DETERMINANTS OF ALLIANCE LONGEVITY: AN EMPIRICAL EXAMINATION OF FACTORS FROM TRANSACTION COST ECONOMICS AND THE DYNAMIC CAPABILITIES PERSPECTIVE

by

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Abstract

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by

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Alliance longevity is an important concept because of its relevance to alliance performance. Since partnering firms are more likely to continue with a better performing alliance than a poorly performing one, scholars have treated alliance longevity as a reflector of alliance performance. However, besides its treatment as a measure of performance, longevity of alliances has not been studied as a meaningful concept by itself. It is seldom recognized that alliance longevity marks the time partnering firms have to overcome relational hurdles and attain alliance-specific goals.

In this study, I develop a model that delineates the various relationships of alliance longevity with a set of antecedent factors. A review of the pertinent literatures on transaction cost economics and dynamic capabilities yields five antecedent factors: alliance type, hierarchy of alliance structure, alliance experience with partner, asymmetry-adjusted alliance experience, and number of partners with alliance unit. The direct and moderating relationships of alliance longevity with these five factors produce eight hypotheses. Two more hypotheses are developed, treating hierarchy of alliance structure as the dependent variable.

Both tobit and Cox regression techniques are appropriate to empirically investigate the eight hypotheses pertaining to alliance longevity. Ordered logit is used to analyze the last two hypotheses predicting hierarchy of alliance structure. The statistical tests use monthly data on 546 alliances. Results support seven of the ten hypotheses advanced by this research. The theoretical development of the research model and the empirical results advance the current state of knowledge on alliance longevity.

For my siblings, Fabiha Naumi and Nafis Rahman

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Firms are now facing greater opportunities of expansion and entry to new markets than ever before. Sometimes, however, it is infeasible for a firm to consider expansion in existing markets or entry to new markets independently. Increased competition has put additional pressure on firms to collaborate with industry rivals, potential competitors, suppliers, and retailers. As a general response to these challenges, firms of all sizes and types often engage in strategic alliances.

Notwithstanding the rising interest among firms in forming alliances, many alliances die a premature death (Kanter, 1994; Park & Ungson, 2001). These alliances do not survive long enough to yield satisfactory levels of performance. Empirical evidence suggests that alliance longevity is positively correlated with subjective assessments of alliance performance (Geringer & Hebert, 1991; Glaister & Buckley, 1998). The correlation between longevity and performance has at least two distinct explanations. First, alliances attaining intermediate performance targets are given the chance to produce further results, extending the longevity and the degree of goal accomplishments. Second, alliances surviving beyond some minimum threshold get more time to adjust to the initial problems that are common in alliance-like joint endeavors. Considering the performance implications, alliance longevity is an important research topic.

In the following sections, I first state the general purpose of this study. Second, I address the broad objectives of this research. Then, I underscore the need for a study on alliance longevity. Fourth, I note the theoretical and practical contributions. Lastly, I list definitions of key terms and sketch the organization of this study.

1.2 Research Purpose

Longevity is the temporal duration of an alliance's survival period. The longer an alliance survives the greater the available time for the alliance to accomplish its goals. The concept of alliance longevity is important because it has performance implications (Barkema, Shenkar, Vermeulen, & Bell, 1997). It is generally assumed that satisfactory alliance performance is reflected in its ability to survive over time. Empirical studies have found significant correlation between alliance longevity and alliance performance (Geringer & Hebert, 1991; Glaister & Buckley, 1998). Often tangible performance takes more time to reveal itself than originally planned for. Kanter (1994) points out how pressures for quick results can lead to premature termination of very promising alliances. Thus, longevity also depends on partnering firms' appreciation of the time requirements of getting work done in collaborative projects.

The general purpose of this study is to examine and understand how alliance longevity is determined by various antecedent factors. Conditions arising from structural, market, legal, and political environments may influence alliance longevity. Notwithstanding, this research is strictly concerned with structural conditions that either hinder or foster alliance longevity. Such a focused approach is adopted for a couple of reasons. First, partnering firms are more able to control their structural conditions vis-à-vis their market, legal, or political conditions. Thus, a refined understanding of the structural determinants of alliance longevity would allow alliance managers to influence the longevity of their alliances by working on the structural conditions. Second, market, legal, or political conditions explain alliance longevity at the industry level, rather than at the alliance level. Combining these conditions with structural determinants will introduce problems associated with multiple levels of analysis.

While certain harmful conditions prevent an alliance from surviving a long time, other more favorable conditions facilitate alliance survival. For example, governance problems (e.g., opportunistic behavior) increase the probability of alliance dissolution, dwarfing alliance longevity. Transaction cost economics suggests governance mechanisms to overcome such problems (Williamson, 1991, 1996; Parkhe, 1993). Partnering firms' alliance management skills also increase the probability of longevity. The dynamic capabilities literature offers fresh insight regarding this issue (Eisenhardt & Martin, 2000; Kale, Dyer, & Singh, 2002).

For practitioners, there is an increasing pressure to figure out how to better manage alliances. Surveying the largest 1,000 companies in America, Harbison and Pekar (1998) report that alliances generate an impressive 35% of those companies' revenues. It is further projected that by 2004, alliances will account for more than 40% of the market value (i.e., $25 trillion) for approximately a quarter of all companies (Bates, 2002). Thus, stakes are high for practitioners to make their alliances perform well. Nevertheless, the failure rates of alliances reported by numerous studies have been consistently hovering around 50% (Bates, 2002; Bleeke & Ernst, 1995; Harrigan, 1988; Park & Ungson, 2001). Therefore, while many alliances fail to achieve satisfactory results, the importance of alliances in generating corporate revenues keeps increasing. Greater alliance longevity can potentially allow more time to yield satisfactory alliance results. Thus, the applied purpose of this research is to provide practitioners a more refined understanding of how alliance longevity is determined.

1.3 Research Objectives

A model of alliance longevity needs to be grounded in existing theory. Significant theoretical tenets of transaction cost economics and the dynamic capabilities literature are particularly relevant in developing a model of alliance longevity. Thus, a preparatory objective is to review these two theoretical streams to identify key antecedent factors influencing alliance longevity.

Transaction cost economics identifies sources of transaction hazards that increase costs of searching for a partner, negotiating and contracting a deal, and monitoring partner behavior. The theory advocates the use of appropriate governance mechanisms to minimize these costs. Transaction cost economics recognizes the important roles played by alliance type, hierarchy of alliance structure, and alliance experience with partner in affecting alliance outcomes. Scholars have separately studied the relationships between alliance type and alliance survival (Park & Russo, 1996), misappropriation hazards and hierarchy of alliance structure (Oxley, 1997), and alliance experience with partner and interfirm trust (Gulati, 1995). Here, my research objective is to orchestrate these factors into an integrated model of alliance longevity.

The dynamic capabilities perspective focuses on firm capabilities of morphing resource make-ups, allowing firms to sustain competitive advantage in a changing and unpredictable environment. With regards to the emerging literature on dynamic capabilities of managing alliances, the objective is to examine whether and in which direction general alliance experience (Zollo et al., 2002; Pangarkar, 2003) and partnering firms' alliance units (Kale et al., 2002) are associated with alliance longevity. Both independent and moderating roles of these factors are of interest. These broad objectives are subsumed in the following research question:

> *How are structural variables, such as alliance type, hierarchy of alliance structure, alliance experience with partner, general alliance experience, and alliance unit, related to alliance longevity?*

The objectives of this research are also relevant for practitioners. According to Das and Teng (1999), alliances generally take more time than initially planned for to produce results. Clearly, longer living alliances would have more time than shorter living alliances to produce tangible results. To that end, the applied objective of this research is to inform alliance managers of the structural determinants that influence alliance longevity. Since managers have some control over structural determinants, they would be able to adjust for certain determinants to increase the potential longevity of their alliances. This would allow additional time for achieving tangible results, diminishing pressures for quick results and decreasing the probability of premature dissolution of many alliances.

1.4 Need for this Research

Transaction cost economics identifies various kinds of governance problems and appropriate mechanisms to overcome them. Not surprisingly, studies applying transaction cost logic to strategic alliances focus on governance mechanisms (e.g., contracts, equity structure, and monitoring) that can be used within the alliance to overcome alliance governance problems (e.g., various forms of opportunism). While hierarchy of alliance structure is recognized as an effective governance mechanism (Dussauge & Garrette, 1995; Oxley, 1997), few studies have examined its association with alliance longevity. Thus, there is a need to extend transaction cost reasoning beyond hierarchy of alliance structure to capture the antecedents of alliance longevity.

In its original form, transaction cost analysis treats an alliance as an individual transaction. According to Rindfleisch and Heide (1997: 49), "[t]his implicit tendency to focus on single transactions and relationships ignores the temporal nature of interorganizational relationships." They call for expanding the unit of analysis from a single transaction to a series of transactions. This would allow transaction cost analysis to capture the buildup of interfirm trust in the alliance in a longitudinal setting.

As an extension of the resource based view, the emerging literature on dynamic capabilities holds substantial promise in explaining alliance management processes. Eisenhardt and Martin (2000) were the first to note that alliancing is appropriately conceived as a dynamic capability (i.e., simple operating routines that evolve over time and with practice). Partly due to the newness of this literature, however, only a couple of studies have so far applied dynamic capabilities concepts in the alliance context. Zollo et al. (2002) argue that general alliance experience breeds alliancing capability, but their empirical results do not support this proposition. Kale et al. (2002) introduce the idea of alliance units to the research literature and observe that greater alliance experience of a firm is associated with the establishment of an alliance unit. There exists a clear need for further examination of these constructs to understand how they are relevant to alliances.

This research is expected to meet practitioner needs as well. Managers of partnering firms have substantial stake in making their alliances successful (Bates, 2002; Harbison & Pekar, 1998). Consequently, managers of partnering firms tend to take alliance longevity for granted, focusing exclusively on results. Thus, alliance longevity remains a commonly assumed, but limitedly understood, concept. Alliance managers need to realize that sufficient alliance longevity provides partnering firms with the requisite time to ensure satisfactory alliance results. Therefore, alliance managers need a better understanding of the conditions that affect alliance longevity. In order to better manage the time available in their alliances, managers need to comprehend the direct and moderating relationships that exist between alliance longevity and its various determinants.

1.5 Potential Contributions

A limitation of prior applications of transaction cost analysis on alliances is that the focus has always been on alliance governance structures. Given different levels of misappropriation hazards in horizontal versus vertical alliance types, I elaborate on the relationship between alliance type and hierarchy of alliance structure. Then, extending the application of transaction cost logic, I examine the independent as well as the interaction effects of alliance type and hierarchy of alliance structure on alliance longevity. Thus, I am able to apply transaction cost logic to analyze not only hierarchy of alliance structures, but also alliance longevity.

Responding to Rindfleisch and Heide (1997), this study extends transaction cost reasoning to capture the relationship of alliance experience with partner and alliance longevity. Alliance experience with partner accumulates over time and can breed interfirm trust (Gulati, 1995). Trust overcomes various governance problems that transaction cost economics addresses in the individual transaction context. Application of transaction cost economics to alliances becomes more complicated as trust diminishes the need for alliance governance mechanisms in the long run (i.e., since transactions are repeated over time).

This study also integrates concepts from dynamic capabilities literature to alliances. As stated earlier, prior to Eisenhardt and Martin (2000), no study explicitly recognized alliancing as a dynamic capability. Generally, dynamic capabilities research has maintained that experience is a key medium to generate dynamic capabilities in firms. Zollo et al. (2002) find partial support for this conjecture. In a separate study, Kale et al. (2002) introduce the idea of having a dedicated alliance function or an organizational unit dedicated to managing all alliance related activities. However, prior studies have not examined the roles of partnering firms' general alliance experience and alliance unit on alliance longevity simultaneously in the same model. This integration, here, offers greater explanatory power of alliance longevity from the dynamic capabilities perspective.

In addition, prior studies on alliances have not synthesized transaction cost economics and dynamic capabilities research. This is primarily due to the newness of the dynamic capabilities literature, especially as it pertains to alliance capabilities (Eisenhardt & Martin, 2000; Zollo et al., 2002). While these theoretical streams are not overlapping to any extent, they are complementary in explaining the alliance process. Therefore, integrating them to develop a model of alliance longevity promises to capture a more comprehensive picture.

This study offers useful insights for practitioners as well. Alliance longevity provides member firms with more time to work on the alliance to yield results. Alliances that show satisfactory intermediate results are likely to get subsequent chances of surviving and producing more advanced results. This positive spiral not only extends alliance longevity, but also enhances alliance performance and member satisfaction from alliance engagement. By learning about the various factors determining alliance longevity, practitioners can pay attention to those factors and ensure prolonged alliance survival.

Notwithstanding the contributions, there are several limitations to this research. While I developed my model on transaction cost economics and dynamic capabilities literature, there are other theoretical streams pertinent to strategic alliances that I do not consider in my model. Particularly, Parkhe (1993) offers a model of alliance governance choice integrating transaction cost economics and game theory. How game theoretic concepts (e.g., type of game characterizing the alliance) would explain alliance longevity remains to be explored. Game theoretic factors are not addressed in this study to keep the model parsimonious and limit the possibility of multicollinearity.

While behavioral uncertainty is well accounted for with transaction cost reasoning, environmental uncertainty is unaccounted for in this study. Alliances with an R&D component may face greater levels of market uncertainty. Then again, R&D alliances are generally formed between horizontal partners, and behavioral uncertainty is high in such an alliance type. Separating the effects of behavioral and environmental uncertainties is beyond the scope of this study. Future research needs to incorporate the independent and interactive influences of different kinds of uncertainties to enrich the alliance longevity model.

Acknowledging the different dynamics in dyadic and multi-partner alliances, I refrained from treating them as the same. The model I develop is specifically relevant to dyadic alliances, which comprise about 87.5% of the 69,000 alliances formed during 1985 and 2001 (*SDC Joint Ventures/Alliances Database*). Future research may use this model as a foundation to develop a customized model of multi-partner alliance longevity.

Practitioners also need to beware that knowledge of alliance longevity is not a sufficient condition for succeeding in alliances. It is a necessary piece of information that allows practitioners to be more aware of the pacing of alliance activities and appreciative of the time pressure inherent in alliance projects. While longevity is correlated with performance, it does not equate to performance. Managers ought to be aware of alliances that might fail to dissolve despite unsatisfactory results and poor prospects. The implication here is to ensure that alliance longevity is achieved for performance reasons, rather than partnering firms' inertia.

1.6 Definition of Terms

In this subsection, I define the most important terms used throughout the paper: (1) strategic alliances, (2) alliance type, (3) hierarchy of alliance structure, (4) alliance experience with partner, (5) general alliance experience, (6) alliance unit, and (7) alliance longevity. Detailed discussions of these can be found in subsequent chapters.

First, definitions of alliances are abundant in the literature. However, not all definitions are carefully crafted (e.g., Hennart, 1988; Kogut, 1988). For this paper, I adopt one of the most detailed and well-accepted definitions by Parkhe (1991: 581, emphasis added): *strategic alliances* are "*relatively enduring interfirm cooperative arrangements, involving flows and linkages that utilize resources and/or governance structures from autonomous organizations, for the joint accomplishment of individual goals linked to the corporate mission of each sponsoring firm.*" The use of the words "relatively enduring" is of particular interest to this dissertation. It suggests that endurance, up to some point, is a desirable characteristic of alliances.

Second, alliances are conceptualized as vehicles to pursue different corporate strategies (Harrigan, 1985a). In other words, alliances capture the essence of horizontal and vertical integration moves. In this dissertation *alliance type* is defined as *the classification of alliances in terms of the nature of interfirm connection, i.e., horizontal vs. vertical.* Interfirm competitive dynamics are more salient in horizontal alliances than they are in vertical alliances (Park & Russo, 1996; Park & Ungson, 1997). Such grouping distinguishes between types of alliances that are more likely to experience relational hazards and those that are not.

Third, alliance activities need to be governed through some kind of an arrangement, especially since investments of two or more firms are at stake. Alliance structure is defined as the governance form of an alliance, involving contractual provisions, equity involvement, and ownership specifications (Hennart, 1988; Yoshino & Rangan, 1995). Alliance structures have control and coordination features embedded in them in various degrees. Gulati and Singh explain that incentive systems and non-market pricing systems are control features and command structure and authority systems, standard operating procedures, and dispute resolution procedures are coordination features (1998: 786). With respect to the control and coordination features, *hierarchy of alliance structure* is defined as *the degree to which control and coordination of joint activities are institutionalized and formalized.* Nonequity structure is the least hierarchical, minority equity structure is moderately hierarchical, and joint venture structure is the most hierarchical.

Fourth, partnering firms often engage in repeated alliances. Firms are more likely to engage in subsequent alliances with each other when prior experiences with their counterparts have been satisfactory. Thus, in a dyadic alliance, both firms need to be satisfied working with each other to engage in a subsequent alliance in the future. More than 20% of the 2400 alliances that Gulati (1995) studied in biopharmaceuticals, new materials, and automotive industries were repeat alliances between partnering firms. Gulati and colleagues have defined this variable around the number of such alliances (Gulati, 1995; Gulati & Singh, 1998). Being consistent with the existing literature, I define *alliance experience with partner* as *the number of all prior and current alliances that two partnering firms have engaged in with each other.*

Fifth, akin to the definition of alliance experience with partner, existing notions of general alliance experience are based on number of all prior alliances (Gulati, 1999, Kale et al. 2002). Thus, I define *general alliance experience of a firm* as *the number of all prior and current alliances that the firm has engaged in.*

Sixth, firm structure consists of units, e.g., departments, providing specialized attention to forming, operating, and monitoring alliances (Hall, 1972/1999). Accordingly, *an alliance unit is an organizational unit with a senior manager of alliances in charge, a designated staff, internal formal authority, and provisions for resources that specializes in exclusively managing all alliance activities of the firm.*

Lastly, given the significant correlation between alliance longevity and alliance performance, there is a tendency to use these terms interchangeably. Alliance longevity has significant implications for alliance performance, for better performing alliances tend to live longer than poorly performing alliances. Longevity has been measured in terms of the temporal duration of an alliance's survival period, using hazard rate models. Following existing concepts, *alliance longevity* is defined as *the time span between an alliance's formation and its dissolution* (Harrigan, 1988; Hennart, Kim, and Zeng, 1998).

1.7 Organization of this Dissertation

This dissertation is divided into six chapters. Chapter 1 has addressed the need for this research and derived a specific research question. In chapter 2, I attend to the core concepts of this study and review the relevant literatures. In chapter 3, I develop my theoretical model about the relationships of type, structure, experience, and longevity. The reasoning in that chapter culminates in a series of hypotheses. I explain the research methodologies appropriate to test these hypotheses in chapter 4. The empirical results of the study are presented in chapter 5. Chapter 6 contains discussion and conclusions of the study.

CHAPTER 2

CORE CONCEPTS AND LITERATURE REVIEW

In this chapter, I review the extant literature on strategic alliances to establish the context of my study. Substantial research focuses on types and structures of alliances. Recent studies have focused on the role of alliance experience in facilitating their management. Alliance longevity has been studied by some scholars over the years, but mostly as a reflector of alliance performance rather than as a meaningful dependent variable itself. These are some of the key areas of alliance research. Despite a burgeoning growth in the alliance literature, confusions and unanswered questions are widespread. I begin by addressing the general notion and rationale of alliances. Then, in subsequent sections, I review the literature on type, structure, experience, and longevity of alliances—all in light of literatures on transaction cost economics and dynamic capabilities. A synthesis of these literatures sets up the stage for further theory development.

2.1 Basic Literature on Alliances

2.1.1 Meaning and Scope of Alliances

There is no clear-cut answer to what constitutes an alliance (Borys & Jemison, 1989; Yoshino & Rangan, 1995). Generally, definitions of alliances can be grouped in terms of broad and narrow scopes. On one hand, the narrow view maintains that interfirm engagements would only qualify as alliances if they entail long-term interdependence, mutual and ongoing contribution, and shared control by alliancing firms (Yoshino & Rangan, 1995). Thus, joint production and joint marketing fall under alliances, but licensing and joint bidding do not. On the other hand, the broad view relaxes the long-term interdependence criterion, recognizing relatively short-term, contractually defined interfirm engagements as alliances (Gulati, 1995; Lei & Slocum, 1991; Mowery, Oxley, & Silverman, 1996). Thus, short-term technology exchange and licensing would be considered alliances under the broad view. Nevertheless, venture capital investments or similar equity investments for strictly financial gains are usually not considered alliances (Pisano & Teece, 1989). The narrow view of alliances precludes several popular forms of interfirm engagements that successfully serve the individual strategic objectives of the firms through joint effort. Thus, recent studies on alliances have mostly adopted the broad view of alliances (e.g., Gulati, 1995; Inkpen & Beamish, 1997; Madhok & Tallman, 1998; Parkhe, 1993; Stuart, 1998).

