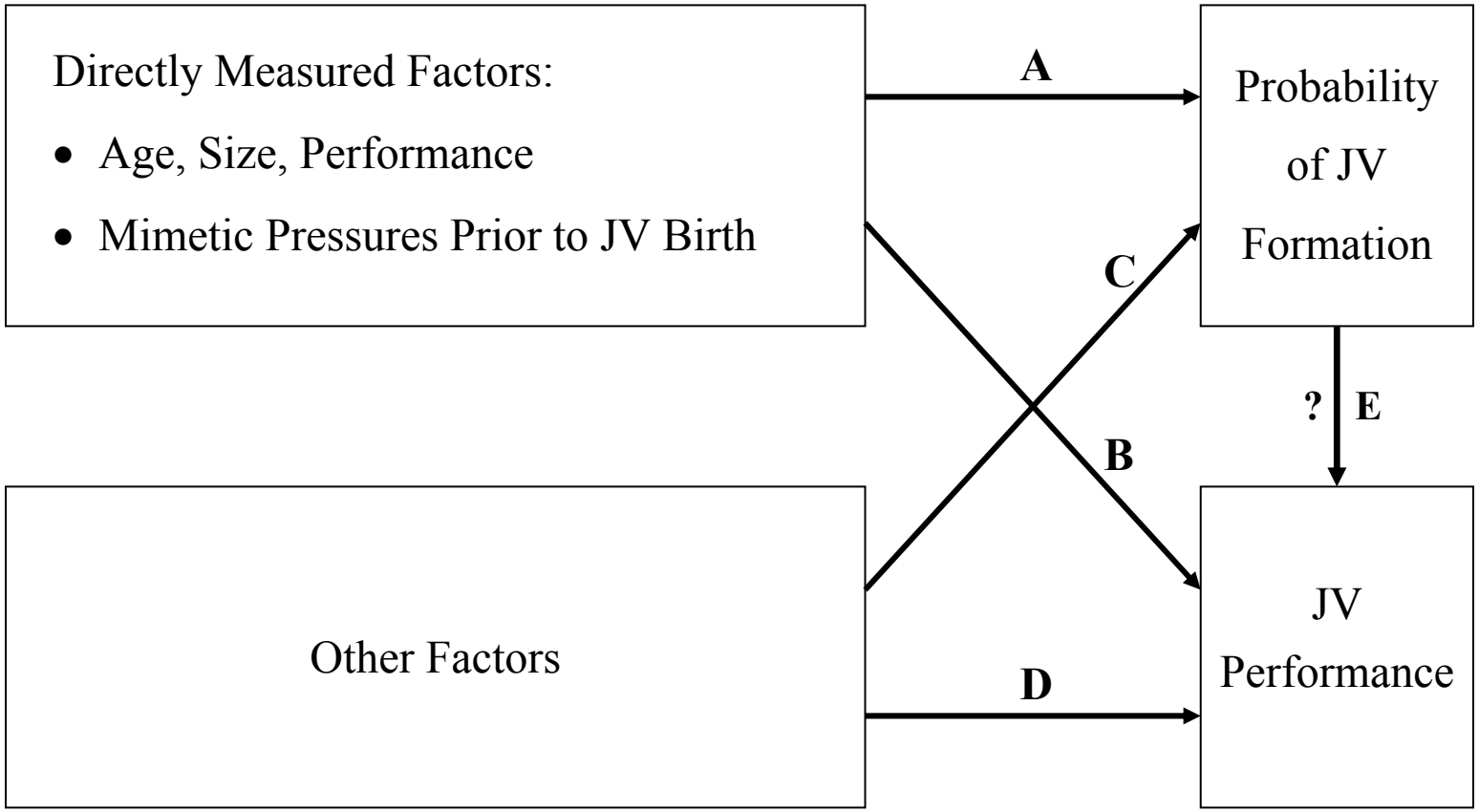

Table 1: Means, Standard Deviations, and Correlations of Key Variables – Formation Model (N = 583 JVs)

Variable	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Formed	0.48	0.50															
2. Size parent1	1.75	1.84	0.53														
3. Size parent2	1.79	1.81	0.62	0.43													
4. Age parent1	45.29	119.0	0.04	0.17	0.01												
5. Age parent2	48.00	120.6	0.05	0.03	0.14	-0.01											
6. Financial perf. parent1	20.08	70.65	0.10	0.11	0.07	0.03	0.02										
7. Financial perf. parent2	18.52	135.9	0.20	0.21	0.25	0.05	0.04	0.11									
8. Technological perf. parent1	1.57	2.12	0.52	0.57	0.60	0.07	0.08	0.08	0.27								
9. Technological perf. parent2	1.47	2.15	0.57	0.58	0.54	0.07	0.07	0.07	0.17	0.38							
10. Social Cues at birth	6.25	0.77	0.13	0.03	0.05	0.06	0.02	-0.03	-0.04	0.03	0.09						
11. JV-experience parent1	0.90	1.33	0.55	0.53	0.55	0.05	0.07	0.15	0.15	0.53	0.52	0.21					
12. JV-experience parent2	1.02	1.45	0.58	0.55	0.57	0.09	0.08	0.16	0.34	0.49	0.53	0.20	0.46				
13. Parent-firms' compatibility	0.11	0.32	0.24	-0.03	0.03	-0.03	-0.02	0.03	0.05	0.01	0.02	0.08	0.06	0.04			
14. Parent-firms' attachment	0.08	0.28	0.32	0.30	0.30	0.03	0.03	-0.03	0.17	0.31	0.25	0.14	0.34	0.38	0.14		
15. Formed between 90 and 93	0.31	0.46	0.15	0.16	0.09	-0.01	0.03	-0.06	-0.07	0.08	0.11	0.22	0.08	0.04	0.04	0.05	
16. Formed between 94 and 01	0.52	0.49	-0.07	-0.13	-0.08	0.04	-0.00	0.05	0.05	-0.07	-0.06	0.46	0.06	0.10	0.03	0.02	-0.70

Table 2: Means, Standard Deviations, and Correlations of Key Variables – Termination Model (N = 973 JV-years)

Variable	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1. Terminated	0.13	0.33																								
2. Size parent1 at birth	2.78	1.85	-.08																							
3. Size parent2 at birth	2.76	1.81	-.03	.15																						
4. Age parent1 at birth	55.42	39.68	-.08	.35	.39																					
5. Age parent2 at birth	52.15	39.53	-.07	.40	.34	.04																				
6. Financial perf. p.1 at birth	34.77	97.19	-.01	.27	.24	.22	.22																			
7. Financial perf. p.2 at birth	60.92	98.63	-.07	.40	.33	.26	.30	.13																		
8. Tech. perf. p.1 at birth	1.14	2.32	-.05	.44	.35	.36	.32	.24	.25																	
9. Tech. perf. p.2 at birth	1.31	2.39	-.07	.45	.46	.33	.36	.25	.34	.11																
10. Social Cues at birth	6.15	0.90	.10	-.19	-.23	-.17	-.07	-.09	-.14	-.16	-.17															
11. Sales parent 1	7.41	2.75	-.07	.48	.48	.35	.35	.21	.35	.32	.39	-.08														
12. Sales parent 2	7.26	2.77	-.06	.47	.50	.33	.37	.25	.31	.31	.38	-.13	.22													
13. Change in sales parent 1	0.09	1.30	-.07	-.08	-.01	-.02	-.04	-.07	.01	-.04	-.02	-.07	-.15	-.23												
14. Change in sales parent 2	0.14	1.47	-.11	-.01	-.00	-.03	-.03	.02	-.02	.02	-.04	-.06	-.23	-.17	.21											
15. JV-experience parent1	5.72	14.18	.04	.21	.16	.15	.17	.20	.20	.26	.09	.02	.19	.20	.03	-.05										
16 JV-experience parent2	4.71	8.70	.02	.28	.29	.20	.21	.21	.33	.09	.40	.01	.28	.27	-.02	.02	.15									
17. Parents' compatibility	0.24	0.43	-.03	-.14	-.15	-.11	-.04	.05	-.13	-.09	-.08	.15	-.15	-.13	-.02	-.04	.00	-.01								
18. Operational overlap	0.60	0.49	-.06	.06	-.01	.06	.04	.09	.14	.20	.15	-.09	.03	-.03	.06	.01	-.03	.04	.19							
19. Parents' attachment	0.15	0.36	.01	.13	.17	.02	.11	.13	.02	.07	.10	.06	.12	.14	-.01	-.00	.14	.20	.12	.05						
20. Equity sharing	0.12	0.33	.05	-.09	-.08	-.11	-.05	-.01	.01	-.11	-.14	.04	-.04	-.05	-.04	-.01	-.07	-.05	-.03	-.08	.02					
21. JV popularity	6.37	0.58	.01	-.03	-.02	-.02	-.02	.00	-.04	-.02	-.01	.34	.03	.01	-.12	-.08	.05	.10	.08	.00	.07	.01				
22. JV age	4.19	3.06	.04	.10	.16	.10	.11	.02	.06	.07	.12	-.37	.16	.20	-.12	-.01	.00	.03	-.01	.08	-.04	-.15	.01			
23. Terminated in 1994	0.08	0.27	.08	.01	-.02	.00	-.03	-.02	-.04	-.01	-.01	.02	-.04	-.02	-.02	-.00	-.00	.02	.00	.02	.01	.02	.35	-.02		
24. Terminated in 1999	0.09	0.29	.13	.00	-.07	-.02	-.02	-.01	-.01	-.02	-.03	.10	-.01	.00	.02	.01	.01	-.04	.00	-.04	-.01	-.00	-.10	.12	-.09	
25. Prob. of formation	0.79	0.31	-.01	.42	.37	.31	.35	.17	.29	.43	.48	.08	.38	.38	-.08	-.08	.19	.26	.12	.03	.29	.01	.06	-.05	-.10	.01