Following this tradition, I also take the broad view of alliances in this dissertation. Admittedly, the broad view of alliances is a convenient one to adopt, as it allows for collecting data from a larger and more diverse population of alliances. A large sample helps in finding significance of subtle effect sizes. Population variance increases with the adoption of the broad definition, as there is an increased likelihood of having adequate numbers of alliances with different types (i.e., horizontal and vertical), structures (i.e., nonequity, minority equity, and joint venture), experience levels (i.e., with partner and in general), and alliance units (i.e., number of partners with such units).

2.1.2 Alliances vs. Other Strategic Moves

Firms have several general strategic moves to choose from, e.g., green field investments, acquisitions, mergers, alliances, and market-based transactions. Strategic moves are needed to access necessary resources and/or to seek opportunities. Green field investments require firms to develop plants and facilities on their own. Often, firms may lack the competence or specialization to establish and run the plant efficiently. An easy way of accessing necessary facilities is through acquisition of another firm that has the desired facilities. However, problems of unwanted baggage coming along with the much needed facilities and inaccurate/exaggerated valuation of a target firm's assets can make acquisitions less attractive (Hennart, 1988). Problems associated with mergers are similar to those found in acquisitions. Moreover, the challenge to thoroughly blend two corporate cultures often proves to be tremendously difficult. In contrast, market transactions do not face the problems that are prevalent in green field investments, acquisitions, and mergers. However, the lack of commitment between parties in a market transaction can result in delivery of substandard products and payment delays. The threat of various forms of opportunism in market transactions introduces an array of governance problems, alluding to the use of hierarchical governance structures (Williamson, 1975, 1985).

Therefore, when firms find other strategic moves (e.g., green field investments, acquisitions, mergers, and market-based transactions) to be less attractive than the choice of alliances, they are likely to use strategic alliances to access resources and seek opportunities. Nevertheless, alliances have their own set of flaws. For instance, threat of partner opportunism exists, but can subside over the course of repeated engagements. Alliances are formed for collaborative work between two or more firms, and differing cultures may hinder relational stability as well as actual work process (Meschi & Roger, 1994). However, these problems are likely to be less acute than they are in mergers or acquisitions. Overall, alliances make an attractive choice as a strategic move for many firms.

2.1.3 Importance of Interfirm Relationship in Alliance Survival

Maintaining an ongoing relationship is more critical in alliances than it is in either markets or hierarchies. It is possible for a firm to develop working relationships with returning clients, and long-term suppliers. Most often such arrangements resemble the dynamics of strategic alliances. For instance, long-term supplier agreements between firms are a typical form of nonequity alliances. However, in strategy research, relationships between firms and individuals are not deemed alliances.

On one end of the continuum, market transactions lack a sense of commitment on the parts of the involved parties. These are almost instantaneous in nature and often a one-time ordeal. Consequently, little relationship develops between involved parties in market-based transactions. At the other end of the continuum, hierarchical firms bring in those elements within the ownership structure that allow them to meet their own needs. Thus, a firm is able to avoid ongoing, interdependent transactions with other firms. This condition, in effect, suggests that no relationship takes place. In short, firms that engage in spot transactions and those that are independent hierarchies do not have to maintain enduring relationships.

Firms in an alliance may enjoy satisfactory goal accomplishment, and yet be reluctant to continue with the venture because of a lack of trust for each other. Bleeke and Ernst (1995) noticed that 24 of the 49 alliances they studied had terminated prematurely because one firm could not trust the other. In other words, longevity of an alliance is at stake even when the alliance fares well in accomplishing its intermediate targets, but is characterized by a high potential for relational hazards. In the long run, poor relationship can lead to poor communication and hinder actual collaborative work process, further complicating alliance-related problems.

The opposite scenario is where the firms have a good relationship, but for external reasons the alliance fails to satisfactorily progress toward reaching its objectives. Thus, level of goal accomplishment is low, although the partnering firms are very friendly with each other. Such an alliance tends to get dissolved mutually after the partners decide that it is not a worthy effort to continue the alliance (i.e., considering the unsatisfactory progress toward accomplishing alliance-specific goals). Consequently, the longevity prospect of such an alliance is also bleak.

Having reviewed the basic literature on alliances, I now focus on alliance characteristics important in this study. These characteristics are discussed in light of the transaction cost and dynamic capabilities literatures.

2.2 Alliance Type

Alliance type depends on the nature of partner connection (Park & Russo, 1996; Park & Ungson, 1997, 2001). The nature of partner connection is different when alliances are formed between competitors, vis-à-vis when they are formed between two firms that are not competing with each other. Competition often eclipses cooperation, hindering satisfactory alliance performance that is dependent on cooperation (Park & Russo, 1996). Alliance members that are not competitors do not have to worry about the negative influence of competition between collaborative partners. Depending on these starkly different natures of partner connections, I now discuss the rationale and nature of horizontal and vertical alliance types.

2.2.1 Horizontal Alliance Type

Alliances formed between immediate competitors are of the horizontal type. Firms form alliances with fierce rivals for economic reasons. First, the cumulative demand of the partnering firms would allow these firms to produce in larger batches, producing economies of scale. Second, by sharing each other's distribution network, horizontal alliance members can reach out to a broader market and enhance sales. Sharing each other's distribution network can too generate economies of scope. Of course, this may give rise to major problems of cannibalization as well. Third, since rival firms have similar plant facilities, higher production efficiency can be achieved by maximizing plant usage through better allocation of responsibilities (Spiegel, 1993). Finally, horizontal alliances bring rivals to jointly overcome environmental uncertainty (Brouthers, Brouthers, & Wilkinson, 1995). Especially when R&D expenses are staggeringly high, it is often too risky to go it alone for any one firm. Only key competitors are interested enough in similar research and are willing to share the risk.

2.2.2 Vertical Alliance Type

Alliances comprising firms that are not direct competitors are of the vertical type. This type of alliance is formed between buyers and suppliers, manufacturers and retailers, firms belonging to related industries, and, in rare instances, firms belonging to unrelated industries. Thus, the term vertical alliance type is used loosely, allowing the inclusion of all alliances that are not between competitors. This approach is consistent with prior conceptualization of vertical alliances (Park & Russo, 1996; Park & Ungson, 1997, 2001). Firms form vertical alliances for various reasons. First, firms needing ongoing, dependable supplies may establish contractual agreements with suppliers. Long-term supplier agreements allow the buyer to get supplies at a discounted price, and provide steady cash flow for the supplier. Second, vertical alliances offer a flexible means of accessing raw materials and/or retailing services, since no costly and permanent acquisitions are needed (Harrigan, 1985b). Third, when dealing with hazardous materials, a firm may opt to seek services from a smaller firm through a contractual alliance and thereby avert potential liability litigation from adversely affected employees (Barney, Edwards, & Ringleb, 1992). Fourth, firms from related industries plan to extend beyond their core businesses through alliances. Such alliances may be economically advantageous if operating synergies can be leveraged (Amit & Livnat, 1988a). Finally, firms from unrelated industries may join forces to achieve greater stability in cash flows (Amit & Livnat, 1988b).

2.2.3 Horizontal Alliance Type vs. Vertical Alliance Type

Several studies have exclusively dealt with either horizontal alliances (e.g., Osborn & Baughn, 1990; Oxley, 1997) or vertical alliances (e.g., Heide & John, 1990). Park and colleagues have compared horizontal alliances with vertical ones across various alliance-related aspects (Park & Russo, 1996; Park & Ungson, 1997, 2001). These studies compare joint ventures formed between firms with the same four-digit primary SIC codes and joint ventures formed between firms with different four-digit primary SIC codes. When fierce competitors collaborate with each other, their ability to learn from each other is significantly higher (Cohen & Levinthal, 1990). This becomes a problem, since there are serious adverse consequences for a focal firm when its competitor/partner learns more than its fair share (e.g., tacit knowledge that serves as the backbone of the focal firm's competitive advantage). Empirical investigations involving datasets of 204 joint ventures (Park & Russo, 1996) and 186 joint ventures (Park & Ungson, 1997) support the hypothesis that vertical alliances have a higher probability of survival than their horizontal counterparts. It can be surmised from these studies that horizontal alliances are inherently riskier than vertical alliances.

2.3 Alliance Structure

Alliance structure has been under the research spotlight for some time. Van de Ven (1976: 25) refers to interorganizational relationships (IR) as *social action systems* and defines the structure and process of such systems: "*Structure* refers to administrative arrangements established to define the role relationships among members. *Process*, conceptualized as a flow of activities, refers to the direction and frequency of resources and information flowing between members. Thus, the structure and process of an IR is the 'organization form' for interorganizational collaboration" (1976: 26, emphasis in original).

2.3.1 Forms and Functions of Alliance Structure

Subsequent studies dealing with alliance structure have distinguished among formal structures of alliances in terms of their degree of hierarchy and associated control and coordination features (Pisano, Russo, & Teece, 1988; Pisano, 1989; Gulati, 1995). Hierarchical controls enable a firm to manage uncertainty. Williamson (1985) points to two types of uncertainties: market uncertainty (i.e., uncertainty about the business environment) and behavioral uncertainty (i.e., uncertainty about the behavior of the economic actor). Coordination and governance features of hierarchical controls assuage market uncertainty and behavioral uncertainty respectively.

Alliances take a variety of structural forms, such as licensing agreements, co-production agreements, co-marketing agreements, distribution agreements, joint R&D projects, long-term supplier relationships, minority equity alliances, and joint ventures. There have been numerous attempts to organize this rich variety of alliance forms (e.g., Dussauge & Garrette, 1995; Gulati, 1995; Gulati & Singh, 1998; Lorange & Roos, 1992; Oxley, 1997).

Lorange and Roos (1992) distinguish among the following structural forms: ad hoc pools, consortia, project-based joint ventures, and business-based joint ventures. They are not explicit about their rationale for categorizing alliance forms in the above way. Transaction cost economics, however, offers an explicit rationale by arranging alliance structures in a markets-hierarchies continuum (Dussauge & Garrette, 1995; Gulati & Singh, 1998; Oxley, 1997).

2.3.2 Markets-Hierarchies Continuum within Alliances

Transaction cost economists have studied alliances by focusing on market- and hierarchy-like characteristics of different types of alliances. Given the prevalence of nonequity-equity dichotomy within the alliance literature, transaction cost economics treats nonequity and equity structures as parallel to markets and hierarchies (e.g., Gulati, 1995). Nevertheless, such treatment results in considerable loss of information. Also, while Williamson (1975) initially proposed a markets-hierarchies dichotomy, he later explicitly recognized the presence of intermediate forms between markets and hierarchies (Williamson, 1985). Similarly, it is imperative to assign a degree of hierarchy (i.e., low, moderate, high) to existing alliance structures.

Hierarchy of alliance structure is defined as the degree to which control and coordination of joint activities are institutionalized and formalized. Among various alliance forms, there exists a continuum of structural hierarchy, ranging from arm's length licensing contracts to equity joint ventures (Dussauge & Garrette, 1995; Gulati & Singh, 1998; Oxley, 1997).

Dussauge and Garrette (1995) develop a taxonomy of alliances based on a complex combination of both strategic and structural features: R&D agreements, unstructured co-production projects, semistructured projects, and business-based joint ventures. They claim that "the four identified patterns can be arrayed according to their increasing degree of internalization" (1990: 519). Oxley (1997: 389-392) uses unilateral contractual agreements, bilateral contractual agreements, and equity-based alliances to develop a market-hierarchy continuum of interfirm alliances. She assumes these alliance forms are progressively hierarchical. Gulati and Singh (1998) discuss five dimensions of hierarchy: command structure and authority systems, incentive systems, standard operating procedures, dispute resolution procedures, and non-market pricing systems. They convincingly argue that different alliance structures have different degrees of hierarchy based on these dimensions. The most hierarchical alliance structure is a joint venture, which creates a separate entity through co-ownership to manage joint activities. The institutionalization and formalization of control and coordination of activities in joint ventures mimic that of independent firms, which are traditional hierarchies. Minority equity structure, involving the exchange of minority equity stakes between partners, is moderately hierarchical. "Hierarchical supervision is typically created by the investing partner joining the board of directors of the partner that received the investment. The presence of one or more individuals on the board of the partner in a minority alliance introduces a fiduciary role into the relationship and is also a vehicle for hierarchical controls" (Gulati & Singh, 1998: 793). Nonequity structure, based on contractual agreements, is the least hierarchical. By default no equity exchange or co-ownership takes place and there is no administrative structure to govern the relationship. Thus, alliances of nonequity structure are akin to market transactions.

Just as hierarchies are chosen over market transactions when anticipated transaction costs in market exchanges are higher (Williamson, 1975; Klein, Crawford, & Alchian, 1978), so too an alliancing firm chooses a more hierarchical alliance structure when it is unaware of its partner's reputation and apprehends relational hazards. Similarly, when relational hazards are low, a focal firm leans toward a less hierarchical (i.e., more market-like) alliance structure. Applying transaction cost logic, scholars have offered valuable insight into alliance structuring behavior of firms (Hennart, 1988; Mjoen

& Tallman, 1997; Oxley, 1997). According to Hennart (1988), the choice of forming a hierarchical alliance is clearly based on transaction cost economizing rationale. He explains, for example, in industries where spot market supplies produce excessive transaction costs (e.g., oil refining), firms are economically better off forming joint ventures with their suppliers. Studying Norwegian international joint ventures, Mjoen and Tallman (1997: 268) find that "bargaining power of the parent is influenced by its relative contribution to the venture, and that this bargaining power in turn gives the parent the ability to achieve activities and overall control, and thereby higher perceived performance." Studying 165 horizontal alliances between publicly held manufacturing firms in the U.S., Oxley (1997: 402) finds that "firms choose more hierarchical arrangements in situations where specification of the relevant property rights can be expected to be problematic" (i.e., *behavioral uncertainty* is high).

2.4 Alliance Experience with Partner

Transaction cost economics has benefited from the social exchange literature, which highlights the influence of prior ties in fostering interfirm trust. Das and Teng (1998) argue that given a low level of interfirm trust in the beginning, greater level of control is needed to garner sufficient confidence in partner cooperation. Repeated ties make two firms familiar to each other, breeding requisite trust. Through a large-scale empirical study of more than 2,400 alliances, Gulati (1995) established that firms that engaged in prior ties are more likely to adopt a nonequity structure rather than an equity structure for their alliances. In other words, firms that become familiar with each other through repeated ties are more likely to move away from equity involvement and favor nonequity alliance structure. In alliances between two unfamiliar firms, equity structure provides the additional level of control to allow repeated ties to take place and trust to develop between partnering firms. Once trust is developed, however, equity structure becomes redundant. Interfirm trust also facilitates collaborative efforts by limiting the need for burdensome bureaucratic paperwork.

Transaction cost economists have historically focused on single transactions (see Rindfleisch & Heide, 1997 for a recent review). Thus the temporal evolution of transactions between two parties has not been considered within the theory. That is, traditional transaction cost theory ignores the temporal nature of alliances. By accounting for alliance experience between partnering firms as one of the independent variables, this dissertation tries to capture the evolution of relationship between alliance partners.

From a different perspective, the literature on dynamic capabilities addresses the influence of alliance experience with partner on alliance longevity. Alliancing capability can be both general and partner-specific. The former kind emanates from general alliance experience, whereas the latter kind emerges out of alliance experience with a specific partner. Clearly, alliancing capabilities of the specific type will only be applicable to alliances with that specific partner. Zollo et al. (2002: 9) explains, "As they [partnering firms] work through the operational details of the collaborative agreement, both partners develop a more refined understanding of each other's cultures, management systems, capabilities, weaknesses, and so forth." Learning to manage new alliances with a specific partner develops sequentially—the interaction pattern smoothens as partnering routines are perfected through repeated alliance engagements. Empirical tests have found mixed support for this position. Results from 145 biotechnology alliances lend strong support that prior experience with a specific partner positively affects the performance of the alliance (Zollo et al., 2002). In contrast, while Pangarkar (2003) hypothesized a positive relationship between prior experience with partner and alliance duration, he found no significant support for this hypothesis studying 83 biotechnology alliances. Pangarkar (2003) forced prior alliance experience between two firms to be a dichotomous variable—either alliance partners had prior experience with each other or they did not. Thus, substantial information was lost, which may have influenced his finding. By capturing prior alliance experience between alliance members in a continuous interval scale, I would be able to avert the methodological drawbacks of Pangarkar's study.

It should be noted here that since this type of experience is partner specific, lessons learned from repeated alliances with a specific partner will be more applicable to future alliances with that same partner than to future alliances in general. The interfirm trust that generates between partnering firms is a unique outcome of this type of experience. This interfirm trust between two partnering firms does not influence the outcome of those alliances that the partnering firms are involved in *separately* with other firms.

Aside from alliance structure and alliance experience with partner, alliance units may also influence alliance longevity. An alliance unit is a part of the larger organizational structure. Therefore, significance of organizational structure in affecting organizational performance is discussed first, before reviewing studies on alliance units per se.

2.5 Significance of Organizational Structure

Chandler (1962) was the first to note that structure follows strategy. He examined the historical developments of four major U.S. firms—Du Pont, General Motors, Standard Oil, and Sears, Roebuck and Company—to conclude that a change in strategy put pressure on associated change in the company's structure. As these firms became increasingly diversified, the functional form of organizing was no longer efficient. Hence, firms switched to a multidivisional structure. Rumelt (1974) extends Chandler's (1962) thesis by integrating economic performance to the original strategy-structure relationship. Firms change their existing structures to become more capable of implementing their strategies. Williamson (1985) explains that as top level managers are relieved from daily operational routines, they are able to devote their efforts and time in strategic decision making. Also, adopting the appropriate structure results in administrative efficiency, which translates to economic gains (Chandler, 1962). In a more recent study re-analyzing Rumelt's (1974) data, Harris and Ruefli (2000: 597) find that a "pure change" in structure (i.e., without any change in strategy) is significantly more salient than a "pure change" in strategy (i.e., without any change in structure) in influencing economic performance.

Clearly, structure is important in influencing firm performance. A deeper and more meaningful query would be how different structural attributes influence different aspects of performance. Research on the impact of certain parts of an organizational structure is just beginning to emerge, especially from scholars studying dynamic capabilities (Nelson, 1991; Teece, Pisano, & Shuen, 1997). The basic idea is that dedicating an organizational unit to manage a specific function will positively influence the effectiveness of that function. Thus, the literature on dynamic capabilities underscores the significance of alliance units to better manage strategic alliances.

2.6 Alliance Units

Alliance units are organizational functions dedicated to manage all alliance-related activities. In any firm, a senior executive oversees the alliance unit. The alliance unit accumulates and analyzes alliance specific knowledge, to identify effective and ineffective alliance practices. This allows the firm to gain dynamic capabilities to better manage its current and future alliances.

2.6.1 Dynamic Capabilities

Theoretical developments in dynamic capabilities literature suggest that firms are able to seek opportunities proactively when they acquire and utilize dynamic capabilities (Eisenhardt & Martin, 2000; Teece et al., 1997; Zollo & Winter, 2002). In fast-changing environments opportunities are many and evolving. Therefore, as the playing field continues to change unpredictably, the traditional resource characteristics posited by the resource based view—valuable, rare, inimitable, and non-substitutable—do not allow firms to sustain competitive advantage. Under such conditions, a firm needs capabilities of constantly morphing its resource make-up to seek new and novel opportunities that continue to arise. Such capabilities are referred to as dynamic capabilities. A firm's dynamic capabilities of managing strategic alliances can be deliberately fostered through alliance units (Kale et al., 2002).

2.6.2 Alliance Units and Dynamic Capabilities

A firm's alliance unit is comprised of alliance managers who oversee and engage in all kinds of alliance activities. Being focused on alliance-related work, the alliance unit staff are able to accelerate the learning process of managing alliances. They are able to extract and codify effective alliancing capabilities from any alliance. Subsequently, they are able to apply this dynamic capability to all other current and future alliances. As Teece et al. assert, "Deep process understanding is often required to accomplish codification. Indeed, if knowledge is highly tacit, it indicates that underlying structures are not well understood, which limits learning because scientific and engineering principles cannot be as systematically applied. Instead, learning is confined to proceeding through trial and error..." (1997: 525-526). Similarly, Zollo and Winter (2002: 339) note, "At any point in time, firms adopt a mix of learning behaviors constituted by a semiautomatic accumulation of experience and by deliberate investments in knowledge articulation and codification activities." They show that the relative effectiveness of capability-building mechanisms depends on frequency, homogeneity, and degree of causal ambiguity of the task at hand. They observe that highly deliberate learning (e.g., knowledge codification) is more effective when the organizational task to be learned is infrequent and heterogeneous rather than prevalent and homogenous.

Since alliancing is an organizational task that is relatively infrequent (i.e., when compared to daily operational activities) and heterogeneous (i.e., many kinds of alliances depending on their size, equity, structure, partners, location, and motive), the use of an alliance unit to deliberately learn and achieve alliancing capability would be very effective. "The lower frequency and greater heterogeneity of alliance activity increases the probability that lessons learned from previous experiences will be applied to a context which is superficially similar but inherently different" (Zollo et al., 2002: 7).

It is the primary responsibility of the alliance unit to learn from prior alliance experience (Draulans, deMan, & Volberda, 2003; Kale et al., 2002). The alliance unit identifies the effective and ineffective practices and refines the experience-based data to highly useful information. Thus, the alliance unit serves as a reservoir as well as a refinery of alliance management know-how. Since the knowledge source for a firm's alliance unit is that firm's general alliance experience, I review studies on this topic next.

2.7 General Alliance Experience

Knowledge accumulated from experience over time is an important component of a firm's core competencies (Mahoney, 1995). According to Penrose (1959: 5), "the experience of management will affect the productive services that all its resources are capable of rendering." Firms learn from experience and retain the knowledge reliving an experience repeatedly. Organizational routines develop as firms learn and remember by doing. While dynamic capabilities resemble the traditional conception of organizational routines under relatively stable and predictable environments (Nelson & Winter, 1982), they are simple, experiential, and unstable processes that develop through iterative execution of activities under high velocity environments (Eisenhardt & Martin, 2000: 1106). Thus dynamic capabilities are likely to develop from transformational experience, as opposed to from static experience (King & Tucci, 2002). "*Static experience* is gained from further elaboration of existing structures, positions, and strategies. *Transformational experience* is gained from changing these attributes" (2002: 172). Dynamic capabilities are built on experience rather than acquired through market transactions (Teece et al., 1997: 528). Even tacit knowledge and abilities become institutionalized through sufficient replication. This is how routines develop within firms (Nelson & Winter, 1982).

Dynamic capabilities of managing complex activities evolve through iterative execution of those activities. Scholars have characterized the iterative process of learning as "sequenced steps" (Brown & Eisenhardt, 1997) and as "consequential" (Eisenhardt & Martin, 2000). Studying six firms in the computer industry, Brown and Eisenhardt (1997) highlight those firms' practice of linking routines exercised in one development project to the next one. Similarly, Kim (1998) observes that Hyundai Motor Company has been benefiting from first developing relatively simpler capabilities pertaining to manufacturing process and then developing more complex capabilities of product design process. Apparently, firms build on prior experience of doing a particular task and become better in executing a related task because of the relevant knowledge acquired from participating in the previous task.

More specifically, dynamic capabilities are bred through "(1) experience accumulation, (2) knowledge articulation, and (3) knowledge codification processes in the evolution of dynamic, as well as operational, routines" (Zollo & Winter, 2002: 339). Eisenhardt and Martin (2000: 1111) maintain a similar view—evolution of dynamic capabilities depends on the deliberate use of practice, codification, mistakes, and pacing to learn. They observe that, "while the evolution of dynamic capabilities occurs along a unique path for any given firm, that path is shaped by well-known learning mechanisms" (2000: 1117). Repeated practice, for example, accelerates the formation of dynamic capabilities (Argote, 1999). Further, small losses (Sitkin, 1992) and crises (Kim, 1998) accelerate the speed of learning and evolution.

Apparently, experience in alliance engagement lets firms learn from mistakes and successes in prior alliances. It can make firms more familiar with certain alliancing practices and beware them of certain pitfalls within the alliancing process. Eisenhardt and colleagues (Eisenhardt & Martin, 2000; Eisenhardt & Sull, 2001) recount how Yahoo developed simple rules as its dynamic capability in managing scores of successful alliances: "Yahoo managers formed an exclusive relationship with a major credit card firm. Shortly, they recognized that this alliance restricted flexibility, especially with regard to retailers, and terminated it at great expense. The 'no exclusive deals' rule emerged from this mistake" (Eisenhardt & Martin, 2000: 1115).

2.7.1 Combined General Alliance Experience

General alliance experience is a firm level construct. Therefore, in dyadic alliances, there are two different general alliance experiences to be concerned with. This situation is unlike that of alliance experience with partner, since both firms in a given alliance can only have exactly the same amount of experience with each other. To resolve this dilemma of changing analytical levels, scholars have taken various routes. Kale et al. (2002) conduct their entire empirical analysis at the firm level. They find general alliance experience is positively associated with the establishment of a dedicated alliance function (i.e., separate organization unit primarily responsible for managing alliance-related activities). Thus, Kale et al. (2002) avert the level dilemma altogether by limiting theorizing of general alliance experience at the firm level. Pangarkar (2003) tests the relationship between general alliance experience and alliance duration, by forcing a dichotomy to this naturally continuous variable. In his alliance dataset, he uses a dummy variable flagging whether the partners (first either firm, then both) have had general alliance experience. Even after forcing a dichotomy, his results suggest that partnering firms' general alliance experience positively influences alliance duration. Zollo et al. (2002) use general alliance experience data of *one randomly selected partner per alliance*. This severely undermines the combined general alliance experience that member firms bring in to an alliance. Perhaps, this is one reason for Zollo et al. (2002) to not find support for their hypothesis about positive relationship between general alliance experience and alliance performance.

2.7.2 Asymmetry in General Alliance Experience

Just as a firm's history over time influences its values and beliefs, so too a firm's general alliance experience will have some influence on its orientation, expectations, and standards toward newly engaged alliances. When partners' views and preferences of managing an alliance sharply contrast, misunderstanding between partners is highly likely. Alliance-related work may be directed in different ways, causing unnecessary delays. Also, a large difference in prior experience may prevent partnering firms from understanding each other's views and expectations, precluding the development of a harmonious interfirm relationship. Thus, asymmetry between alliance members' general alliance experience is likely to partially diminish the positive influence of the combined general alliance experience on alliance longevity.

Empirical findings suggest that asymmetry in partnering firms' age (i.e., general business experience) make joint ventures dissolve prematurely (Park & Ungson, 1997). Hence, it is not too far a jump to expect that asymmetry in general alliance experience of partnering firms also would have some negative impact on alliance longevity. When estimating the combined general alliance experience of partnering firms in an alliance, adjusting for the asymmetry in members' general alliance experience will yield a more refined construct, which positively influences alliance longevity.

2.7.3 Asymmetry-Adjusted Combined Alliance Experience

Adjusting partnering firms' combined general alliance experience for asymmetry in their experience bases is a novel, but realistic approach in studying the role of experience in alliance longevity. The very few studies that exist in this area do not conceptualize the role of general alliance experience in such refined manner. For example, Pangarkar (2003) reduces the general experience of partners to an artificial dichotomy, so that an alliance either has partners with general alliance experience or not. Zollo et al. (2002) use general alliance experience data of just one firm within the alliance, selecting that firm randomly. Kale et al. (2002) use general alliance experience of individual firms, since their research queries are confined at the firm level. Notwithstanding, there seems to be agreement regarding the approach of assessing general alliance experience in terms of alliance counts.

While dynamic capabilities of alliancing reside at the firm level, it has consequences at the alliance level. Clearly, there is a shift in level of analysis, which needs to be conceptually understood and empirically accounted for. In a dyadic alliance, two firms with varying degrees of alliancing capabilities join forces. From the perspective of a specific firm, the probability of succeeding in the alliance would be higher than it was when it had less alliancing capabilities. However, this still does not tell us how much the success of the alliance will be influenced by the alliancing capabilities of its members.

The dilemma of dealing with two levels of analysis can be resolved through aggregation. Since two firms are engaging and bringing in resources to any given alliance, the dynamic capabilities of each member firm needs to be accounted for. Thus, instead of accounting for general alliance experience of a randomly selected firm, I would add the general alliance experience of the partnering firms. This figure would reflect the combined alliancing capability that would work in favor of the alliance. However, as discussed earlier, the difference or asymmetry in general alliance experience is expected to have some diminishing effect on the combined alliancing capability, necessitating some adjustments (see subsection 3.2.5 for details).

2.8 Alliance Longevity

Alliance longevity has received substantial attention in alliance research. In the strategic management and related literature, with the exceptions of Joskow (1987), Hennart et al. (1998), and Hennart and Zeng (2002), scholars have viewed alliance longevity as a reflector of alliance performance. Quite notably, political scientists study longevity of political alliances per se and enjoy ready access to large longitudinal datasets. Nevertheless, the amount of empirical work on political alliance longevity is quite inadequate. Bennett (1997: 847) aptly notes, "most empirical work has examined alliance *duration* only in passing" (1997: 847, emphasis in original).

While longevity and performance are significantly correlated (Barkema et al., 1997; Geringer & Hebert, 1991; Glaister & Buckley, 1998, 1999), they are different constructs (Hatfield, Pearce, Sleeth, & Pitts, 1998). Alliance longevity refers to the length of the life span of an alliance. It is calculated as the temporal duration between formation and dissolution of the alliance. Premature dissolution of an alliance is a significant phenomenon. Park and Ungson (2001: 39) argue, "dissolving an ongoing cooperative structure is significant considering powerful social-psychological motivations to preserve the cooperative relationships that entail transaction-specific investments."

Interestingly, alliance longevity reacts differently to time than does alliance performance. That is, the probability that an alliance will cease to exist increases as the alliance continues to age beyond a certain point. In fact, hazard rate curves generated by management and political science scholars have confirmed that alliances enjoy an initial period of safe survival, beyond which the probability of dissolution continues to increase, before starting to diminish slightly at some distant future. Bennett's (1997) findings from 207 interstate alliances during 1816 and 1984 offer strong support for this conjecture. In contrast, probability of achieving satisfactory alliance performance increases with the passage of time.

Since alliances are formed with a finite horizon (even if the horizon is unspecified), what constitutes average alliance duration has been a passing query for several studies. For example, average duration of the 83 biotechnology alliances that Pankarkar (2003) studies is 36 months, which is comparable to average duration of 42 months for Harrigan's (1988) sample of 895 alliances in a variety of industries. Studies focusing exclusively on joint ventures have reported considerably longer average life span (e.g., Kogut, 1989; Hennart et al., 1998). When alliances have indeterminate ends (as is the case for most joint ventures), they tend to last as long as the conditions for profit are promising. In contrast, alliances with determinate ends are dissolved either upon reaching the expiration date or earlier than that due to poor prospects.

Longevity carries with it several advantages for an alliance. For example, in a long-living alliance, partnering firms have the chance to balance out short-term payoff inequities, strengthening the bond between those firms. Greater longevity also means more time for the alliance project to breakeven and start making profits. Das and Teng (1999) argue that alliances require more time than they are initially planned for because of various unforeseen contingencies. These contingencies are inevitable when two firms are forming an alliance for the first time. Dozens of misunderstanding and cooperation-obstacles have to be overcome before members can actually concentrate on accomplishing task objectives.

Scholars have often used longevity as an indicator of performance (e.g., Barkema et al., 1997; Harrigan, 1988; Pangarkar, 2003; Park & Ungson, 1997, 2001). This is a standard assumption in the political science literature (Bennett, 1997; Gaubatz, 1996; Reed, 1997). While well-performing alliances live throughout their usefulness, poorly performing alliances are prematurely dissolved. Alliances plagued with relational difficulties too generally die a premature death. Therefore, significant correlation between alliance performance and alliance longevity is expected. Empirical studies confirm the significant correlation between subjective measures of alliance performance and alliance duration (Geringer & Hebert, 1991; Glaister & Buckley, 1998). Given that longevity and performance of alliances are separate constructs, it can be inferred that one may have some influence on the other and vice versa (resulting in significant correlation).

Firms often form alliances for long-term strategic reasons, rather than short-term financial advantages (Glaister & Buckley, 1999). For example, learning a leaner production process, developing technological know-how, improving market position, and gaining legitimacy within the industry are viable strategic motives that have long-term consequences. Under such circumstances, performance of an alliance would be more effectively captured by the extent to which alliance-specific tasks are being accomplished in the alliances (Anderson, 1990; Geringer & Hebert, 1991). When firms steadily move forward realizing their alliance-specific goals, they are likely to continue with their alliance projects (i.e., prolonging the lives of the alliances).

While performance of alliances is concerned with meeting certain task objectives, these objectives will have to be met through joint effort that is dependent on a good working relationship. Akin to the notion of independent firms' goal accomplishment, alliances' goal accomplishment depends on member firms' internal competencies (of the alliance as well as the member firms), external environment, and appropriate strategic choices. However, as firms must *collaborate* in accomplishing alliance-specific goals, importance of a good working relationship is more salient in alliances than in market-based transactions or in independent firms.

Empirical evidence suggests that alliances with stable relationships will survive longer than those with tumultuous relationships (Harrigan, 1988). Alliance members fluently cooperating with each other will enjoy a stable relationship. Luo (2002) finds that cooperation within an alliance relationship enhances contractual adaptability, which in turn encourages more cooperation. Analyzing data from 293 international joint ventures, he demonstrates that "contract completeness and cooperation drive IJV performance both independently and interactively" (2002: 903).

Severe conflict hampers cooperation. Studying 261 U.S.-Chinese joint ventures, Ding (1997: 39) observes that severe conflict exists in quality control, export/import, and human resources areas, and conflict between parent firms is negatively associated with joint venture performance. Severe conflict, opportunistic behavior, and outright animosity are various forms of relational difficulties. Relational difficulties between alliancing firms cause decision making deadlocks, communication lags, and production shutdowns. Making matters worse, a partner has little motivation to cooperate with another firm when the relational tie is weak (Buchel, 2003). Partnering firms are highly likely to prematurely terminate their alliances under such conditions, truncating alliance longevity.

2.9 Synthesis

The preceding literature review addresses several facets of the burgeoning literature on strategic alliances. Transaction cost economics explains alliance longevity in light of governance problems and governance mechanisms to solve those problems, whereas the dynamic capabilities literature underscores the importance of experience and partnering firms' alliance units in influencing alliance outcomes. Following Geringer and Hebert (1991) and Glaister and Buckley (1998), it is assumed that satisfactory alliance outcomes will result in greater alliance longevity.

Two theoretical schools that offer compelling explanations for alliance longevity are transaction cost economics and the dynamic capabilities literature. Scholars have extended the application of these theories to better understand various aspects of strategic alliances. Considering the focus on type, structure, experience, and longevity of alliances, a review of these two literatures appeared to be most appropriate.

Alliance- and firm-level structures aside, the role of alliance type and alliance experience are important in their own right. Alliance type sets up the context for varying degrees of governance problems that transaction cost economics offer solutions for. Alliance experience has implications for better management of the alliance process (Zollo et al., 2002). Alliance experience with a specific partner breeds interfirm trust as well (Gulati, 1995). Thus, alliance experience, both of the general and the specific kind, has an overall positive influence on alliance outcomes.

The extant literature deals with alliance structure in different ways. The most widely used framework to study alliance structure is in terms of equity involvement. Thus, many studies have differentiated nonequity structure from equity structure. Joint ventures have ordinarily been considered a special form of equity structure. However, there are occasional suggestions in the literature that joint ventures may be distinctly different from other equity alliances (Daussage & Garrette, 1995). Gulati and Singh (1998) argue that nonequity, minority equity, and joint venture structures are progressively hierarchical. Thus, they move away from a nonequity-equity dichotomy toward a hierarchy of alliance structures.

In addition to alliance structure, findings of a recent article suggest that some elements of firm structure may be positively related to longer living alliances (Kale et al., 2002). The literature on firm capability subsumes the notion of alliance capability or the firm capability to effectively manage its alliances. If greater alliance capability is instrumental in achieving greater alliance longevity, tracing the roots of alliance capability seems a worthwhile venture.

Our knowledge on how to structure alliances for greater longevity remains fragmented. Recent developments in the dynamic capabilities literature allude to the role of firm capabilities (albeit fostered by firm structure) to better manage the alliancing process. Transaction cost economics underscores the problem of relational hazards in alliances. It advocates the use of various governance mechanisms to overcome interfirm relational hazards, and thereby increase the probability of alliance survival. Seemingly, an integrated model of alliance longevity is needed, where longevity is influenced by steady progress toward alliance goals and a stable, well-governed relationship. In the next chapter such a model is developed that is predicated upon different aspects of alliance- and firm-structures, and that recognizes the roles played by alliance type and alliance experience.

CHAPTER 3

RESEARCH MODEL

Strategic alliances are relatively enduring collaborative arrangements between firms to mutually pursue and meet individual goals (Parkhe, 1991). Endurance of alliances refers to their ability to continue to be operational. Therefore, greater endurance results in greater longevity in alliances. Furthermore, scholars consistently observe that alliance longevity is significantly correlated with subjective assessment of alliance performance (Barkema et al., 1997; Geringer & Hebert, 1991; Glaister & Buckley, 1998). Thus, alliance longevity is an important topic of research. Given the importance of alliance longevity, the principal purpose of this study is to better understand the factors that lead to the continued maintenance of strategic alliances. Figure 1 presents an integrated model of alliance longevity.

A general assumption in this study is that alliance longevity is a desirable outcome. It is possible that in rare instances partnering firms will continue with an ailing alliance because of their escalating commitments (Ring & Van de Ven, 1994). Also, firms suffering from organizational inertia may be reluctant to dissolve alliances that were once successful (Miller, 1990). Potential undesirable consequences of alliance longevity remain unexplored in the current study and deserve substantial future research.

3.1 Rationale for the Model

In chapter 1, I argued that greater longevity translates to more time for partnering firms to achieve their alliance goals. However, alliance longevity is seldom the principal criterion variable in alliance research models. Hence, there is a need for theoretically and empirically examining the antecedent factors of alliance longevity. In chapter 2, it became evident from the literature review that transaction cost economics and dynamic capabilities literatures offer significant and distinct explanations of alliance outcomes. Integrating the pertinent tenets of these two theoretical perspectives produces a theoretically grounded predictive model of alliance longevity.

On one hand, while transaction cost economics has been widely used to explain alliance-structuring behavior (Dussauge & Garrette, 1995; Oxley, 1997), its application to understand alliance longevity has been limited. Inherent risks of different alliance types and hierarchical governance mechanisms of various alliance structures are transaction cost issues relevant to alliance longevity. Recent extensions to the theory in the area of repeated ties (Gulati, 1995) also holds promise in explaining alliance longevity.

On the other hand, dynamic capabilities literature, as it pertains to alliances, is just beginning to emerge (Teece et al., 1997; Eisenhardt & Martin, 2000). Partnering firms' dynamic capabilities of managing strategic alliances positively influence alliance outcomes. Deliberate learning of such alliance capabilities can happen through alliance roles or units and general alliance experience of partnering firms. Such roles or units are able to extract, interpret, codify, and disseminate the general alliance experience of partnering firms, increasing the probability of long-term survival of current and future alliances.

Clearly, transaction cost economics and the dynamic capabilities perspective have different, but complementary focuses. Relational hazards give rise to transaction costs, which are minimized by adopting appropriate governance mechanisms. The theory is oblivious to partnering firms' capabilities of managing alliance activities. The dynamic capabilities literature addresses this area. Together, transaction cost economics and the dynamic capabilities literature explain both relational and operational aspects of strategic alliances.

Integrating transaction cost and dynamic capabilities literature, I develop a model of alliance longevity that incorporates the antecedent factors dealt with by each theoretical stream. Given their potential relevance to alliance longevity, five antecedent factors are considered: alliance type, hierarchy of alliance structure, alliance experience with partner, number of partners with alliance units, and asymmetry-adjusted combined alliance experience. In section 3.2, possible interactions between the five predictors and their impact on alliance longevity are discussed. In section 3.3, I examine interrelationships among some select predictors: alliance type, hierarchy of alliance structure, and alliance experience with partner. Treating hierarchy of alliance structure as the dependent variable, I discuss the predictor roles of alliance type and alliance experience with partner.

3.2 Predictors of Alliance Longevity

3.2.1 Alliance Type

In the previous chapter, I reviewed two types of alliances: horizontal and vertical. These types depend on the nature of connection between the partners. The alliance type is horizontal when alliance partners are competitors of each other and otherwise it is vertical. In terms of partner connection, the entire population of alliances can be split into horizontal and vertical types (Mowery et al., 1996). Several studies have exclusively dealt with either horizontal alliances (e.g., Osborn & Baughn, 1990; Oxley, 1997) or vertical alliances (e.g., Heide & John, 1990). Some recent studies have also compared horizontal alliances with vertical ones across various alliance-related aspects (Park & Russo, 1996; Park & Ungson, 1997, 2001; Rindfleisch & Moorman, 2001). The contrasting nature of horizontal and vertical alliance types is well received in the literature. Horizontal alliances are formed between firms within the same industry sector. Hence, horizontal alliance members belong to the same stage of a given value chain (Spiegel, 1993: 570). Being consistent with prior studies, all non-horizontal alliances are automatically deemed vertical (Park & Russo, 1996; Park & Ungson, 1997; Rindfleisch & Moorman, 2001). These alliances are between firms belonging to different industry sectors, which may or may not be located in different stages of the same value chain. I argue in the following paragraphs that alliance type influences alliance longevity.