Table 3: Discrete-Time Event History Analyses of JV Formation Rates*

Predictor variable	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
Size parent 1 (log # of employees)		0.456 ••• (0.102)	0.463 ••• (0.101)	0.454 ••• (0.102)	0.451 ••• (0.102)	0.457 ••• (0.103)	0.465 ••• (0.102)
Size parent 2 (log # of employees)		0.208 • (0.098)	0.225 • (0.098)	0.206 • (0.099)	0.204 • (0.098)	0.206 • (0.100)	0.228 • (0.101)
Age parent 1		-0.009 (0.005)	-0.010 (0.005)	-0.010 (0.005)	-0.010 (0.005)	-0.010 (0.005)	-0.010 (0.005)
Age parent 2		-0.000 (0.002)	-0.000 (0.002)	-0.000 (0.003)	-0.000 (0.002)	-0.000 (0.002)	-0.000 (0.003)
Financial perf. parent 1 (ROA)		-0.003 (0.004)	-0.002 (0.004)	-0.003 (0.004)	-0.004 (0.004)	-0.003 (0.004)	-0.001 (0.004)
Financial perf. parent 2 (ROA)		-0.003 (0.002)	-0.002 (0.002)	-0.003 (0.002)	-0.004 (0.002)	-0.004 (0.002)	-0.003 (0.003)
Technological perf. parent 1		0.201 •• (0.072)	0.152 •• (0.074)	0.202 •• (0.073)	0.206 •• (0.073)	0.248 •• (0.093)	0.207 •• (0.093)
Technological perf. parent 2		0.420 ••• (0.087)	0.387 ••• (0.086)	0.419 ••• (0.088)	0.425 ••• (0.088)	0.467 ••• (0.107)	0.452 ••• (0.108)
Institutional pressures at birth		1.011 •• (0.373)	1.035 •• (0.372)	1.014 •• (0.375)	1.011 •• (0.374)	0.988 •• (0.374)	1.019 •• (0.376)
Size parent 1 x size parent 2			-0.066 (0.046)				-0.101 (0.052)
Age parent 1 x age parent 2				-0.000 (0.000)			0.000 (0.000)
Financial perf. parent 1 x financial perf. parent 2					0.000 (0.000)		0.000 (0.000)
Technological perf. parent 1 x technological perf. parent 2						0.060 (0.069)	0.093 (0.071)
JV-experience parent 1	0.870 ••• (0.102)	0.424 •• (0.144)	0.450 •• (0.146)	0.425 •• (0.144)	0.424 •• (0.144)	0.403 •• (0.147)	0.433 •• (0.150)
JV-experience parent 2	0.894 ••• (0.106)	0.605 ••• (0.131)	0.589 ••• (0.131)	0.605 ••• (0.132)	0.616 ••• (0.134)	0.631 ••• (0.135)	0.643 ••• (0.135)
Parent-firms' compatibility	1.699 ••• (0.250)	2.134 ••• (0.313)	2.245 ••• (0.329)	2.137 ••• (0.314)	2.131 ••• (0.312)	2.131 ••• (0.313)	2.275 ••• (0.332)
Parent-firms' attachment	5.167 (62.116)	4.508 (259.1)	4.816 (265.8)	4.511 (249.1)	4.488 (344.1)	4.673 (252.5)	4.989 (253.1)
Formed between 90 and 93	-0.203 (0.249)	-1.837 • (0.749)	-1.862 • (0.741)	-1.844 • (0.754)	-1.834 • (0.750)	-1.774 • (0.755)	-1.743 (0.751)
Formed between 94 and 2001	-0.860 ••• (0.254)	-2.397 •• (0.810)	-2.389 •• (0.804)	-2.406 •• (0.818)	-2.394 •• (0.811)	-2.358 •• (0.814)	-2.295 •• (0.817)
-2 * Log-likelihood	374.42•••	283.00•••	280.80•••	282.99•••	282.81•••	282.05•••	277.89•••
Δ Fit from prior model (χ^2)**	n.a.	91.428•••	2.2	0.005	0.181	0.944	4.191