Horizontal alliances are more likely to dissolve earlier than vertical alliances for several reasons. First, horizontal alliance partners, as competing firms, would find it difficult to commit to cooperation fully. To gain an advantageous position vis-à-vis its partner, a firm may consider various non-cooperative behaviors, such as holding back critical information, distorting results, and luring away key personnel from the partner firm to slyly learn firm-specific know-how. Rindfleisch and Moorman (2001: 3) observe that horizontal alliances generate a low degree of relational embeddedness. That is, competitor firms are generally unable to overlook the rivalry between them to view their partners strictly as collaborators. The spirit of cooperation is dwarfed when partners of a horizontal alliance continue to fear and be suspicious of each other. Thus, Park and Russo (1996) argue that horizontal joint ventures are plagued with relational difficulties, which results in a higher rate of early dissolution. They find strong support for their hypothesis studying 204 joint ventures.

Second, following transaction cost economics, I assume that some alliancing firms are sometimes opportunistic (Williamson, 1975, 1985). According to the theory, probability of partner opportunism is higher when partner behavior is unknown and uncertain (Rindfleisch & Heide, 1997). Alliance partners that are otherwise competitors operate under high levels of behavioral uncertainty, since the rival partner's next moves are usually unknown to the other partner.

Third, in horizontal alliances, the consequences of inadvertently leaking company secrets are severe. Direct competitors have the highest capabilities to appropriate knowledge from their counterparts. This is because "learning performance is greatest when the objective of learning is related to what is already known" (Cohen & Levinthal, 1990: 131). Distinctive competencies (e.g., technology, proprietary formula, and key personnel) of a firm are very relevant and useful to its competitors. Since competitors are involved in similar research and development, the technological knowledge each has overlaps to some extent. The knowledge bases of two competing alliance partners are, therefore, complementary in nature. If exposed to the competitor's technological knowledge and know-how, a firm is in a position to learn such knowledge quickly and effectively. Of course, learning the competitor's knowledge would give one alliance partner undue benefits, jeopardizing the long-term competitive advantage of the other partner. This possibility makes long-term alliance survival untenable.

Fourth, horizontal alliances often involve very costly projects exploring new and uncertain business prospects. This increases the alliance's performance risk, which is the probability of failing in the alliance project due to reasons other than non-cooperation (Das & Teng, 1996; Ireland, Hitt, & Vaidyanath, 2002). The most risky alliances are the technologically complex ones and almost invariably formed between rivals (i.e., horizontal alliances). Even if the two firms fully collaborate, the higher level of performance risks associated with horizontal alliances will make them prone to a higher rate of failure, limiting their longevity. Firms still engage in such risky alliances because the potential payoff is significantly greater than that of a relatively less risky alliance.

Fifth, since vertical alliances are not formed between competitors, the harmful competitive dynamics are not as pronounced in them. Not surprisingly, Rindfleisch and Moorman (2001) find that relational embeddedness in vertical alliances is significantly higher than that in horizontal alliances. Often a vertical alliance is formed between two firms where the success and growth of the downward firm results in increased demand for supplies from the upward firm (i.e., an opportunity to generate more revenue). Thus, a vertically linked firm can have a vested interest in its partner's success and would not behave in a way that would jeopardize the alliance's long-term prospects. Empirical findings that longevity of vertical joint ventures is greater than that of horizontal joint ventures is in line with the argument that vertical alliances experience low relational hazards vis-à-vis their horizontal counterparts (Park & Russo, 1996; Park & Ungson, 1997).

Finally, vertical alliances are often not based on one major project, but an ongoing stream of exchanges. For example, long-term buyer-supplier relationships resemble incessant flow of supplies at a bargain price for the buyer and a guaranteed sale of a certain volume for the supplier. Similarly, other alliances, where firms of different industries co-market their products or use each other's distribution channels, are not scheduled to end shortly. Also, these alliances do not involve high performance risk projects. Therefore, they are not affected by an extraordinary failure rate due to performance risks (i.e., probability of failure due to reasons other than non-cooperation).

Considering the various reasons described so far, I hypothesize the relationship between alliance type and alliance longevity as follows:

H1: Vertical alliances experience greater longevity than horizontal alliances.

3.2.2 Hierarchy of Alliance Structure

Main Effect. Alliance structure has been under the research spotlight for almost three decades (Franko, 1971; Dussauge & Garrette, 1995; Harrigan, 1985a; Hennart, 1988; Osborn & Baughn, 1990; Pfeffer & Nowak, 1976; Van de Ven. 1976). The large volume of research on alliance structure has highlighted some specific roles that structures play. First, transaction cost economics underscores the utility of hierarchical structure in governing partner behavior. Hierarchy (i.e., the extent to which control and coordination features are formalized within the structure) is a technical term in transaction cost economics, which is different from the classical conception of organizational hierarchy (i.e., structural layers vertically differentiating organizational structure). Throughout this study, the term hierarchy is used strictly as a technical term of transaction cost economics. Hierarchy of alliance structure becomes critical when partner reputation is unknown and the focal firm anticipates partner opportunism due to high behavioral uncertainty and/or asset specificity conditions. Therefore more hierarchical structures can deter partner opportunism and keep an alliance from terminating prematurely.

Second, hierarchical structures also have significant coordination features (Bernard, 1938; Chandler, 1962; Thompson, 1967). Therefore, alliances dealing with highly complex tasks, requiring high levels of task coordination, are better off adopting a more hierarchical structure. The idea behind coordinating interdependent tasks is to facilitate alliance accomplishment. Even when intermediate goals are not fulfilled per partnering firms' satisfaction, the alliance may be continued if it holds promise in delivering results in the long run. Thus, better coordination of interdependent tasks is expected to extend the life span of an alliance.

Joint ventures, formed through the creation of a separate autonomous entity co-owned by the parent firms, are the most hierarchical among alliance structures (i.e., maximum facility of formal control and coordination). "Such alliances provide a high level of discretion to the entity in which the joint activities are being conducted, which provides a dedicated management with a mandate to make decisions that optimize the activities contributed by each partner toward the accomplishment of their joint goals" (Gulati & Singh, 1998: 787). Thus, joint ventures are expected to have greater longevity vis-à-vis all other alliances.

In strategic alliances, the need for coordinating interdependent tasks is clear. "It arises from the complexity of ongoing coordination of activities to be completed jointly or individually across organizational boundaries and the difficulties associated with decomposing tasks and specifying a precise division of labor across partners in the alliance, all of which require ongoing communication and decisions" (Gulati & Singh, 1998: 784). Despite the need for coordination, not all alliances are structurally equipped to coordinate interdependent tasks effectively. More hierarchical structures are more conducive to accomplishing alliance goals, ensuring ongoing alliance operations.

Third, more hierarchical alliance structures are locked into a relationship by their equity investments. These projects tend to require greater levels of resource commitments, which become sunk costs when the alliance is dissolved prematurely. Firms bounded by equity investments in their alliances are not going to simply write-off their resource commitments to the alliance. Rather, escalation of commitment (Staw, 1981; Levinthal & Fichman, 1988) toward the alliance may make partnering firms more attached to their collaborative project, delaying a much warranted termination of the alliance.

Studying 92 manufacturing joint ventures, Kogut (1989) observes 59.8% joint ventures survive beyond 4 years of age. In contrast, studying 895 alliances of various kinds, Harrigan (1988) reports 42% alliances survive more than 4 years. Again, Kogut (1989) reports 46.5% joint ventures survive beyond 5 years of age. Studying 83 biotechnology alliances of various kinds, Pangarkar (2003) observes that only 15% of alliances survive beyond 5 years of age. Clearly, Kogut's (1989) data on joint ventures' average longevity is noticeably longer than that reported by Harrigan (1988) and Pangarkar (2003), who used all kinds of alliances. These contrasting findings hint about the greater longevity of joint ventures (i.e., the most hierarchical alliance structure) compared to alliances in general. Thus,

H2: Hierarchy of alliance structure is positively related to alliance longevity.

So far, I have argued in favor of a direct link between structural hierarchy and longevity of alliances. In the remainder of this subsection the focus is on whether and how hierarchy of alliance structure influences the relationship between alliance type and alliance longevity.

Moderating Effect. The previous sub-subsection makes the case that alliances with more hierarchical structures will have greater longevity. This is due to two distinct reasons: control and coordination features of hierarchical structures. While these features are necessary in managing every strategic alliance, the degree to which they are needed varies across types. Thus, an alliance type that needs high levels of control and coordination facilities will benefit significantly from more hierarchical structures, whereas another alliance type that does not need high levels of control and coordination will benefit marginally from more hierarchical structures.

In subsection 3.2.1, I discussed the nature of horizontal and vertical alliance types at some length. Horizontal alliances, being formed between rival firms, are categorized by fierce competition between partners. Potential for a partner to misappropriate proprietary technology, shirk, and withhold critical information is higher in horizontal alliances than it is in vertical alliances. Thus, horizontal alliances need strong forms of control facilities to govern partner behaviors. More hierarchical alliance structures are able to fulfill this apparent need to control partner behaviors.

Aside from control needs, certain alliance projects demand high levels of interdependence that require partners to closely coordinate with each other. Joint R&D alliances, co-development alliances, and, to some extent, co-production or co-manufacturing alliances require high levels of partner coordination to successfully achieve alliance goals. These specific kinds of alliances are generally formed by competitors, characterizing these alliances as horizontal type. In contrast, vertical alliances, such as buyer-supplier relationships and manufacturer-retailer agreements, require considerably less interdependence between partners. Therefore coordination needs in vertical alliances are not as pronounced either. Since more hierarchical structures offer greater coordination benefits (Chandler, 1962; Thompson, 1967), such alliance structures will facilitate the effective functioning of horizontal alliances but will be unable to positively influence the functioning of vertical alliances. Thus,

H3: Hierarchy of alliance structure increases the longevity of horizontal alliances more than it increases the longevity of vertical alliances.

3.2.3 Alliance Experience with Partner

Main Effect. As discussed earlier, alliance experience with a specific partner makes partnering firms become familiar to each other. Familiar firms are more trusting of each other (Gulati, 1995), which is a necessary condition for cooperation. Alliances with ample cooperation between partners are more likely to overcome intermediate obstacles and move toward accomplishing alliance goals. Moreover, these alliances are less likely to be plagued by partner opportunism, since opportunism is conceived of as the inverse of cooperation. These qualities are the basis of a good working relationship. A healthy working relationship, emanating from greater alliance experience with partner, prevents certain possibilities of premature dissolution due to a lack of trust or fear of various forms of misappropriation.

As briefly mentioned in the preceding subsection, partnering firms engaging in repeated alliances develop routines about how to work on their collaborative projects. These partner-specific routines enhance a firm's dynamic capability of alliancing with a specific partner. Since two subsequent alliances are not the same, routines developed through iterative alliance engagements with the same partner are still dynamic in nature. They offer simple rules to underscore the superficial similarity between two issues as well as adjust for deeper differences between the issues. Zollo et al. hypothesize, "The greater the number of previous alliances established by a firm with the same partner, the better the performance of the focal alliance" (2002: 11). Empirical results support this hypothesis. They study 145 biotechnology alliances and find that partner-specific experience, rather than general alliance experience or technology-specific experience, has a positive impact on alliance performance. Therefore, *H4: Alliance experience with partner is positively related to alliance longevity.*

If a firm has negative experience in its alliance with a partner, it is unlikely to engage in repeated alliances with that specific partner. Thus, for most cases, alliance experience with partner refers to positive experience. Nevertheless, since some partnering firms may engage in successive alliances with each other despite initial negative experiences, the issue warrants some discussion.

A negative alliance experience may serve as a lesson for two partnering firms, benefiting the functioning of future alliances between them. That is, notwithstanding the negative results, these partners may have a positive learning experience by identifying the problems that existed in their collaboration process and the promising areas that need to be further worked on. It is reasonable to assume that, under conditions of initial negative alliance experience, two firms would engage in repeated alliances only if they were able to learn from their mistakes and could avoid them in the future. Under such circumstance, negative alliance experience with partner would positively influence longevity of future alliances.

Moderating Effect. In the previous sub-subsection, I have argued and hypothesized the independent relationship between alliance experience with partner and alliance longevity. In the previous subsection, I also offered arguments and conjectured the independent relationship between alliance structural hierarchy and alliance longevity. This sub-subsection will explain the moderating role of alliance experience with partner in the relationship between hierarchy of alliance structure and alliance longevity.

While I have argued that hierarchy of alliance structure is positively related to alliance longevity, under specific circumstances the strength of this relationship fluctuates. Though not a common phenomenon, some nonequity alliances have comparable or even greater longevity than joint ventures. This deviation from expected difference in longevity between nonequity and joint venture structures suggests the presence of moderating effects. I argue that alliance experience with partner negatively moderates the relationship between hierarchy of alliance structure and alliance longevity. More specifically, under conditions of greater alliance experience with partner, influence of the hierarchy of alliance structure on alliance longevity starts to diminish.

Previously I have explained that effects of alliance experience serve as substitutes for control and coordination needs that are common to interorganizational relationships. This condition makes hierarchies redundant, since the control and coordination features of more hierarchical structures would remain underutilized. In order for more hierarchical alliance structures to exert their benefits upon alliances, there must be sufficient scope for the control and coordination features of these structures to be utilized. Greater alliance experience with partner reduces the need to control partner behavior as interfirm trust starts to generate. Similarly, the need to coordinate complex tasks becomes less necessary as partnering firms develop operating routines to avert some of the complexities of subsequent alliance projects. Thus, alliances with various levels of structural hierarchy may experience similar levels of longevity as they are influenced by the effects of partnering firms' alliance experience with each other. The argument above leads to the following hypothesis:

H5: Greater alliance experience with partner weakens the relationship between hierarchy of alliance structure and alliance longevity.

Alliance experience with partner not only generates trust (Gulati, 1995), but also smoothens operational procedures in the alliance (Zollo et al., 2002). Thus, alliance experience with partner may lessen some of the difficulties observed in horizontal alliances. For example, horizontal alliance partners find it difficult to commit to cooperation, since they are competitors of each other outside the alliance. Such partnering firms also experience a higher degree of behavioral uncertainty, increasing the probability of partner opportunism. However, as mentioned earlier, interfirm trust starts to develop when horizontal alliance partners have had prior ties with each other. Trusting firms are more likely to commit to cooperation and less likely to behave opportunistically with each other. Consequently, alliance experience with partner is expected to moderate the relationship between alliance type and alliance longevity.

3.2.4 Number of Partners with Alliance Unit

Nelson (1991) describes, "Structure involves how a firm is organized and governed, and how decisions actually are made and carried out, and thus largely determines what it actually does, given the broad strategy. A firm whose strategy calls for being a technological leader that does not have a sizeable R&D operation, or whose R&D director has little input into firm decision making, clearly has a structure out of tune with its strategy" (p. 67). Along similar lines, Teece et al. (1997) note that firm capabilities are best understood in terms of structures and processes of the organization, since they are critical in implementing value-creating strategies. Following this logic, I argue that a firm that generates a large percentage of its revenue from alliance activities ought to have an executive-level alliance role or an alliance unit spearheaded by a senior executive to manage all alliance-related activities. This would ensure its structure to be in tune with its strategy.

Recently, several large firms have established departments or units of strategic alliances to exclusively attend to crises and monitor performances of their alliances. This is a new characteristic in firm structure, since such a unit was practically nonexistent prior to the 1990s and is still a relatively uncommon feature among firms (*Hoover's Online*). The existence of a department dedicated to alliance-related issues within the larger structure of a firm has significant strategic implications. In the remainder of this section, I will present the various benefits and drawbacks of having a dedicated unit to manage alliance-related issues. To be consistent in language, I will refer to such a unit as the 'alliance unit.'

First, both qualitative and quantitative data get stored in the alliance unit as a firm engages in numerous alliances over time. The alliance role or unit is in a position to analyze these data, producing for the alliancing firm valuable knowledge about effective and ineffective processes, practices, and outcomes in managing strategic alliances. The alliance unit is often able to codify such alliance-specific knowledge. As the literature on dynamic capabilities suggest, codification allows an alliancing firm to apply lessons learned from one particular alliance to all the other alliances that it engages in (Eisenhardt & Martin, 2000; Teece et al., 1997). Even when knowledge from alliance experience is tacit in nature and cannot be readily codified, the alliance unit can serve as the hub of such tacit knowledge by providing a platform where managers of its different alliances can come together and share their experiences. Thus, a firm with an alliance unit within its structure would improve in managing its alliances, avoiding premature terminations.

Second, partner selection is deemed as a critical step in forming an alliance (Geringer, 1991). On one hand, firms enter into alliances to mitigate specific needs or to seek unprecedented opportunities. Finding the right match in selecting a partner is critical to meeting these needs or realizing these opportunities. On the other hand, differences in goals and cultural values between alliance members stall decision making, threatening the alliance's prospects. Trade publications frequently report how alliance deals get initiated among top managers of two firms over some casual conversation. Thus, no systematic screening takes place to find the most competent and complementing firm as an alliance partner. The alliance unit is responsible for such systematic search and the senior executive in charge of the alliance unit is in a position to either conduct alliance negotiations or advise the CEO of the nature of partner s/he should be looking for. By being aware of the alliancing trends and history within the industry, it is in a unique position to advise top management (i.e., the final deal makers) about the most appropriate candidates for a strategic alliance. This leads to effective partner selection, as top managers of the firm seek alliances with potential partners that they know are a good fit.

Third, the alliance unit facilitates the mobilization of internal resources to support the alliance initiative. "Visionary alliance leaders may lack the power or organizational authority to access key resources that may be necessary to ensure alliance success" (Kale et al., 2002: 751). Creation of an alliance unit (albeit headed by a senior executive) grants alliance managers the right to access and coordinate internal resources across different functions and divisions. On one hand, when certain functions of the firm refuse to help or conform to alliance-related demands, the senior executive of the alliance unit can effectively push the issue to higher authorities (e.g., CEO or COO) and resolve the problem quickly. This allows an alliance to access scarce resources scattered in remote parts of the alliancing firm. On the other hand, while any particular alliance manager may not know the whereabouts of different resources within a large firm, it is more likely that such information will be readily available to the alliance unit as a whole. This helps the coordination process. As different areas of the firm become involved, the probability of economizing through economies of scope also increases.

Fourth, alliance performance is hard to measure. Often the absence of a suitable point of reference hinders performance evaluation. An alliance unit is capable of assessing alliance performance more effectively when a firm has engaged in several alliances already. Since alliance managers are required to report alliance activities and performance to the unit, the unit is able to assess comparative performance of different alliances. Accordingly, the unit advises poorly performing alliances specific ways to alter their courses to overcome the difficulties they might be facing. The unit is also able to facilitate benchmarking among alliances, where best practices of different alliances are used as benchmarks that other alliances strive to achieve. Firms with an alliance unit would be less likely to pull the plug on an alliance, before analyzing the situation and taking corrective measures. Hence, many alliances facing initial difficulties may overcome them and continue to be in operation for many years.

Fifth, alliances are often replete with interfirm disputes. Disputes often make an otherwise promising relationship stale. Kale et al. (2002) observe in their field data that the alliance unit serves as a mediator when disputes between alliance partners become difficult to handle. It is reasonable to surmise that dispute resolution will be more effective when both firms engaging in the alliance have alliance units than when only one of the alliance members has such a unit. This is because even when an alliance unit tries to mediate disputes between two firms at the alliance level, the absence of such a unit in one of the firms prevents the alliance members from talking on the same turf. This leads to communication lags, preventing alliancing firms from resolving their relational difficulties.

Finally, the alliance unit can make the event of the alliance more visible to the market. The existence of an alliance unit in the firm structure gives market analysts an unambiguous entity to inquire about alliances of the firm. Such a unit is able to respond to analysts' queries regarding strategic issues of the alliance (production schedule, expected duration or alliance horizon, synergy with other projects that the firm is engaged in, etc.), generating a favorable market evaluation. Alliance announcements that are favorably received by the market are unlikely to dissolve prematurely because of fears of adverse market reactions.

In light of these various reasons, partnering firms' alliance units are likely to ensure good economic health and survival of the alliance. As more member firms establish such alliance units, the alliance will be able to tap into incremental benefits of having multiple alliance units. Therefore,

H6: The number of partners with alliance units is positively related to alliance longevity.

3.2.5 Asymmetry-Adjusted Combined Alliance Experience

Main Effect. The construct collaborative experience refers to experience gathered from all previous experiences of interfirm collaborations (Simonin, 1997). Experience in managing alliances allows a firm to learn by doing. According to the dynamic capabilities perspective, firms learn from experience through evolution, adaptation, and replication (Nelson & Winter, 1982; Teece et al., 1997). Hence, firms more experienced in managing alliances are likely to be highly skilled in alliance management, learning from prior mistakes and successes.