• $p < .05$; •• $p < .01$; ••• $p < .001$; two tailed tests.

* N = 583 JVs with 278 formation events. ** For models 3-7: Δ Fit from model 2 ($\chi 2$)

Table 4: Discrete-Time Event History Analyses of JV Failure Rates*

Predictor variable	Model (8)	Model (9)	Model (10)	Model (11)	Model (12)	Model (13)	Model (14)
Size parent 1 at birth		0.183 * (0.089)	0.207 (0.117)	0.183 * (0.089)	0.183 * (0.089)	0.181 * (0.090)	0.303 * (0.140)
Size parent 2 at birth		0.320 *** (0.087)	0.344 ** (0.114)	0.321 *** (0.087)	0.321 *** (0.087)	0.318 *** (0.088)	0.433 ** (0.135)
Age parent 1 at birth		-0.005 (0.003)	-0.005 (0.003)	-0.004 (0.004)	-0.004 (0.004)	-0.005 (0.003)	-0.005 (0.005)
Age parent 2 at birth		-0.004 (0.003)	-0.004 (0.003)	-0.004 (0.005)	-0.004 (0.005)	-0.005 (0.003)	-0.004 (0.005)
Financial perf. parent 1 at birth		0.000 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
Financial perf. parent 2 at birth		-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)
Technological perf. parent 1 at birth		-0.050 (0.057)	-0.050 (0.057)	-0.045 (0.057)	-0.045 (0.057)	-0.100 (0.077)	-0.157 (0.087)
Technological perf. parent 2 at birth		-0.084 (0.058)	-0.082 (0.058)	-0.083 (0.058)	-0.081 (0.058)	-0.139 (0.077)	-0.190 * (0.085)
Institutional pressures at birth		0.434 ** (0.148)	0.437 ** (0.148)	0.435 ** (0.148)	0.427 ** (0.148)	0.414 ** (0.149)	0.403 ** (0.150)
Size parent 1 x size parent 2			-0.008 (0.027)				-0.043 (0.040)
Age parent 1 x age parent 2				-0.000 (0.000)			-0.000 (0.000)
Financial performance parent 1 x financial performance parent 2					-0.000 (0.000)		-0.000 (0.000)
Technological performance parent 1 x technological performance parent 2						0.019 (0.018)	0.042 (0.025)
Slack resources parent 1	-0.188 *** (0.039)	-0.255 *** (0.052)	-0.256 *** (0.052)	-0.256 *** (0.052)	-0.254 *** (0.052)	-0.256 *** (0.053)	-0.265 *** (0.053)
Slack resources parent 2	-0.204 *** (0.038)	-0.267 *** (0.050)	-0.268 *** (0.050)	-0.267 *** (0.049)	-0.266 *** (0.049)	-0.267 *** (0.049)	-0.275 *** (0.049)
Change in slack resources parent 1	-0.196 *** (0.056)	-0.177 *** (0.054)	-0.177 *** (0.054)	-0.177 *** (0.054)	-0.178 *** (0.054)	-0.175 *** (0.054)	-0.177 ** (0.054)
Change in slack resources parent 2	-0.253 *** (0.056)	-0.266 *** (0.053)	-0.267 *** (0.053)	-0.266 *** (0.053)	-0.267 *** (0.054)	-0.263 *** (0.053)	-0.268 *** (0.054)
JV-experience parent 1	0.012 ** (0.004)	0.014 ** (0.005)	0.014 ** (0.005)	0.014 ** (0.005)	0.014 ** 0.005)	0.014 ** (0.005)	0.014 ** (0.005)
JV-experience parent 2	0.029 *** (0.008)	0.031 *** (0.009)	0.031 *** (0.009)	0.031 *** (0.009)	0.031 *** (0.010)	0.031 *** (0.009)	0.031 *** (0.009)
Parent-firms' compatibility	-0.825 ** (0.261)	-0.981*** (0.270)	-0.957 *** (0.281)	-0.975 *** (0.272)	-0.966 *** (0.273)	-1.034 *** (0.277)	-0.952 *** (0.282)
Operational overlap	-0.245 0.191	-0.061 (0.207)	-0.064 (0.207)	-0.063 (0.208)	-0.054 (0.208)	-0.027 (0.210)	0.004 (0.212)
Parent-firms' attachment	0.220 (0.259)	0.021 (0.269)	0.036 (0.272)	0.023 (0.269)	0.029 (0.270)	-0.019 (0.272)	0.029 (0.275)
Equity sharing	0.354 (0.250)	0.389 (0.268)	0.385 (0.268)	0.393 (0.269)	0.391 (0.268)	0.345 (0.273)	0.283 (0.278)
JV popularity	-0.245 (0.201)	-0.436 * (0.223)	-0.427 * (0.224)	-0.435 * (0.223)	-0.427 * (0.223)	-0.444 * (0.223)	-0.402 (0.224)

JV age	0.605 ••• (0.126)	0.619 ••• (0.131)	0.619 ••• (0.131)	0.619 ••• (0.131)	0.618 ••• (0.131)	0.619 ••• (0.131)	0.619••• (0.130)
JV age^2	-0.042 ••• (0.010)	-0.039 ••• (0.011)	-0.039 ••• (0.011)	-0.039 ••• (0.011)	-0.039 ••• (0.011)	-0.038 ••• (0.011)	-0.037 ••• (0.011)
Terminated in 1994	0.885 •• (0.302)	1.016 •• (0.318)	1.013 •• (0.318)	1.016 •• (0.318)	1.014 •• (0.318)	1.017 •• (0.319)	0.997 •• (0.319)
Terminated in 1999	0.962 ••• (0.239)	0.861 ••• (0.248)	0.861 ••• (0.248)	0.863 ••• (0.248)	0.862 ••• (0.248)	0.858 ••• (0.248)	0.854 ••• (0.249)
Probability of formation	0.815 • (0.361)	1.049 • (0.437)	1.021 • (0.447)	1.038 • (0.441)	1.020 • (0.443)	1.232 • (0.471)	1.246 •• (0.474)
-2 * Log-likelihood	648.792•••	623.375•••	623.282•••	623.347•••	623.185•••	622.306•••	620.271•••
Δ Fit from prior model (χ^2) **	n.a.	25.417••	0.093	0.028	0.19	1.069	3.104

• $p < .05$; •• $p < .01$; ••• $p < .001$; two tailed tests.