Simonin (1997: 1158) conjectures, "Firms with greater collaborative experience will achieve higher levels of collaborative know-how." Surveying 151 firms, he found significant support for this hypothesis. Experience is institutionalized through routines. Routines capturing alliance experience are, however, not static but dynamic in nature. That is, whereas static routines allow the mastery of a particular skill, dynamic routines accommodate the constantly changing nature of some task by offering flexibility in their applications. Simonin (1997: 1158) offers a telling example:

> The draft of a letter of intent for a new joint venture is likely to reflect a format and content derived from previous experiences with a related, but still very different, context and situation. In that regard, the letter of intent is a manifestation of an organizational routine—the drafting process—that can be partially codified and formally updated over time.

In short, general alliance experience breeds dynamic routines, which facilitate better alliance management and increases the likelihood of alliance survival.

Alliance experience teaches firms the dos and don'ts of alliancing. Such firms become better in screening partners, negotiating contract, monitoring progress toward alliance goals, managing a good working relationship, and demonstrating patience in the time of alliance related crises. Moreover, Powell, Koput, and Smith-Doerr (1996) claim that firms with greater alliance experience are more able to manage a diverse portfolio of alliances. They argue, "firms learn from exploration and experience how to recognize and structure different types of alliances" (1996: 120-121).

Zollo et al. (2002) address another key advantage of alliance experience, namely that of learning curve benefits. Learning curve benefits would make alliancing a more efficient process, precluding redundant paperwork, motions, and activities. Thus, partnering firms are able to make their alliancing experience more productive and rewarding. These conditions are conducive to producing favorable intermediate goal accomplishments, keeping members contented and willing to continue with the venture.

When two firms form an alliance, the general experience of each firm contributes to the alliance outcome. The combined general alliance experience needs to be adjusted for possible asymmetry that may exist between partnering firms' alliance experience base. Asymmetry in alliance experience increases the probability that partnering firms will have different ways of approaching certain alliance tasks, leading to potential misunderstandings between them. It is assumed that the greater the asymmetry in partnering firms' general alliance experience, the greater would be its effect on diminishing the positive influence of combined general alliance experience. To account for the magnitude of the asymmetry, I adjust the sum of general alliance experience of both members by subtracting from that sum the absolute difference of the members' general experience. Consider two alliances X1 and X2. Firms *i*1 and *j*1 form X1 alliance, and firms *i*2 and *j*2 form X2 alliance. Also assume that general alliance experience of firms *i*1 and *j*1 are 10 alliances each, whereas general alliance experience of firms *i*2 and *j*2 are 1 alliance and 19 alliances respectively. Simply adding the alliance experience bases would suggest that the combined general alliance experience is 20 alliances in both X1 and X2 alliances. However, adjusting for asymmetry, combined general alliance experience in X1 remains 20 alliances, but in X2 becomes 2 alliances [i.e., for X1, $(10 + 10) - (|10 - 10|) = 20$; and for X2, $(1 + 19) - (|1 - 19|) = 2$]. Therefore, the effect of general alliance experience on alliance longevity will be much more salient for X1 alliance compared to that for X2 alliance. Although, one of the firms brings in a wealth of general alliance experience in alliance X2, the stark difference of partnering firms' alliance experience bases is likely to diminish the effects of combined alliance experience on alliance X2's longevity.

Considering the above stated reasons and the rationale for adjusting for asymmetry in partnering firms' alliance experience bases, I advance the following hypothesis:

H7: Asymmetry-adjusted combined alliance experience is positively related to alliance longevity.

Moderating Effect. Simonin (1997: 1158) aptly states, "although knowledge about collaborations can be gleaned from external sources, much of this knowledge may not have value until it is internalized and applied to a firm's own unique situation." Therefore, the primary source of alliance management knowledge for any firm is its own alliance experience. Basically, alliance experience gives a firm exposure to unique alliance-relevant situations and a hands-on experience to deal with those situations. More alliance experience means the culmination of a greater amount of data. Such experience has valuable knowledge-content that the firm needs to process and practice through some mechanism.

An alliance unit generates alliance capability by accumulating, storing, integrating, and diffusing alliance management knowledge (Kale et al., 2002: 749). An alliance unit would be able to process the rich source of data amassed through alliance experience and produce valuable alliance management knowledge for the firm. The greater the amount of knowledge being processed, the higher would be the probability for an alliance unit to find a new alliance management best practice. That is to say, alliance unit's ability to improve alliance outcomes and alliance longevity is dependent on the amount of data alliance experience generates. From the dynamic capabilities perspective, general alliance experience of alliance members serve as raw materials that their alliance units process and produce dynamic capabilities of managing alliances.

The alliance management knowledge coming from general alliance experience of two partnering firms may be counterproductive if asymmetry exists in their experience bases. Alliance roles or units can only benefit from extracting, interpreting, codifying, and disseminating alliance management knowledge that both partnering firms understand and agree on. Therefore, general alliance experience of each partnering firm needs to be adjusted for possible asymmetry, before such experience can influence the relationship between number of partners with alliance units and alliance longevity. Thus, the longevity of alliances, where members have more alliance units, will further increase when the members have greater asymmetry-adjusted combined alliance experience. Hence,

H8: Asymmetry-adjusted combined alliance experience strengthens the relationship between number of partners with alliance units and alliance longevity.

3.3 Predictors of Hierarchy of Alliance Structure

3.3.1 Alliance Type and Hierarchy of Alliance Structure

The potential for partner opportunism is high in horizontal alliances formed between rival firms. Tying firms to the alliance through some substantial means mitigates risks of appropriation. According to transaction cost economics, equity involvement acts as one such tying mechanism. Equity involvement takes two distinct forms: exchange of minority stake in each other's equity (i.e., minority equity structure) and co-ownership of a third company (i.e., joint venture structure). Exchange of minority stakes of each other's ownership is less hierarchical than is co-ownership (Gulati & Singh, 1998).

Dissolving hierarchical alliance structures is not easy, especially when a partner has behaved opportunistically with its counterpart (Williamson, 1996). For one, a firm may not cooperate with its partner in repurchasing the partner's stake in it. Also, as legally separate entities, joint ventures cannot be dissolved one-sidedly. Thus, a partner behaving opportunistically will risk retaliation from its counterpart at a later time, as the partner will be unable to conveniently walk away from the joint venture. Furthermore, both minority equity and joint venture structures give untrusting firms the requisite confidence about each other to form an alliance (Das & Teng, 1998). Thus, more hierarchical alliance structures put a check on such non-cooperative proclivities and generate interfirm confidence that stabilizes the relationship.

When alliance firms hold equity stakes in each other, they involve in cross shareholding. Studying the Dutch financial industry, Dietzenbacher, Smid, and Volkerink (2000) find that horizontally linked firms experience a higher profit margin when the linkages involve cross shareholding. They argue that cross shareholding forces firms to think from their partners' perspectives, since action that may harm the partners would mean diminished value of the shares held through cross holding arrangements (Dietzenbacher et al., 2000: 1223-1224). Therefore, in addition to the difficulty of untangling the equity-based alliance relationship, potential economic loss from the diminished value of the equity stake would discourage competitive behavior between alliance firms.

Transaction cost economics suggests firms would prefer less hierarchical alliances when they do not anticipate relational hazards (Williamson, 1991, 1993). Assuming that administrative costs increase with the level of organizational hierarchy, firms would prefer hierarchical forms of alliances only when there is an expressed need for such a structure. Among the different types of alliances, the interpartner dynamics in vertical alliances reflect strong relational ties (Rindfleisch & Moorman, 2001). When interfirm relationship does not indicate imminent or potential problems, requiring alliancing firms to take minority equity stakes in each other is uncalled for. Therefore, governance features of more hierarchical structures will remain underutilized in a vertical alliance.

Admittedly, vertical alliances do pose some relational hazards, but these are often overcome through alternative governance mechanisms. For example, studying 165 relationships between manufacturers and suppliers in the chemical industry, Stump and Heide (1996) observe that manufacturers adopt a variety of governance mechanisms, such as partner selection, incentive design, and monitoring to counter supplier misappropriation of a manufacturer's specific investment. In other words, structural hierarchy is not the primary method of controlling alliance activities in vertical alliances. The argument above suggests,

H9: Hierarchy of alliance structure is greater in horizontal alliances than in vertical alliances.

3.3.2 Alliance Experience with Partner and Hierarchy of Alliance Structure

Transaction cost economics holds that since recurring transactions allow involved parties to recoup the costs associated with hierarchical governance structures, such would be the preferred governance choice of partnering firms when they engage in recurring transactions (Williamson, 1985). The high costs of managing hierarchical alliance structures do have implications on the requisite length of such alliances. Clearly, alliancing firms would need relatively longer time to breakeven the higher costs associated with more hierarchical alliance structures. Nevertheless, empirical studies have generally failed to support this position (see Rindfleisch & Heide, 1997: 31).

Presumably some other factors are playing major roles here. Notions from social exchange theory offer a trust-based explanation.

While transaction cost theory ignores the buildup of trust through repeated alliances, social exchange theory focuses on the trust building process in exchange relationships. Gulati (1995) argues that alliancing partners' preference for nonequity structures over equity structures reflects interfirm trust between those firms. He shows empirically that firms unfamiliar with each other are more likely to form equity alliances in the beginning and nonequity alliances later in subsequent alliances between each other. He explains that repeated alliances make alliance partners increasingly more familiar to each other, breeding interfirm trust. This finding helps explain why repeated ties between same partners would be negatively related to hierarchical governance.

Firms in repeat alliances also develop routines to facilitate the collaborative process. Routines make complex tasks relatively straightforward and expedite otherwise time-consuming tasks. Also, the need for frequent joint consultations is lessened, as routines offer adequate guidelines to deal with recurring roadblocks that partners face in the process of working toward their alliance goals. Hence, alliances between partners that have accumulated a lot of alliance experience with each other require less coordination even when the nature of the task is quite interdependent. These alliances would not need the coordination facilities that more hierarchical structures can offer. As a result, structures of such alliances are likely to be less hierarchical. Thus,

H10: Alliance experience with partner is negatively related to hierarchy of alliance structure.

The basic argument behind the relationship between alliance type and hierarchy of alliance structure is to economize transaction cost. Since horizontal alliances have inherent risks of non-cooperation, hierarchical structures are useful to govern partner behavior in alliances. The stark difference in cooperative dynamics between horizontal and vertical alliances may diminish as two partnering firms engage in repeated alliances. Building greater alliance experience with each other these firms develop interfirm trust (Gulati, 1995), lubricating the collaborative process (Arrow, 1974). Thus, the need for hierarchical governance diminishes under such circumstance.

3.4 Concluding Remarks

Overall, the ten hypotheses of this chapter capture an integrated model of alliance longevity. The first eight hypotheses summarize the independent and moderating relationships of alliance longevity with five predictor variables: alliance type, hierarchy of alliance structure, alliance experience with partner, number of partners with alliance units, and asymmetry-adjusted combined alliance experience. These predictor variables were derived from transaction cost and dynamic capabilities literatures.

The final two hypotheses take a step backward and treat hierarchy of alliance structure as a dependent variable. It is conjectured that hierarchy of alliance structure is related to alliance type and alliance experience with partner. These two hypotheses follow traditional application of transaction cost economics in predicting alliance-structuring behavior.

The model developed in this chapter offers a multi-variable explanation of alliance longevity. The five predictor variables comprise the key relevant factors posited by transaction cost economics and the dynamic capabilities literature. Transaction cost economics does not focus on alliance management capabilities of firms, whereas dynamic capabilities arguments are based around the sources and impact of partnering firms' alliance capabilities. Similarly, the dynamic capabilities perspective does not focus on the potential relational hazards and the need for appropriate governance mechanisms in alliances, which are principal concerns of transaction cost economics. Both strong alliance management capabilities and a well-governed relationship are needed for prolonged alliance survival. Thus, antecedent factors of alliance longevity, derived from these two theoretical perspectives, complement each other well. The proposed model promises to explain a practically and statistically significant portion of the variations in longevity across different kinds of alliances.

CHAPTER 4

RESEARCH METHODOLOGY

This chapter attends to the methodological issues that are relevant in empirically investigating the strengths of the hypotheses derived in the previous chapter. Research design of this study is non-experimental, since the predictor variables are observational rather than clinically controlled. The study uses longitudinal data, which is instrumental in measuring alliance longevity.

Hazard rate analysis and various techniques within multiple regression are used to analyze the data. Results obtained from these analyses are based on correlations and do not prove causation. While theoretical discussion preceding the hypotheses in chapter 3 permits cautious inferences of causality, research hypotheses have been carefully worded to only express correlation between independent and dependent variables.

4.1 Data Description

I chose to use secondary sources of data for several reasons. First, in this study independent, dependent, and control variables are all dealing with objective data. That is, these data elements do not require subjective assessments of a rater (or multiple raters).

Second, research using secondary data does not deal with response rates, averting potential problems of nonresponse bias. Nonresponse bias, quantified by Cochran (1977), is the error in the surveyed data, which results from the nonparticipation to the survey by a specific group of people. This is particularly the case in alliance research (Dickson & Weaver, 1997; Parkhe, 1993; Saxton, 1997; Steensma, Marino, Weaver, & Dickson, 2000). Response rates reported in alliance articles published in the most esteemed scholarly journals generally range from 15% to 35%. Everything else being equal, a lower response rate results in a smaller sample size, limiting the power of statistical tests to detect a significant effect (Cohen, 1992). Considering journal editors' general reluctance in accepting non-significant findings (Rosenthal, 1979), the average response rates in alliance surveys could be much less for unpublished research than those for journal articles. Hence, many empirical articles on alliances do not get published, gathering dust inside file drawers[1]. Alliance scholars attribute the low response rate to the nature of the data and the subsequent need to have inputs from senior management. Usually surveys are sent out to senior managers who are responsible for managing alliances in their respective companies. These managers are generally too busy to respond to unsolicited research questionnaires and would often refrain from responding. Another possibility, which is even more alarming, is that the questionnaires may actually get completed by executive assistants and may not necessarily reflect the alliance managers' critical inputs requested in the questions.

Third, expenses of a survey can easily reach several thousand dollars, despite the high uncertainty regarding response rates. While secondary databases are also expensive, they are generally made available by research libraries. Thus, there is also economic justification in using a secondary database to conduct my empirical investigation.

There are certain disadvantages of using secondary data sources, which warrant consideration. Admittedly, the use of secondary data limits a researcher's choice of how different variables of the model can be specified. That is, since secondary data are collected prior to the conceptual development of a study, the variables of the model need to be specified with strict caution. In contrast, data collected through a survey, designed

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[1] File drawer problem occurs because journal editors are usually reluctant to accept nonsignificant findings (Rosenthal, 1979).

especially to test a given model, allow substantial flexibility to the researcher in specifying variables of that model.

Finally, secondary sources usually contain readily available data that are simple and objective in nature. For research containing complex constructs, such data are not directly usable. However, scholars have often justified the reliance on simple and objective proxies to study complex organizational constructs. For example, by showing repeated alliance engagements result in partner firms moving away from equity-based to nonequity ties, Gulati (1995) concluded that familiarity breeds trust. Here, number of prior ties between two alliancing firms serves as the proxy for familiarity between alliancing firms and the move from equity-based to nonequity alliances serves as evidence of accumulated interorganizational trust. The data elements I use in my model are directly observed and reported in the SDC Joint Ventures/Alliances Database and in Hoover's Online.

4.2 Data Sources

4.2.1 SDC Joint Ventures/Alliances Database

The Securities Data Company (SDC) database on alliance is among the most comprehensive sources of data on alliances. Although the alliance data starts from 1985, systematic data collection begins from 1989. Anand and Khanna (2000) noted that SDC data had comprehensive coverage of all alliance activities from 1994. However, I observed that alliance coverage was comparably comprehensive from 1992.

The database dates back to 1985 and is updated daily. The coverage contains reports on more than 95,000 alliances that are grouped into seven arbitrary kinds: generic strategic alliances, joint ventures, licensing agreements, manufacturing agreements, marketing agreements, R&D agreements, and supply agreements. SDC collects data from numerous resources: SEC filings, similar filings in international settings, trade publications, and wires and news sources. From these sources, SDC collects data on more than 200 elements per alliance. Some of the noteworthy elements are company profiles of alliance members, company profiles of the joint venture (if the alliance constitutes creating a new company), capitalization value of the joint venture, source of funds, nature of alliance activity, alliance technique (i.e., technology transfer, cross technology transfer, distribution channeling, etc.), full deal description (i.e., what were the needs of the firms and how the alliance will meet such needs), list of historic events throughout the life span of the alliance, and related mergers and acquisitions purchase information. Considering the breadth and depth of SDC alliance data, it serves as the main source of data for my study. I will explain specific data elements and data compilation methods in the Variable Definitions and Operationalizations section.

It is important to note that termination data is only limitedly available in the SDC dataset. Also, SDC does not report the minority-equity status of alliances in any systematic manner. Thus, for every alliance within my sample, data on termination date and minority equity status is retrieved from the Factiva information universe—a joint venture of Dow Jones Interactive and Reuters.

4.2.2 Hoover's Online

Hoover's Online, recently acquired by Dun & Bradstreet, is an online database that offers proprietary business data. The data on each firm include a comprehensive profile, in-depth financials, competitors and competitive analysis, full list of key people and their designation, and relevant contact information. The eighty-member editorial team of Hoover's Online keeps track of 18,000 public and private companies. I use

Hoover's Online data on senior executives and their designations to determine the presence of alliance units.

4.3 Sample

4.3.1 Power Analysis

Statistical power refers to the probability of a significance test to rightfully reject a null hypothesis (Cohen, 1988). Statistical power analysis depends on "the relationships among the four variables involved in statistical inference: sample size (N), significance (α), population effect size (ES), and statistical power" (Cohen, 1992: 156). A priori power estimation methods vary across different types of significance tests. I use tobit and Cox regression (see section 4.5 for reasons and discussion)—two special forms of multiple regression—for my study. According to Cohen (1988: 444), the formula iteratively used to compute the required sample size to ensure desired level of statistical power in multiple regression analysis is as follows:

$$v = \frac{\lambda}{f^2} - u - 1$$

where v = a function of required sample size

λ = function of effect size index (i.e., $f^2 \times N$)

f^2 = effect size; measured as $R^2_{YB}/(1 - R^2_{YB})$, where R^2 is a common form of effect

u = number of independent variables

$N = v + u + 1$ (N is the desired sample size)

A trial value of v is initially selected from the λ tables. Then, if the computed N implies a substantially different value for v, the formula is used iteratively using the new v value.

A priori power analysis is useful in finding out the requisite sample size for detecting the population effect to be statistically significant at a certain level. Power analysis saves resources dedicated for research. If a researcher discovers that the minimum sample size needed to find statistically significant findings is far greater a number than s/he can manage, then there is no point in trying to conduct that research to begin with. Conversely, it is possible to find significance for even the most infinitesimal effect, given a large enough sample size. Therefore, with respect to research circumstances, it is necessary to assess the minimum effect size for which empirical investigation would be warranted. I used Borenstein, Cohen, and Rothstein's (1997) *Power and Precision* software, to run a power analysis for multiple regression. With a medium effect size ($f^2 = .10$), a moderate significance level ($\alpha = .05$), and a conventional power requirement of .80, the requisite sample size comes out to be 122. With a higher level of desired power of .95, the requisite sample size is 184. When data is scarce and increasingly expensive to acquire, a sample size larger than this would amount to waste of valuable resources. Using the same method, with a small effect size ($f^2 = .04$), a moderate significance level ($\alpha = .05$), and a conventional power requirement of .80, the requisite sample size is 314. To have power at .95 level, the sample size needs to be 481. Given the power analysis above, I would need a sample size of at least 122 alliances to detect the statistical significance of a medium effect of $f^2 = .10$ and conventional power of .80 (i.e., 20% probability of failing to reject the null hypothesis when it is false). Also, I would not need a sample of more than 481 alliances to detect even a small effect of $f^2 = .04$ with a high power of .95 (i.e., 5% probability of failing to reject the null hypothesis when it is false).

4.3.2 Population Characteristics

Alliances can be formed among many firms. In this study, however, the sample is limited to alliances formed between two firms only (please see Ch. 1 for reasons). These dyadic alliances may fall within any SIC code (i.e., 01 and 99, covering the complete range of industries). SIC code 01 to 09 is the division of agriculture, forestry, and fishing. SIC code 10 to 14 is the mining division. These two together capture raw materials type of goods. SIC code 15 to 17 is the construction division and SIC code 20 to 39 is the manufacturing division. Various kinds of services (e.g., transportation, communication, electric, gas, and sanitary) fall under SIC code 40 and 49. These groups capture the production of different goods and services. Wholesale and retail trades fall between SIC code 50 and 59, and capture marketing-related activities. SIC code 60 to 69 covers financial, insurance, and real estate firms. SIC code 70 to 89 covers various service firms, including hospitals, automotive repairs, motion pictures, educational institutions, and law offices. Finally, all public administration entities fall between SIC code 90 and 99. In terms of two-digit SIC classification, I look at 82 industries. Such a broad range is selected because it captures a large spectrum of commercial activities, which is also instrumental in having an adequate number of alliances of both horizontal and vertical types in my sample.