* N = 973 JV-years with 128 termination events. ** For models 10-14: Δ Fit from model 9 (χ^2)

Table 5: A JV's Likelihood of Formation and Termination as a Function of its Parent-Firms' Sizes at Birth

Parent-firm size at birth	Likelihood of formation	Likelihood of termination
Small (Mean - S.D.)	0.35	0.44
Average (Mean)	0.64	0.55
Large (Mean + S.D.)	0.90	0.68

Table 6: Discrete-Time Event History Analyses of JV Failure Rates (with and without the Heckman procedure) *

Predictor variable	Model (15)	Model (16)
Size parent 1 at birth	0.184 • (0.089)	0.183 • (0.089)
Size parent 2 at birth	0.312 ••• (0.088)	0.320 ••• (0.087)
Age parent 1 at birth	-0.004 (0.003)	-0.005 (0.003)
Age parent 2 at birth	-0.004 (0.003)	-0.004 (0.003)
Financial perf. parent 1 at birth	0.001 (0.001)	0.000 (0.001)
Financial perf. parent 2 at birth	-0.001 (0.001)	-0.001 (0.001)
Technological perf. parent 1 at birth	0.010 (0.053)	-0.050 (0.057)
Technological perf. parent 2 at birth	-0.027 (0.053)	-0.084 (0.058)
Institutional pressures at birth	0.510 ••• (0.144)	0.434 •• (0.148)
Slack resources parent 1	-0.242 ••• (0.052)	-0.255 ••• (0.052)
Slack resources parent 2	-0.251 ••• (0.049)	-0.267 ••• (0.050)
Change in slack resources parent 1	-0.184 ••• (0.054)	-0.177 ••• (0.054)
Change in slack resources parent 2	-0.268 ••• (0.053)	-0.266 ••• (0.053)
JV-experience parent 1	0.014 •• (0.005)	0.014 •• (0.005)
JV-experience parent 2	0.030 ••• (0.009)	0.031 ••• (0.009)
Parent-firms' compatibility	-0.810 •• (0.256)	-0.981••• (0.270)
Operational overlap	-0.127 (0.204)	-0.061 (0.207)
Parent-firms' attachment	0.210 (0.256)	0.021 (0.269)
Equity sharing	0.564 • (0.256)	0.389 (0.268)
JV popularity	-0.437 •• (0.220)	-0.436 • (0.223)
JV age	0.594 ••• (0.129)	0.619 ••• (0.131)

JV age^2	-0.037 $^{\cdot\cdot\cdot}$ (0.011)	-0.039 $^{\cdot\cdot\cdot}$ (0.011)
Terminated in 1994	0.992 $^{\cdot\cdot}$ (0.316)	1.016 $^{\cdot\cdot}$ (0.318)
Terminated in 1999	0.861$^{\cdot\cdot\cdot}$ (0.248)	0.861 $^{\cdot\cdot\cdot}$ (0.248)
Probability of formation		1.049 $^{\cdot}$ (0.437)
-2 * Log-likelihood	629.204 $^{\cdot\cdot\cdot}$	623.375 $^{\cdot\cdot\cdot}$
Δ Fit from prior model (χ^2) **	na	5.829 $^{\cdot}$

$^{\cdot}$ $p < .05$; $^{\cdot\cdot}$ $p < .01$; $^{\cdot\cdot\cdot}$ $p < .001$; two tailed tests.

* N = 973 JV-years with 128 termination events.