Considering the availability of more comprehensive coverage of alliance activities from 1992 by the SDC database, I decided to study alliances that were in existence during any part of a ten-year period between January 1, 1992 and December 31, 2001. The nature of the data is longitudinal. Longitudinal data is desirable, given the time-varying nature of some of the independent variables of this study, namely alliance experience with partner and asymmetry-adjusted combined alliance experience. More specifically, I am using pooled cross-sectional time series data (also known as panel data), which is both left and right censored. Alliances without formation data (i.e., since formation occurred before the beginning of 1994) are left censored and alliances without termination data (i.e., since termination did not occur by the end of 2001) are right censored. Considering the nature of the data, maximum likelihood tobit and Cox regression are appropriate statistical tests for this study (Maddala, 1983/1994; Morita, Lee, & Mowday, 1993).

4.3.3 Population Identification and Sampling Strategy

A total of 90,422 alliances were announced during January 1, 1985 and December 31, 2001. Of these, 69,169 alliances had been actually formed through formal signing. This is expected, since many deal negotiations are plagued by severe conflict and hard bargaining, such that the participants opt out of the negotiations without commencing a formal agreement. From these, I excluded alliances that had dubious status (e.g., letter of intent, pending, renegotiated, rumor discontinued, rumor, and seeking to form joint venture). All of these are pre-formation phases and should not be a part of the alliance dataset. This screening step dropped 72 alliances, leaving 69,097 in the dataset. Of these, 60,583 were dyads. Within the dyadic alliance population, I screened for alliances where the partners and alliance activities were located in the U.S. Since my study does not deal with any international variables, strictly focusing on U.S. alliances does not preclude the testing of any of the hypothesis. Moreover, alliance events of U.S. firms are more likely to receive press coverage, increasing the probability of gathering alliance termination data. This step reduced the population size to 15,561. Furthermore, since public firms are required to report on significant strategic moves (e.g., mergers, acquisitions, and alliances) and updated corporate structure, which are relevant to this study, screening for publicly held partnering firms is a logical and reasonable step. I also eliminated alliances that were terminated prior to January 1, 1992 (i.e., the beginning of the sampling period). The final sampling frame for this study comprises 3,695 alliances.

From this sampling frame of alliances, a sample of 1000 alliances is generated using random sampling. This allows room for missing data on as much as half of the sample. That is, even if complete data is available for only 50% of the sample, I would have sufficient number of cases with complete data (i.e., N = 500) to detect statistical significance of a small effect size at both $\alpha = .05$ and $\beta = .05$ (see subsection 4.3.1 for power analysis).

It is important to note that missing data is very common in alliance research. Of the randomly sampled 1000 alliances, 70 were incorrectly coded as alliances by SDC (i.e., they were instances of mergers, acquisitions, and capital investments). Alliance longevity data were unverifiable for another 384 alliances. Thus, the final workable sample constitutes 546 alliances. In this study, alliance longevity data is unavailable in approximately 40% of the random sample. Hence, the results of this study are only generalizable to the alliance population for which longevity data is available. Future studies can consider directly contacting alliances with unavailable longevity data to empirically investigate the existence of systematic bias.

4.4 Variable Definitions and Operationalizations

4.4.1 Dependent Variable: Alliance Longevity

The dependent variable in this study is alliance longevity. Consistent with prior research, alliance longevity is defined as the temporal period that an alliance remains operational (Barkema et al. 1997: 429). For purposes of calculation, the time span between the formation and dissolution of an alliance captures the alliance longevity. For refined assessments of alliance longevity, the time span is measured in terms of months (Pangarkar, 2003), as opposed to years (Barkema et al., 1997).

A few studies on alliance longevity have operationalized longevity in terms of hazard rate, which is the probability of an alliance's longevity to end at time *t*, given the alliance has remained operational for time *t*. I adopt this operationalization for the empirical analysis. This operationalization allows the use of Cox proportional hazards analysis, which is an appropriate way to analyze longitudinal data with time-varying independent variables (Hennart et al., 1998; Morita et al., 1993). Further discussion on model estimation and specification is in the next section. Converting alliance longevity data to alliance hazard rate is a two step process. First, survival function for the entire sample with censored data, based on the longevity of all alliances, is calculated as follows:

$$\hat{S}_{PL}(t) = \left(\frac{\text{number of surviving alliances after } t_1}{\text{number of surviving alliances just prior to } t_1}\right)\left(\frac{\text{number of surviving alliances after } t_2}{\text{number of surviving alliances just prior to } t_2}\right)\cdots\left(\frac{\text{number of surviving alliances after } t_j}{\text{number of surviving alliances just prior to } t_j}\right)$$

The survival value is then plugged into the hazard function below to obtain the hazard rate for the entire sample:

$$\hat{h}(t) = 1 - \frac{\hat{S}_{PL}(t)}{\hat{S}_{PL}(t-1)}$$

4.4.2 Independent Variables

There are five distinct independent variables in the model: alliance type, hierarchy of alliance structure, alliance experience with partner, number of partners with alliance units, and asymmetry-adjusted combined alliance experience. The last two independent variables are derived from firm level variables of presence of alliance units and general alliance experience respectively. These variables are defined and operationalized below.

Alliance Type. Alliance types are assessed by analyzing the nature of the connection between two alliancing firms. Following prior research, alliance partner's primary SIC code is used to assess the nature of connection between two alliance partners (Mowery et al., 1996; Park & Russo, 1996; Park & Ungson, 1997). Alliance partners are horizontally linked if their primary SIC code is identical at the four-digit level. All other remaining alliances are labeled vertical alliances.

Consider an alliance between Bristol-Myers Squibb and Cell Therapeutics. Both firms' primary SIC code is 2834 (Pharmaceutical Preparations). Therefore, the alliance will be labeled as a horizontal alliance. In contrast, the AOL-Sun alliance is a vertical one, since at the time of the alliance AOL's primary SIC code was 7379 (Computer Related Services, Not Elsewhere Classified) and Sun Microsystems's primary SIC code was 3571 (Electronic Computers). In this study, alliance type is a dichotomous, categorical variable. Horizontal alliances are coded as 0 and vertical alliances are coded as 1. Since this variable is derived from transaction cost economics, I avoided further classification of alliance type (e.g., in terms of related and unrelated diversification) because such classification is not pertinent to transaction cost arguments.

Hierarchy of Alliance Structure. Hierarchy of alliance structure refers to the degree to which formal structural features exist to control and coordinate alliance activities (Gulati & Singh, 1998). Nonequity structure is least hierarchical, since it does not employ any significant control or coordination mechanism, except for the contractual agreement. Minority equity structure is moderately hierarchical because exchange of minority equity stakes usually comes with a membership in the invested firm's board, which allows for some degree of control and coordination abilities to partnering firms. Joint venture is the most hierarchical because the creation of a separate autonomous company provides for various control and coordination features, such as incentive systems, internal pricing mechanisms, formal authority structures, operating procedures, and dispute resolution procedures. From the above explanation and following Gulati and Singh's (1998: 795) approach, alliance structures are coded in terms of their degree of hierarchy: nonequity structure = 1, minority equity structure = 2, and joint venture = 3. The above coding is in increasing order (i.e., ordinal scale), but does not necessarily reflect equal intervals. Ordinal regression programs (e.g., STATA 7.0) are able to convert this kind of coding to special forms of binary codes for calculation purposes (for details on statistical coding, please see Long and Freese, 2001).

Alliance Experience with Partner. Alliance experience with partner has been conceived as number of prior ties in previous studies (Gulati, 1995; Gulati & Singh, 1998; Pangarkar, 2003; Zollo et al., 2002). Hence, this variable has been operationalized as the number of alliances two partners have engaged in with each other in the past. Therefore, where N_{ij} is the number of alliances between firms i and j,

$$\text{Alliance Experience with Partner}_{ij} = N_{ij}$$

Alliance Units. This is a firm level construct. The existence of an alliance unit or alliance position is reflected by the assignment of a senior executive in charge of all alliance activities. It is reasonable to expect that a company with an alliance unit will have in its top management team a senior executive of alliances, who is exclusively responsible for successful planning and implementation of alliances. This is how Kale et al. (2002: 754) operationalize their construct called dedicated alliance function: "a position to manage or coordinate all alliance-related activity in the firm." They conceptualize a dedicated alliance function as an alliance unit from organizational structure perspective. Note that an alliance unit can comprise as few as one senior manager with no staff. Whether and to what degree alliance unit size affects alliance outcomes need to be researched in future studies. In this study, I am not analyzing these relationships because of complications in collecting relevant data (e.g., contacting each firm through a survey). Response rates of alliance-related surveys have been very low (as discussed in section 4.1), posing serious difficulty to collect primary data.

In Hewlett Packard (HP), Senior Manager Bill Russell is in charge of Global Alliances, HP Worldwide Operations. Hence, HP will be labeled as having an alliance unit. In contrast, Procter & Gamble (P&G) does not have any senior executive exclusively dealing with alliance-specific issues. Thus, P&G will be labeled as *not* having an alliance unit. Firm-specific complete lists of senior managers and their designations are available through Hoover's Online, which covers 18,000 public and private companies worldwide. Hoover's includes a variety of titles (e.g., senior manager, vice president, senior vice president, executive vice president, director, and chief alliance officer), as long as they are deemed executive positions within the company.

Number of Partners with Alliance Units. In dyadic alliances, three scenarios are possible with respect to partners having alliance units within their structures. Alliance units can be present in (a) neither firms, (b) any one firm, and (c) both firms. Applying this knowledge converts the firm level construct of alliance units to an alliance level construct of number of partners with alliance units. This is an interval scale with three possible outcomes: 0 (neither partner has an alliance unit), 1 (only one firm has an alliance unit), and 2 (both partners have alliance units).

General Alliance Experience. This is a firm level construct. Like the treatment of alliance experience with partner, scholars have operationalized this construct in terms of count measures as well (Kale et al., 2002; Zollo et al., 2002). In the following equation, alliance experience of the *i*th firm is the number (N) of its prior and current alliances (i.e., alliances formed before the focal alliance):

$$\text{General Alliance Experience}_i = N_i$$

Note that when measuring experience (with a specific partner or in general), all past alliances listed in the original, total SDC dataset (i.e., N = 69,097) are accounted for.

Asymmetry-Adjusted Combined Alliance Experience. Each alliance member brings into the alliance its respective general alliance experience. Combining general alliance experience of partnering firms is necessary to convert the firm level construct to an alliance level construct. Also, from the alliance's perspective, both partners' general alliance experiences play roles in influencing alliance outcomes. However, as discussed in detail in chapter 3, when combining general alliance experience of two partnering firms, the asymmetry in their alliance experience bases needs to be adjusted for. After adding the general alliance experience of two firms, the absolute difference of their general alliance experience is subtracted to adjust for the harmful effects of asymmetry in alliance experience bases. Asymmetry-adjusted combined alliance experience is operationalized as follows:

$$(N_i + N_j) - (|N_i - N_j|)$$

Consider the alliance between Amazon and Kozmo, formed in March 2000. At that time, Amazon had taken part in 12 alliances with 14 different partners. Therefore, Amazon's general alliance experience was 12 alliances. In contrast, in March, 2000, Kozmo had taken part in just one other alliance (with Starbucks), which was signed in February, 2000. Thus, Kozmo's general alliance experience was 1 alliance. Given this data, asymmetry-adjusted combined alliance experience would be $(12 + 1) - (|12 - 1|) = 13 - 11 = 2$ alliances. In contrast, if Amazon and Kozmo's general alliance experience were 6 and 7 alliances respectively (i.e., keeping the total number of alliances the same), asymmetry-adjusted combined alliance experience would be $(6 + 7) - (|6 - 7|) = 13 - 1 =$ 12 alliances.

4.4.3 Control Variables

Control variables are useful to adjust for effects of various related but extraneous factors that may confound the strength of the relationship observed through statistical analyses.

Predetermined Alliance Longevity. An alliance may cease to exist in a relatively short period of time because it has met its expected targets and/or projected duration. Even when the alliance is performing extremely well, partner firms are obliged to dissolve the alliance at the end of the stated expiration date. They may create another alliance immediately or renew the older alliance, which is considered a different alliance from the original one. For example, Texas Instruments and Hitachi initially formed an alliance in 1988 with a definitive alliance horizon of three years. Immediately after the fruitful completion of that alliance, the partners decided to establish another ten-year alliance in 1991. Notwithstanding the influence of type, structural hierarchy, experience, and alliance units on the 1988-alliance, its longevity was predetermined. Less than five percent of alliances have predetermined longevity in my sample. Similarly, Barkema et al. (1997) found 1 out of 31 alliances to have an explicitly stated life span. A dummy variable is created—1 if alliance longevity is determined during formation and 0 if alliance longevity is open-ended—to control for any effects that predetermined longevity might have on actual alliance longevity.

Size Differential. The size of partner firms in any given alliance can vary freely. As difference in size between partner firms increases, the communicative distance may also increase. Especially for the smaller firm, it may become very difficult to access the right personnel of the larger firm in making alliance-specific decisions. Thus, it is possible that despite favorable conditions, an alliance may be prematurely dissolved because of the excessive size differential that was hindering fruitful problem solving for the alliance. Size differential would not only impede relational embeddedness, but also hamper task accomplishment within the alliance. Firm size differential has been used as a control variable in studies on mergers and acquisitions (e.g., Banning, 1999; Ramaswamy, 1997) and strategic alliances (e.g., Artz & Norman, 2002; Gulati & Singh, 1998). Size differential is operationalized as the absolute difference between the asset size of two alliance partners *i* and *j*:

$$\text{Size Differential}_{ij} = |\text{Asset}_i - \text{Asset}_j|$$

Table 1 includes the definitions and operationalizations of the dependent, independent, and control variables of this study.

4.5 Model Estimation and Specification

In hypotheses 1 through 8, the dependent variable is alliance longevity. As explained earlier, this dependent variable is left and right censored. On one hand, alliances that were formed prior to 1992 but terminated after 1992 are left censored. On the other hand, alliances that were formed by 2001 and continued to be in existence beyond 2001 are right censored. The dependent variable, alliance longevity, is also defined by the "alliance dissolution" event. That is, alliance longevity data is only complete when "alliance dissolution" occurs. Thus, the dependent variable can be viewed as the hazard rate of alliances as well. Given the nature of this dependent variable, two statistical techniques are appropriate in testing hypotheses 1 through 8: tobit and Cox regressions. Both statistical techniques are used in this study to increase the robustness of the findings and offer multiple interpretations of the results.

4.5.1 Tobit Model with Left and Right Censoring

Determining the appropriate statistical model is a critical step in the design stage of the study. For hypotheses 1 to 8, the dependent variable—alliance longevity—is only accounted for during January 1, 1992 through December 31, 2001. Data on longevity cannot be fully known for alliances formed prior to January 1, 1992 and alliances continuing to remain operational after December 31, 2001. Thus, the dependent variable has a limited range, rendering ordinary least squares regression inappropriate (Greene, 1990). The tobit method, derived from the seminal contribution of Tobin (1958), appropriately specifies the statistical model for limited dependent variables. Several management scholars have utilized the tobit model when dealing with dependent variables of limited range (e.g., Amihud & Lev, 1981; Haunschild, 1993).

The tobit model begins with the assumption of an underlying latent dependent variable y^* (i.e., the alliance's (unobserved) propensity of experiencing a certain level of longevity). The latent variable produces the standard regression equation:

$$y_i^* = \beta' x_i + u_i \qquad \text{where } u_i \sim N(\mu, \sigma^2)$$

y^* is related to observed y_i in the following way:

$$y_i = L_i \qquad \text{if } y_i^* \leq L_i$$

$$y_i = y_i^* \qquad \text{if } L_i < y_i^* < U_i$$

$$y_i = U_i \qquad \text{if } y_i^* \geq U_i$$

where L_i and U_i are, respectively, the lower and upper limits of the dependent variable's range.

Tobit utilizes the maximum likelihood function. The idea here is "to find that set of estimates of the parameters that, if these parameter estimates were true of the population, would have most likely generated the observed sample data" (Breen, 1996: 18). Significance of individual coefficients is assessed with *t*-tests. With respect to the above notations, the maximum likelihood function (*ML*) of tobit model is written as follows:

$$ML(\beta, \sigma \mid y_i, x_i, L_i, U_i) = \prod_{y_i = L_i} \Phi\left(\frac{L_i - \beta\ x_i}{\sigma}\right) \prod_{y_i = y_i} \frac{1}{\sigma} \phi\left(\frac{y_i - \beta\ x_i}{\sigma}\right) \prod_{y_i = U_i} \left[1 - \Phi\left(\frac{U_i - \beta\ x_i}{\sigma}\right)\right]$$

where Φ is the distribution function and ϕ is the density function of the standard normal evaluated at $\beta\ x_i / \sigma$ (Maddala, 1983/1994: 152).

4.5.2 Cox Proportional Hazards Model

The dependent variable of alliance longevity in this study is the time between the formation of the alliance and the event that marks the end of longevity, namely alliance dissolution. Therefore, aside from using tobit regression, it is also appropriate to use survival analysis to specify the main model of this study (i.e., concerning hypotheses 1 to 8). Various techniques can be used to conduct survival analysis. Considering the nature of my independent variables—dichotomous (alliance type), ordinal scaled (hierarchy of alliance structure), continuous (number of firms with alliance units), and time-dependent (alliance experience)—regression analog technique is an appropriate choice (as discussed at length in Morita et al., 1993).

Following Morita et al.'s (1993) article on survival analysis, several management scholars have utilized survival analysis using the Cox proportional hazards model, i.e., Cox regression, in their studies (Hennart et al. 1998; Parker, Peters, & Turetsky, 2002; Trevor, 2001). Parker et al. (2002) apply Cox regression to investigate how distressed firms' survival depends on different corporate governance attributes and financial characteristics. Similarly, Shane and Foo (1999) use Cox regression to examine the role of institutional legitimacy on the survival of 1292 new American franchisors during 1979-1996. In organizational behavior, Trevor (2001) uses a hazard rate model applying Cox regression to study voluntary turnover as an outcome of ease of movement in the job market and job satisfaction.

In alliance research, Hennart et al. (1998) use Cox regression to specify their model. They compare the longevity of joint ventures with that of wholly-owned subsidiaries. They use the Cox proportional hazard model because it is well suited for longitudinal analysis and it permits the use of censored cases. Others studying alliance longevity have adopted alternative techniques to specify their alliance hazard functions (Barkema et al., 1997; Dussauge, Garrette, & Mitchell, 2000; Park & Russo, 1996; Park & Ungson, 1997). For example, the accelerated failure-time model has been used with a Weibull distribution (Barkema et al., 1997), lognormal distribution (Park & Russo, 1996; Park & Ungson, 1997), and gamma distribution (Dussauge et al., 2000). Accelerated failure-time models require a priori specification of the baseline hazard function's distribution. Considering the lack of any consensus regarding such a distribution, I need a technique that does not require such a priori specification of the baseline hazard function.

When a distribution of the baseline hazard function cannot be ascertained, the Cox proportional hazard model can be used (Cox, 1972). In Cox regression, hazard rate distribution is unspecified. Nevertheless, this technique allows the use of left and right censored data and also independent variables that are duration-dependent by nature (e.g., experience level).

Assumption of proportionality is key in Cox regression. The assumption is tested by comparing graphs of the cumulative baseline hazard function across levels of each predictor. Proportional lines can be parallel, converging, or diverging—they cannot, however, be a combination of these three characteristics. The idea is to check whether hazard lines due to different independent variables are proportional to the baseline hazard function. It must be noted here, even when proportionality assumption is not met, a stratified Cox proportional hazards model can be effectively used instead. According to Morita et al. (1993: 1449), "The presence of a multimodal distribution may suggest that a researcher should consider stratifying the population into meaningful subsets." Hence, baseline hazards of each stratum are potentially different from and are nonproportional to each other.

Based on the discussion so far, I will use the Cox proportional hazards model to specify the empirical model of this study (i.e., concerning hypotheses 1 to 8). The hazard function of this study is the conditional probability of an alliance's termination at time *t*, given the alliance has survived for time *t*. Formally,

$\hat{h}[t; X, Y(t)]$ = hazard function for alliance at time t, with time-independent predictor values of X and time-dependent predictor values of Y

$$= h_0(t)\exp[\hat{B}_1 X_{Type} + \hat{B}_2 X_{Hierarchy} + \hat{B}_3 X_{Type}X_{Hierarchy} + \hat{B}_4 Y(t)_{PartExp} + \hat{B}_5 X_{Hierarchy}Y(t)_{PartExp}$$
$$+ \hat{B}_6 X_{NumUnit} + \hat{B}_7 Y(t)_{GenExp} + \hat{B}_8 X_{NumUnit}Y(t)_{GenExp} + \hat{B}_9 X_{PreLong} + \hat{B}_{10} X_{SizeDif}]$$

In the above equation, $h_0(t)$ is the baseline hazard function. The part of the equation within the exponential resembles a simple regression equation, with the constant-multiplier subsumed by the baseline hazard function.

Tobit and Cox regression models are used to test all hypotheses that pertain to the principal dependent variable of this study—alliance longevity. These hypotheses are 1 through 8. Hypotheses 9 and 10 treat hierarchy of alliance structure as the dependent variable. The Tobit approach is inappropriate, since dependent variables for hypotheses 9 and 10 are neither censored nor truncated. Also, Cox regression is not appropriate to test these hypotheses, since they do not deal with alliance survival in any way. Hypotheses 9 and 10 can be specified by an ordered logit model.

4.5.3 Ordered Logit Model

Hypothesis 9 delineates the relationship between alliance type and hierarchy of alliance structure. Hypothesis 10 captures the relationship between alliance experience with partner and hierarchy of alliance structure. Here, the common dependent variable—hierarchy of alliance structure—has an ordinal scale. Nonequity structure is least hierarchical, minority equity structure is moderately hierarchical, and joint venture is most hierarchical. However, since the difference in the degree of hierarchy between different alliance structures is not equal or fixed, applying ordinary linear regression will produce biased results (Greene, 1990). Treating an ordered categorical variable in a nominal scale results in the unnecessary loss of information. The most appropriate model for ordered categorical dependent variables is the ordered probit or ordered logit model. While for most practical purposes, results of probit and logit are highly similar (Amemiya, 1981; Greene, 1990), the rationale for selecting either procedure is linked to the study design. Probit analysis assumes a normal distribution function and is appropriate when study design is experimental. This is generally not the case for strategic management research, where the nature of the data is largely observational. It is more appropriate to assume a logistic distribution vis-à-vis a normal distribution when analyzing observational data (*SPSS 11.5 Manual*). Thus, the ordered logit model is specified to test hypotheses 9 and 10.

The ordered logit model assumes that there is a continuous latent variable D with m-1 threshold points (where m is the number of categories in the ordinal dependent variable). Since there are three categories in my dependent variable, I have two threshold points δ_1 and δ_2. The value in the observable dependent variable (i.e., hierarchy of alliance structure) depends on the D scores vis-à-vis δ_1 and δ_2. Hence,

Hierarchy of alliance structure $_i$ = 1 if D_i is $\leq \delta_1$

Hierarchy of alliance structure $_i$ = 2 if $\delta_1 \leq D_i \leq \delta_2$

Hierarchy of alliance structure $_i$ = 3 if $D_i \geq \delta_2$

The latent variable D_i is estimated by $\hat{Z}_i$, where $\hat{Z}_i$ is the summation of the $\hat{\beta}$s for the k independent variables (i.e., alliance type and alliance experience with partner).

$$\hat{Z}_i = \sum_{k=1}^{k} \hat{\beta}_k X_k$$

The idea is to manipulate the $\hat{\beta}$s and δs to get the categorically fitted values as close as possible to the observed values in the dependent variable. In ordered logit model, the probability of hierarchy of alliance structure to be of a particular kind is expressed as follows:

$$P_{(\text{hierarchy of alliance structure} = 1)} = \frac{1}{1+\exp(Z_i - \delta_1)}$$

$$P_{(\text{hierarchy of alliance structure} = 2)} = \frac{1}{1+\exp(Z_i - \delta_2)} - \frac{1}{1+\exp(Z_i - \delta_1)}$$

$$P_{(\text{hierarchy of alliance structure} = 3)} = 1 - \frac{1}{1+\exp(Z_i - \delta_2)}$$

Tobit, Cox proportional hazards, and ordered logit analyses can all be done using STATA (see Frone, 1997 for a discussion). STATA and LIMDEP are arguably the most powerful econometric softwares to conduct statistical analyses of limited dependent variables. I will use STATA 7.0 to run empirical tests of the statistical models specified in this section.

CHAPTER 5

RESULTS

This chapter reports the results of the different statistical analyses conducted in this study. Descriptive statistics are presented first. Second, results of tobit and Cox regression analyses, testing alliance longevity hypotheses (i.e., hypotheses 1 through 8), are reported. In this section, coefficient signs and statistical significance levels are considered. Coefficient signs test whether the results are in the predicted directions of the hypotheses. Significance levels reveal the probability of incorrectly accepting the hypotheses in this study (i.e., incorrectly rejecting the null hypotheses). These two criteria satisfy the requirements of basic hypothesis testing. The third section discusses the magnitude of direct and moderating effects of the independent variables on alliance longevity. Here, marginal effects for tobit and hazard ratios for the Cox regression are reported. The fourth section contains results of hypotheses 9 and 10, pertaining to hierarchy of alliance structure. The results are summarized in the final section.

5.1 Descriptive Statistics

Empirical analyses of this dissertation are based on data from 546 dyadic alliances. 645 publicly traded U.S. firms formed these alliances. Complete longevity data are available for 240 alliances. Of the remaining 306 alliances, 20 were formed prior to 1992 (i.e., left censored) and 286 did not terminate by the end of 2001 (i.e., right censored). Such high skewness in the dependent variable is common and expected when dealing with longevity data. For alliances with complete longevity data, the average longevity was 30.72 months. Between the two alliance types studied in this dissertation, 30% were horizontal and 70% were vertical. In terms of alliance structure, 71% had nonequity structures, 7% had minority equity structures, and 22% had joint venture structures. In approximately 16% of the alliances, the partners had prior alliance experience with each other. Almost 80% of the partnering firms had some general alliance experience aside from the focal alliance. In terms of number of partners with alliance units, neither firm had a dedicated alliance role or unit in 75% of the alliances, while 22% had one partner with a dedicated alliance role or unit and only 3% had both partners with such a role or unit.

Following convention, the Pearson Product Moment correlation matrix is presented in Table 2. While such a matrix is useful to screen for possible multicollinearity, the correlations between the limited dependent variable and all other independent variables undermine the actual strength of the relationships. This is because the correlation computations do not account for the censored portions of the data. For the same reason, OLS regression is an inappropriate technique to analyze limited dependent variable data. Pearson correlations below 0.50 between all but two possible pairs of independent and moderating variables suggest that multicollinearity is not an influential force that may sway the results of the study (most pairwise correlations are below 0.30). The two instances of high correlations exist (a) between hierarchy of alliance structure and its interaction with alliance type ($r = 0.89$) and (b) between number of partners with alliance units and its interaction with asymmetry-adjusted combined alliance experience ($r = 0.85$). Hence, test results involving these particular interaction variables need to be interpreted cautiously (i.e., H3 and H8).

5.2 Tobit and Cox Regression Techniques

5.2.1 Differences

Given the limited range of the dependent variable tobit analysis is well suited to yield robust and interpretable results. Additionally, since alliance longevity depends on some underlying hazard function, survival analysis (i.e., Cox Proportional Hazards Model) also produces meaningful results.

As a regression technique, tobit is much more prevalent than Cox. This is because the data must be linked to the survival of the subject in Cox regression, but no such restriction exists for tobit regression. In statistical analysis of longevity data, tobit and Cox regressions are both able to analyze limited range dependent variables. They differ in terms of their treatment of the dependent variable, however. On one hand, tobit regression tests the maximum likelihood of alliance longevity to exceed a certain level. On the other hand, Cox regression tests likelihood of alliance termination at time t, given the alliance has survived time t. In other words, while the tobit technique focuses on the likelihood of ongoing survival, the Cox technique focuses on the end of survival (subject to previous longevity). Therefore, tobit and Cox techniques seem to analyze the same phenomenon from two different sides.

5.2.2 Assumptions

The tobit methodology assumes that the standard error of the prediction has a normal distribution and is not heteroskedastic. Histogram of the standard error of the prediction fit well with the standard normal distribution line. To assess heteroskedasticity, I ran the Breusch-Pagan test (Breusch & Pagan, 1979). As presented in Table 3A, the Breusch-Pagan χ^2 statistic is significant at $p < 0.001$ level, confirming a low level of heteroskedasticity in the standard error of the prediction.

The Cox Proportional Hazards model is based on the proportionality assumption. This means that the data on each independent variable need to affect the baseline hazard rate proportionally. The proportionality assumption in Cox regression is validated by the Schoenfeld test (*STATA* 7.0). If the χ^2 significance level for each independent and moderating variable is greater than 0.10, the proportionality assumption is met. Results in Table 3B effectively validate the proportionality assumption.

5.3 Tobit and Cox Regression Analyses of Alliance Longevity

Tobit and Cox regression results, testing hypotheses 1 through 8, are presented in this section. Each hypothesis pertaining to alliance longevity is tested by both Tobit regression and Cox regression methods. Control variables are first tested separately in Model 1, then by adding independent variables in Model 2. After testing all five independent variables separately, their simultaneous effects are tested by running the analyses with all five independent variables in the same model. When testing moderating variables, I used the two independent variables of interest and their interaction term. Moderating variables are tested in Model 3. Lastly, the overall model, comprising both independent and moderating variables, is tested.

Building on transaction cost economics, I argued that alliance type (H1, +), hierarchy of alliance structure (H2, +), and alliance experience with partner (H4, +) influence alliance longevity. I also hypothesized that hierarchy of alliance structure influences the longevity of horizontal alliances more than vertical alliances (H3, –), and that alliance experience with partner weakens the relationship between hierarchy of alliance structure and alliance longevity (H5, –). Hypotheses 6 through 8 were advanced in light of the dynamic capabilities perspective. I argued that number of partners with alliance units (H6, +) and asymmetry-adjusted combined alliance experience (H7, +) positively affect alliance longevity. I also hypothesized that asymmetry-adjusted combined alliance experience positively influences the relationship between number of partners with alliance units and alliance longevity (H8, +).

All the results presented in this chapter are controlled for predetermined longevity and asset differential. According to the results, predetermined longevity is a statistically significant predictor of alliance longevity ($p < 0.001$ for tobit and $p < 0.05$ for Cox). Asset differential appears not to be a significant predictor of alliance longevity.

As presented in Table 4A, after controlling for predetermined longevity and asset differential, tobit analysis yields a statistically significant positive relationship ($p < 0.001$) between alliance type and alliance longevity. That is, vertical alliances are more likely to experience greater longevity than horizontal alliances, lending support for hypothesis 1. In Table 4B, after controlling for longevity and asset differential, Cox Proportional Hazards analysis offers modest statistical support ($p < 0.10$) that vertical alliances experience lower termination hazards than horizontal alliances, reinforcing the findings of the Tobit analysis. Therefore, alliance type is positively related to alliance longevity (i.e., coding vertical alliances as 1 and horizontal alliances as 0).

Hypothesis 2 predicted a positive relationship between hierarchy of alliance structure and alliance longevity. Empirical results in Tables 5A and 5B, however, suggest the relationship to be in the opposite direction. After controlling for predetermined longevity and asset differential, both tobit ($p < 0.001$) and Cox ($p < 0.01$) coefficients for hierarchy of alliance structure are significant in the opposite direction of that hypothesis. The reverse direction of the finding warrants further discussion.

According to the results, hierarchy of alliance structure is negatively related to alliance longevity. This finding is in stark contradiction to mainstream transaction cost economics reasoning. A possible explanation is along the lines of bureaucratic costs. While transaction cost economics advocates the use of more hierarchical governance mechanisms in the face of relational hazards, bureaucratic costs associated with running more hierarchical structures is not critically assessed by the theory. The results seem to suggest that more hierarchical structures are simply too expensive to use in alliances that are meant to last for a very long term. Transaction cost economists may argue that greater longevity allows alliances additional time to recuperate their investments into hierarchical governance. Initial investments (e.g., equity purchasing fees and expenses of procuring joint venture facilities) are one-time expenditures, which can be recuperated when alliances last long enough. In contrast, bureaucratic costs (e.g., salaries of alliance managers and support staff, expenses of maintaining alliance offices) are ongoing, which increase linearly over time. Thus, the longer the alliance survives, the greater would be the amount of resources invested to simply run the more hierarchical structure of the alliance.

Transaction cost economics only focuses on relational hazards and suggests use of hierarchical governance as a response to relational crises. However, when relational crises are not imminent, I argued that alliances would benefit from coordination facilities. Again, coordination features are critically important in highly interdependent alliances, e.g., R&D agreements and co-development projects. These tend to be formed by horizontal partners. Hence, it seems that features of structural hierarchy—control and coordination—are very useful in horizontal alliances. Nevertheless, the opportunity costs of maintaining a hierarchy may actually deter firms from using them when not needed. If firms form joint ventures when they are not needed, then the bureaucratic costs may bring down the alliance performance. This may make partners less motivated to continue with the alliance. The preceding discussion explains reverse results in hypothesis 2.

Results of both tobit and Cox analyses offer strong support for hypothesis 4 (note that results for hypothesis 3 are reported later in this section, since it involves a moderating relationship), which predicts a positive relationship between alliance experience with partner and alliance longevity. After entering the control variables, the tobit coefficient is significant at $p < 0.001$ level and the Cox coefficient is significant at $p < 0.05$ level (see Tables 6A and 6B).

The zero-order effect of number of partners with alliance units on alliance longevity is statistically significant, lending support for hypothesis 6 (note that results for hypothesis 5 are reported later in this section, since it involves a moderating relationship). Both tobit and Cox coefficients are significant at $p < 0.001$ and $p < 0.05$ levels respectively, when predetermined longevity and asset differential are controlled for (see Tables 7A and 7B).

The fifth and final independent variable is asymmetry-adjusted combined alliance experience. This variable was log-converted for testing purposes because its range was otherwise too large. As predicted in hypothesis 7, the positive effect of this variable on alliance longevity was strongly supported by both tobit and Cox regression results. As Table 8A suggests, after controlling for predetermined longevity and asset differential, the tobit coefficient was significant at $p < 0.001$ level. Similarly, as Table 8B suggests, Cox coefficient for this variable was significant at $p < 0.05$ level.

So far, I have reported the significance of zero-order regression coefficients for the five independent variables of this study. Except for the main effect of hierarchy of alliance structure, the main effects of the other four independent variables were supported when tobit and Cox regressions had been run separately for each of them. The implicit assumption in this kind of testing is that when the effect of one independent variable is analyzed the influences of all other variables are held constant. However, the true test of significance of the effects of these five independent variables would be through simultaneously testing all five independent variables in the same model. Results of tobit analysis in Table 9A suggest that when all five independent variables are tested together (after adding the control variables), their effects remain significant at 0.001 level. Results of Cox Proportional Hazards analysis in Table 9B reveal more modest findings. While the signs of all five main effects remain unchanged, the significance level is $p < 0.05$ for alliance type, not significant for hierarchy of alliance structure, $p < 0.10$ for alliance experience with partner, not significant (p < 0.12, which is very close to the 0.10 threshold) for number partners with alliance units, and not significant for asymmetry-adjusted combined alliance experience.

Overall, the results of the direct relationships between alliance longevity and the five independent variables of this study were encouraging. Now, results of moderating variables will be discussed, as a precursor to presenting the results of the full model comprising both independent and moderating effects.

To test each of the three moderating effects in this study, I simultaneously analyzed the effects of the independent as well as the moderating effects. According to tobit results in Table 10A, hierarchy of alliance structure influences horizontal alliances' longevity more than it influences vertical alliances' longevity ($p < 0.001$). Similarly, the Cox coefficient says that hierarchy of alliance structure decreases the hazards in horizontal alliances more than it decreases the hazards in vertical alliances. However, results from the Cox regression, presented in Table 10B, are statistically non-significant. Given the strong correlation between hierarchy of alliance structure and its interaction with alliance type ($r = 0.89$), the lack of significance in Cox regression results may be attributable to multicollinearity, which can suppress the significance of the effect of at least one of the highly correlated variables. Overall, hypothesis 3 is at best partially supported by the results obtained from tobit and Cox regressions.

Hypothesis 5 predicts a negative moderating effect of alliance experience with partner on the relationship between hierarchy of alliance structure and alliance longevity. Tobit regression coefficients for the interaction term of hierarchy of alliance structure and alliance experience with partner is in the predicted direction and statistically significant at $p < 0.001$ level, after accounting for control variables and main effects (see Table 11A). Cox regression coefficients offer comparatively modest results (see Table 11B). They are also in the predicted direction and statistically significant at the $p < 0.10$ level.

Finally, a third moderating influence, involving number of partners with alliance units and asymmetry-adjusted combined alliance experience, is predicted in hypothesis 8. Asymmetry-adjusted combined alliance experience is expected to positively influence the relationship of number of partners with alliance units and alliance longevity. The tobit and Cox regression results are statistically significant for this hypothesis, but in the reverse direction from what were predicted (see Tables 12A and 12B). Hence, results did not support hypothesis 8. The reverse direction of this moderating relationship warrants further discussion.

The reverse results of hypothesis 8 appear to be counterintuitive. Hypothesis 8 stated that asymmetry-adjusted combined alliance experience would strengthen the relationship between number of partners with alliance units and alliance longevity. Following the dynamic capabilities perspective (Eisenhardt & Martin, 2000; Zollo et al., 2002), I argued that general alliance experience of partnering firms would serve as the raw materials that alliance units would process to generate alliance-specific knowledge. This reasoning overlooks two critical issues: (1) the diminishing utility of additional general alliance experience and (2) the need of managerial resources to codify additional alliance experience to gain useful knowledge of effective alliance management.

In particular, if one general alliance experience is largely similar to that of another general alliance experience, then additional asymmetry-adjusted combined alliance experience will become a burden to alliance units that are responsible for coding and disseminating knowledge derived from such experience. On one hand, the potential to gain new alliance specific knowledge decreases as partnering firms acquire more and more general alliance experience. On the other hand, the managerial resources needed to codify and disseminate knowledge from these experiences remain at about the same level. It is likely that alliance units will be pressed for resources to effectively manage alliance activities when the task of coding and disseminating knowledge from additional alliance experiences would otherwise engage the units. This explains the reverse results of hypothesis 8.

I also ran tobit and Cox analyses for the complete model, comprising five independent and three moderating variables. In the overall model, presence of multicollinearity makes results for two predictor variables unstable. First, hierarchy of alliance structure's coefficient sign changes direction when its interaction with alliance type is included in the model. This is presumably due to multicollinearity, as the correlation between the two variables is 0.89. Second, the coefficient sign changes for the interaction of number of partners with alliance units and asymmetry-adjusted combined alliance experience. This change may also be attributable to multicollinearity, as the correlation between number of partners with alliance units and the interaction term in question is 0.85. Apart from these two instances, tobit coefficient signs and significance levels presented in Table 13A remained unchanged in the complete model.

However, Cox regression results presented in Table 13B were weakened when all independent and moderating variables were run simultaneously (after controlling for predetermined longevity and asset differential). Alliance experience with partner was significant at $p < 0.05$ level. Significance levels for alliance type ($p < 0.117$) and number of partners with alliance units ($p < 0.102$) marginally crossed the 0.10 threshold of significance. Hierarchy of alliance structure and asymmetry-adjusted combined alliance experience were not significant in the overall model. Results of the interaction terms were consistent with results from previous runs involving two main effects and one interaction effect. Cox regression coefficient for hierarchy of alliance structure×alliance experience with partner was significant at $p < 0.10$ level. However, Cox coefficients for alliance type×hierarchy of alliance structure and number of partners with alliance units×asymmetry-adjusted combined alliance experience were not significant.

5.4 Magnitude of Tobit and Cox Regression Effects on Alliance Longevity

While coefficient signs and significance levels of the effects are sufficient to test the hypotheses addressed in this study, analyses of the magnitudes of the effects provide a richer interpretation of the results. However, magnitude of effects from the tobit regression is not readily interpretable. Unlike OLS coefficients, the tobit coefficients do not reflect the magnitude of the marginal effects of changes in the independent variables on the expected value of the dependent variable. This obstacle is overcome through McDonald and Moffitt's (1980) decomposition, which effectively expresses the tobit coefficient in terms of marginal effects. Marginal effects of each predictor variable are available for both (a) data that account for the censored part and (b) data that are strictly uncensored. While the tables present both columns, the discussion below refer to marginal effects that were computed after accounting for censored data.

According to Table 14A, after controlling for predetermined longevity and asset differential, vertical alliances are 1.0349 times more likely to experience a longer longevity than horizontal alliances (H1, +). Zero order hazard rates of alliance type, obtained from Cox regressions, are consistent with the tobit findings. As presented in Table 14B, vertical alliances are 0.7254 times as likely to experience a termination compared to horizontal alliances.

As reported in the previous section, the results did not support the positive relationship hypothesized between hierarchy of alliance structure and alliance longevity (H2, +). Zero order effect of hierarchy of alliance structure reveals that alliances with one more layer of hierarchy in their structure (i.e., minority equity over nonequity and joint venture over minority equity) are 1.0563 times less likely to survive longer than their counterparts (see Table 15A). Now, the hazard ratio of hierarchy of alliance structure obtained from Cox regression is 1.2362, which means alliances with an extra layer of hierarchy in their structures are 1.2362 times as likely to experience terminations before alliances without the extra layer of hierarchy (see Table 15B).