Table 7: Summary of Hypotheses

H#	Independent construct	Independent variable*	Effect on JV Formation
1a	Parent-firms' sizes at birth	Logged number of employees	Positive
1b	Parent-firms' ages at birth	The difference between the current year and the parent-firm's incorporation date	Positive
1c	Parent-firms' prior performance at birth	1. Return on assets 2. Total number of patents obtained by the firms in the prior year	Positive
2a	Interaction between the parent-firms' sizes	The products of the variables used in H1a	Positive
2b	Interaction between the parent-firms' ages	The product of the variable used in H1b	Positive
2c	Interaction between the parent-firms' levels of prior performance	The products of the variables used in H1c	Positive
5a	Institutional pressures at birth	Logged number of JV created in technology intensive industries	Positive
	Independent construct	**Independent variable**	**Effect on JV Failure**
3a	Parent-firms' sizes	Logged number of employees	Positive
3b	Parent-firms' ages	The difference between the current year and the parent-firm's incorporation date	Positive
3c	Parent-firms' prior performance	1. Return on assets 2. Total number of patents obtained by the firms in the 3 prior years	Positive
4a	Interaction between the parent-firms' sizes	The products of the variables used in H3a	Positive
4b	Interaction between the parent-firms' ages	The product of the variable used in H3b	Positive
4c	Interaction between the parent-firms' levels of prior performance	The products of the variables used in H3c	Positive
5b	Institutional pressures	Logged number of JV created in technology intensive industries in the year prior to the formation of the JV	Positive

* All independent variables were measured in the year prior to the formation of the JV

Table 8: Variables and Operationalization

	Variable	Source	Operationalization
Dependent Variables	JV Formation	Securities Data Company (SDC).	1 = JV was formed 0 = otherwise
	JV failure rate	Letters sent to firms	1 = JV was terminated 0 = otherwise
Independent Variables	Parent-firm age	COMPUSTAT	The difference between the current year and parent-firm's incorporation date
	Parent-firm size	COMPUSTAT	1. Logged number of employees
	Parent-firm prior performance	COMPUSTAT	1. Return on assets 2. Total number of patents obtained by the firms in the prior year
	Institutional pressures	Securities Data Company (SDC).	Number of JV created in technology intensive industries in the year prior to the formation of the JV
Parent-firm Controls	JV experience	SDC for 1986-2001, Lexis-Nexis for prior years	Cumulative number of JVs across a firm's life (formation model) Number of JVs created in prior year (termination model)
	Dedicated alliance function	Letters sent to firms	1 = a dedicated alliance function existed, 0 = otherwise
	Interfirm network	SDC for 1986-2001, Lexis-Nexis for prior years	Net number of firms met in past alliances
	Financial motivations for joint venturing	COMPUSTAT	Debt/equity
	Slack resources	COMPUSTAT	1. Logged Sales 2. Change in sales
Dyad level Controls	Parents' compatibility	SDC	1 = parent firms' primary operations in the same 3-digit sic code, 0 = otherwise
	Operational overlap	SDC	1 = JV's 3-digit SIC code is the same as at least one of its parent firms', 0 = otherwise

	Parent-firms' attachment	SDC for 1986-2001, Lexis-Nexis for prior years	Number of prior alliances between the two firms
	Equity sharing	SDC	Absolute difference between the parents' equity shares
Industry Level Controls	R&D intensity	Schonfeld and Associates	R&D investment expressed as a percentage of net sales averaged for each industry in which a JV has been, or could have been created
	Demand Growth	Department of Commerce	Average annual growth rate of industry shipments
	Market Concentration	Census of Manufacturing	Eight-firm concentration ratio (%), as of 1997
Other Controls	JV popularity	SDC	Logged number of JV created in technology intensive industries in the current year
	Other temporal trends		A piece-wise model using several dummies to capture the net effect of time varying macro-economic factors

Table 9: Technology-Intensive Industries and Their SIC Codes

SIC	Industry
281,6	Industrial chemicals
282	Plastic materials and synthetics
283	Drugs
284	Soaps, cleaners, and toilet goods
285	Paint and allied products
287	Agricultural chemicals
289	Miscellaneous chemical products
291	Petroleum refining
348	Ordnance and accessories, n.e.c
351	Engines and turbines
353	Construction and related machinery
355	Special industry machinery
356	General industrial machinery
357	Computer and office equipment
361	Electric distribution equipment
362	Electrical industrial apparatus
365	Household audio and video equipment
366	Communication equipment
367	Electronic components and accessories
371	Motor vehicles and equipment
372,6	Aerospace
381	Search and navigation equipment
382	Measuring and controlling devices
384	Medical instruments and supplies
386	Photographic equipment and supplies

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