Table 16A presents the zero order tobit effect of alliance experience with partner, which suggests that a marginal increase in alliance experience with partner makes the alliance 1.0403 times more likely to experience a greater longevity (H4, +). In terms of Cox regression results presented in Table 16B, a marginal increase in alliance experience with partner reduces the hazard ratio to 0.8386, suggesting that such alliances are only 0.8386 times as likely to experience a termination compared to alliances where partners have one fewer alliance engagement with each other.

The magnitude of tobit and Cox regression effects for number of partners with alliance units was impressive. Tobit results in Table 17A, suggest that alliances with a marginal increase in the number of partners with alliance units (i.e., from 0 to 1 and 1 to 2) are 1.1061 times more likely to have a greater longevity than alliances without such a marginal increase (H6, +). In Table 17B, the hazard ratio of 0.6882 suggests that, alliances with one additional partner with alliance units are 0.6882 times as likely to terminate compared to alliances without such a condition. In other words, the termination hazards reduce by one third when alliance partners have alliance management roles or units.

Interpretation of tobit and Cox results of asymmetry-adjusted combined alliance experience becomes complicated as this independent variable is log-converted in the dataset. The marginal effects are of log-converted values of asymmetry-adjusted combined alliance experience. Hence, tobit effect in Table 18A says alliances with a marginal increase in the log of asymmetry-adjusted combined alliance experience are 1.0296 times more likely to experience a greater longevity than alliances without such a marginal increase (H7, +). In terms of hazard ratios presented in Table 18B, a marginal increase in the log of asymmetry-adjusted combined alliance experience reduces the hazard ratio for the alliance to 0.8997.

When all five independent variables are tested simultaneously, their respective effects become somewhat smaller vis-à-vis their zero-order effects. As presented in Table 19A, alliances are likely to experience greater longevity if they are of vertical type versus horizontal type (1.0582 times), have a marginal increase in alliance experience with partner (1.0260 times), have a marginal increase in number of partners with alliance units (1.0713 times), and have a marginal increase in the log of asymmetry-adjusted combined alliance experience (1.0084 times). Alliances with a marginal increase in hierarchy of alliance structure are 1.0374 times more likely to have a shorter longevity than alliances without such an increase. In terms of Cox hazard ratios presented in Table 19B, alliances are likely to experience a lower probability of termination if they are of vertical type versus horizontal type (hazard ratio of 0.6703), have a marginal increase in alliance experience with partner (hazard ratio of 0.8736), have a marginal increase in number of partners with alliance units (hazard ratio of 0.7710), and have a marginal increase in the log of asymmetry-adjusted combined alliance experience (hazard ratio of 0.9866). In contrast, alliances with a marginal increase in hierarchy of alliance structure have a hazard ratio of 1.1630.

In this dissertation, three moderating relationships have been tested as well. Moderating relationships are captured by interaction terms. For example, the interaction term of alliance type and hierarchy of alliance structure captures the moderating influence of hierarchy of alliance structure on the relationship between alliance type and alliance longevity. The interaction term is negative as predicted, which means that hierarchy of alliance structure weakens the relationship between alliance type and alliance longevity (H3, –). While longevity of vertical alliances is greater than horizontal alliances, the difference in longevity becomes smaller when a more hierarchical structure is adopted. According to the tobit effect presented in Table 20A, a marginal increase in the interaction term of alliance longevity and hierarchy of alliance structure affects alliance longevity of horizontal and vertical types in such a way that vertical alliances are 1.0228 times less likely than before to have a greater longevity than horizontal alliances. In terms of Cox regression, presented in Table 20B, the interaction term of alliance type and hierarchy of alliance structure has a hazard ratio of 0.8796, which means that a marginal increase in hierarchy of alliance structure makes vertical alliances vis-à-vis horizontal alliances 0.8796 times more likely than before to experience a premature termination.

Following transaction cost arguments, greater hierarchy helps horizontal alliances overcome both control and coordination needs, making them more enduring. However, greater hierarchy has no such effect on vertical alliances. Thus, when compared between vertical and horizontal alliances, the hazards decrease for horizontal alliances in the presence of greater hierarchy and have little effect on vertical alliances.

Another moderating relationship of interest is the influence of alliance experience with partner on the relationship between hierarchy of alliance structure and alliance longevity (H5, –). In Table 21A, tobit effect of the interaction term of hierarchy of alliance structure and alliance experience with partner says that a marginal increase in the interaction term decreases the likelihood of longevity 1.0613 times for alliances that are more hierarchically structured vis-à-vis those that are not as hierarchically structured. That is, the hypothesized positive relationship between hierarchy of alliance structure and alliance longevity weakens as the positive influences of alliance experience with partner substitute the control and coordination features of more hierarchical structures. The results point out a negative relationship between hierarchy of alliance structure and alliance longevity. As I discussed earlier, the negative relationship is well explained by the potential bureaucratic costs associated with more hierarchical structures. Thus, unless it is really warranted for, having a more hierarchical structure may pose unnecessary strain on the alliance partners to not only make profit out of the alliance, but also to match the bureaucratic costs of running the hierarchical structure. This negative effect can diminish in the presence of more alliance experience with partner, because less bureaucracy is needed in the presence of trust (which is an expected outcome of more alliance experience with partner). As presented in Table 21B, Cox hazard ratio for the interaction term is 1.2257, which means that a marginal increase in the interaction term of hierarchy of alliance structure and alliance experience with partner makes the alliance 1.2257 times less likely to terminate when alliances are less hierarchical as opposed to more hierarchical. In other words, a marginal increase in alliance experience with partner makes alliances with one fewer layer of structural hierarchy 1.2257 times less likely to terminate than alliances with one more layer of structural hierarchy.

The third moderating relationship deals with asymmetry-adjusted combined alliance experience and number of partners with alliance units. As reported earlier, results did not support this hypothesis. As log of asymmetry-adjusted combined alliance experience increases, it makes alliances with a higher number of partners with alliance units 1.0071 times more likely to survive longer than alliances with one fewer partner with alliance units (see Table 22A). Along the same lines, Cox hazards ratio for the interaction term is 1.0521, which means alliances with a higher number of partners with alliance units are 1.0521 times as likely as other alliances to terminate in the presence of a marginal increase in the log of asymmetry-adjusted combined alliance experience (see Table 22B).

Finally, all five independent effects and three moderating effects were tested simultaneously. The magnitudes of the effects are generally reduced compared to zero-order effects. However, the presence of the interaction terms increases the risk of multicollinearity, making the results unstable. The marginal tobit effects for the overall model are reported in Table 23A and Cox hazard ratios are reported in Table 23B.

5.5 Logistic Regression Analysis of Hierarchy of Alliance Structure

Hypotheses 9 and 10 predicted relationships of hierarchy of alliance structure with alliance type and alliance experience with partner. Since data on hierarchy of alliance structure have an ordinal scale, ordered logit was run to test these hypotheses.

The zero-order effect of alliance type on hierarchy of alliance structure is statistically not significant. The coefficient sign is not in the predicted direction either. In contrast, the zero-order effect of alliance experience with partner on hierarchy of alliance structure is statistically significant at $p < 0.10$ level. The coefficient sign follows the predicted direction. When both independent variables are entered simultaneously in the model, the significance levels and the coefficient signs remain unaltered. Therefore, results in Table 24 do not find a significant relationship between alliance type and hierarchy of alliance structure (H9, –), but they suggest a significant negative relationship between alliance experience with partner and hierarchy of alliance structure (H10, –).

Hypothesis 9 is rejected as the results suggest that alliance type does not significantly relate to hierarchy of alliance structure. The sign of the coefficient is positive, which is opposite from the predicted direction. However, the effect is not large enough to be significant in the opposite direction. Here, transaction cost reasoning did not hold true under empirical investigation. It seems, partnering firms are more concerned about potential bureaucratic costs and are not very keen to use more hierarchical alliance structures as a means to overcome potential relational hazards common in horizontal alliances.

In terms of the magnitude of effects, the results in Table 25 suggest that hierarchy of alliance structure is expected to be greater for vertical alliances than for horizontal alliances. The odds of vertical alliances having a greater hierarchy of alliance structure are 0.1317 times more than the odds of horizontal alliances. The results also suggest that for each additional alliance experience with partner, the odds of having a greater hierarchy of alliance structure decrease 0.2645 times.

5.6 Results Summary

As Table 26 suggests, the results presented in this chapter fully supported three and partially supported four of the ten hypotheses. Hypotheses 4, 5, and 10 were fully supported. Hypotheses 1, 3, 6, and 7 were partially supported. Hypotheses 2, 8, and 9 were not supported. Coefficient signs of tobit and Cox regressions were generally consistent. This consistency increases the robustness of the results, suggesting that the results are not sensitive to specific statistical techniques (as long as they are appropriate). Overall, the results of this study are encouraging. In the next and final chapter of this dissertation, I will discuss these findings in theoretical and applied terms.

CHAPTER 6

DISCUSSION AND CONCLUSIONS

While strategic alliances are inherently temporary systems, a dearth of research exists on the temporal duration of their effectiveness. This is most likely due to focus on growth and profitability as the criterion of interest in alliance research, rendering survival as an axiom. The lack of theoretical understanding of alliance longevity has managerial implications as well. Many promising alliances fail to produce satisfactory results because of their inadequate longevity, which remains an elusive concept to alliance practitioners. This dissertation addressed these theoretical and applied needs for research, advancing existing knowledge on alliance longevity.

Transaction cost economics and the dynamic capabilities perspective served as the theoretical backdrop for this study. The five independent variables were: alliance type, hierarchy of alliance structure, alliance experience with partner, number of partners with alliance units, and asymmetry-adjusted combined alliance experience. Three moderating relationships were also hypothesized. Two additional hypotheses captured a couple of interrelationships among the independent variables. The data generally supported the hypotheses (i.e., seven of the ten hypotheses were supported). In the next section, I discuss the overall findings.

6.1 Overall Findings

The empirical results supported seven of the ten hypotheses advanced by this dissertation. Of the five main effect hypotheses, four were supported. Of the three moderating effect hypotheses, two were supported. And, of the two hypotheses capturing the interrelationships among the independent variables, one was supported.

I hypothesized a main effect relationship for each of the five structural determinants of alliance longevity. As reported in chapter 5, results supported the hypotheses capturing the relationships of alliance longevity with alliance type (H1), alliance experience with partner (H4), number of partners with alliance units (H6), and asymmetry-adjusted combined alliance experience (H7). While I hypothesized a positive relationship between hierarchy of alliance structure and alliance longevity (H2), the results suggested a statistically significant opposite relationship. I explained this reversed finding in terms of partnering firms' concerns for bureaucratic costs, which are not explicitly accounted for in transaction cost economics. Presumably, high bureaucratic costs of more hierarchical structures exceed the transaction cost economizing benefits of such structures. This is especially the case when alliances are not expected to experience very high levels of relational hazards (usually in vertical alliances).

Interaction effects of this study were limitedly supported. Hypothesis 3 predicted that hierarchy of alliance structure would increase the longevity of horizontal alliances more than it would increase the longevity of vertical alliances. The results were at best modest. Due to the high sensitivity of the tobit technique, even a small marginal effect was large enough to be statistically significant. In contrast, the Cox hazard ratio was too small to be statistically significant. Hypothesis 5 predicted that greater alliance experience with partner would weaken the relationship between hierarchy of alliance structure and alliance longevity. For this hypothesis, the tobit and Cox results were in their predicted direction and statistically significant. Lastly, hypothesis 8 predicted that asymmetry-adjusted combined alliance experience would strengthen the relationship between number of partners with alliance units and alliance longevity. The results, however, were in the opposite direction of what was hypothesized. The results suggested that asymmetry-adjusted combined alliance experience weakened the relationship between number of partners with alliance units and alliance longevity.

The reverse direction of the results for the interaction of number of partners with alliance units and asymmetry-adjusted combined alliance experience was explained in chapter 5 in light of diminishing marginal utility of experience. Hypothesis 8 stated that asymmetry-adjusted combined alliance experience would strengthen the relationship between number of partners with alliance units and alliance longevity. In developing this hypothesis, I did not consider the diminishing effect of additional general alliance experience by the partnering firms. In particular, if one general alliance experience is largely similar to the next general alliance experience, then additional asymmetry-adjusted combined alliance experience will become a burden to alliance units that are responsible for coding and disseminating knowledge derived from the experience. It is likely that alliance units will be pressed for resources to effectively manage the alliances when the task of coding additional experience would otherwise engage the units.

The tobit model appeared to be highly sensitive compared to the Cox model in finding statistical significance. Cox significance levels served as a check to the very high significance levels determined by tobit results. In terms of effect sizes, however, both tobit and Cox results were comparable.

Other than the eight hypotheses pertaining to alliance longevity, two additional hypotheses, involving hierarchy of alliance structure with alliance type and alliance experience with partner, were advanced. Results suggested a statistically significant negative relationship between alliance experience with partner and alliance longevity (H10), but did not offer any significant support for the relationship between alliance type and alliance longevity (H9). Concerns of bureaucratic costs may have intimidated partnering firms of both horizontal and vertical alliances from adopting more hierarchical alliance structures. This explains the non-significant finding of hypothesis 9.

Lastly, a cautionary note on generalizability needs to be addressed. Generalizability of the overall findings is limited to the extent to which longevity data were verifiable for the alliance. Of the 1000 alliances randomly sampled from the sampling frame, 70 were mislabeled as alliances when they were actually mergers, acquisitions, or capital investments and alliance longevity data were not verifiable for another 384 alliances. The results of this study do not tell us anything about the longevity of such alliances that do not have verifiable longevity data. More specifically, the findings of this study are relevant and applicable to dyadic U.S. domestic alliances formed by publicly traded firms, for which alliance longevity data are verifiable (i.e., confirmed ongoing status or termination).

6.2 Theoretical Contributions

While scholars have considered alliance longevity as a measure of alliance performance, they have not theorized about alliance longevity as a meaningful concept in itself. Consequently, recent reviews of the alliance literature have not recognized studies on alliance longevity (Gray, 1994; Gulati, 1998). The current research addressed this void in the alliance literature. This section discusses the theoretical contributions of the current research.

First, there is clearly a bias on the parts of both strategy researchers as well as practitioners to focus excessively on performance. Alliance longevity is axiomatic in alliance performance research, because partnering firms need sufficient time in their alliances to achieve satisfactory performance. Taking a step backward, this study inquires what determines longevity in alliances. As a response, this research offers a model of structural determinants of alliance longevity. Hence, the core theoretical contribution of this dissertation is the development of a structural model of alliance longevity.

It should be noted that alliance longevity is not simply a proxy for alliance performance, but rather a separate concept in itself. Whereas longevity has a survival orientation, performance has a growth orientation. Admittedly, survival is necessary to allow growth in alliances. However, this does not mean that greater alliance longevity will ensure better alliance performance. That is, adequate alliance longevity is necessary, but not a sufficient condition, for satisfactory alliance performance.

Second, in developing this model, I integrated transaction cost and dynamic capabilities perspectives to examine five factors that determine alliance longevity. I theorized that alliance type, hierarchy of alliance structure, alliance experience with partner, number of partners with alliance units, and asymmetry-adjusted combined alliance experience are all relevant in understanding alliance longevity.

The variables in the research model are integrated on the basis of their contributions to either the relational and/or operational functioning of alliances. While transaction cost economics is concerned about relational hazards and associated governance mechanisms in alliances, it does not recognize the role of partnering firms' alliance capabilities. In contrast, the dynamic capabilities literature focuses on how alliance experience and alliance units generate alliance capabilities, but the theory does not address relational hazards and governance adequately. Thus, transaction cost economics and the dynamic capabilities perspective address relational and operational aspects of alliances respectively. According to Colombo (2003: 1224), "bringing the consideration of firms' idiosyncratic capabilities into the governance question, as is suggested by the competence-based literature, is a valuable complementary addition to more traditional arguments based on TCE [transaction cost economics] and other contractual theories." Since relational and operational aspects influence alliance longevity in complementary ways, combining the determinants derived from these two theoretical perspectives results in an integrated model of alliance longevity.

Also, since alliances involve independent firms, research needs to simultaneously deal with alliance and firm level concepts. The theoretical perspectives on which this dissertation is developed—transaction cost economics and the dynamic capabilities perspective—meet that need. While in transaction cost economics the unit of analysis is the transaction (e.g., alliance), in the dynamic capabilities perspective it is the firm. Thus, determinants of alliance longevity derived from these theoretical perspectives simultaneously deal with alliance and firm level issues. This argument suggests that the research model of this dissertation is theoretically integrated.

Third, building on the relationship between alliance type and alliance structure, this study extended the application of transaction cost logic to examine the independent as well as the moderating effects of alliance type and hierarchy of alliance structure on alliance longevity. While conceptually it is argued that hierarchy of alliance structure is positively related to alliance longevity, empirical results were significant in the opposite direction. Apparently, transaction cost economics did not explain alliance longevity as expected. On one hand, it was hypothesized and empirically observed that vertical alliances with a lower probability of relational hazards were more likely to experience a longer longevity than horizontal alliances. On the other hand, contrary to transaction cost economics reasoning, hierarchy of alliance structure was negatively related to alliance longevity. As I explained in the previous chapter, it appears that partnering firms' concerns of high bureaucratic costs may be exceeding the marginal control and coordination benefits of more hierarchical alliance structures. Thus, in an attempt to extend transaction cost economics logic to explain alliance longevity, an unprecedented realization here is the need to incorporate the concept of bureaucratic costs to the existing theoretical framework of transaction cost economics.

Formally, transaction cost economics states that firms exist in order to reduce transaction costs incurred in market-based exchanges (Coase, 1937). Examples of transaction costs include screening for reliable business partners, negotiating deals, drafting contracts, and monitoring partners' activities. For firms engaging in alliances, transaction costs decrease as more hierarchical structures (i.e., minority equity over nonequity and joint venture over minority equity) are adopted to govern the alliances. However, bureaucratic costs or the costs of managing more hierarchical alliance structures (e.g., salaries of managers and staff engaged in alliance activities and expenses of maintaining an alliance office) are not accounted for in transaction cost economics.

Apparently, transaction costs and bureaucratic costs are inversely related to each other. On one hand, while bureaucratic costs are low in market-like transactions, transaction costs are high. On the other hand, while transaction costs decrease when more hierarchical governance structures are adopted, bureaucratic costs of managing such structures increase. Thus, the choice of governance structure, as explained by transaction cost economics, needs to account for added bureaucratic costs while attempting to minimize transaction costs. If the expected decrease in transaction costs were less than the potential increase in bureaucratic costs, then the choice of more hierarchical structures would have economic justification. However, there may be times (e.g., in vertical alliances and repeated ties) when the expected reduction in transaction costs is not large enough to match the associated increase in bureaucratic costs. Transaction cost logic ought to be revised under such circumstances. The theory needs the following caveat: More hierarchical structures may not lead to economizing of overall costs for the firm, when the potential reduction of transaction costs is not large enough to match the associated addition of bureaucratic costs.

Fourth, scholars have criticized transaction cost economics' static nature (i.e., focusing on one transaction) and have called for a dynamic orientation of transaction cost economics that considers multiple transactions over time (Rindfleisch & Heide, 1997). To that end, to account for the development of relationships between partnering firms over multiple alliances, the effects of prior alliance engagements between partnering firms were considered. The statistically significant results reconfirm the value of extending transaction cost economics over the course of multiple alliances.

Fifth, this study also includes concepts from the dynamic capabilities perspective with alliances. Prior studies have not taken into account roles of partnering firms' general alliance experience and alliance unit on alliance longevity simultaneously in the same model. While the dynamic capabilities perspective is a firm level theory, I transformed its firm level variables to apply them to the alliance level. For example, existence of alliance unit in firm structure (Kale et al., 2002) was transformed to number of partners with alliance units. Similarly, partnering firms' general alliance experience (Simonin, 1997; Zollo et al., 2002) was transformed to asymmetry-adjusted combined alliance experience. These transformations allowed for the inclusion of structural variables that have not been examined at the alliance level before.

Finally, dynamic capabilities scholars have argued that general alliance experience can be processed and transformed to valuable alliance management knowledge (Eisenhardt & Martin, 2000). Additionally, recent findings by Kale et al. (2002) suggest that alliance units gather, interpret, codify, and disseminate knowledge from general alliance experience. Building on these premises, I argued that more general alliance experience meant more ingredients to create alliance management knowledge. However, the statistically significant reverse findings required some alternative explanation. Apparently, the current version of the dynamic capabilities perspective does not consider the diminishing marginal utility of additional experience. There is also no consideration of the resources needed to interpret and codify additional experience. Results suggest that the marginal utility of incremental asymmetry-adjusted combined alliance experience diminishes, but the resources needed to interpret and codify additional alliance experience remains at about the same level. Thus, the dynamic capabilities perspective needs to account for these complexities.

6.3 Managerial Implications

Systematic understanding of alliance longevity has several implications for managers who are charged with overseeing alliance operations. First, this study conveys to alliance practitioners the importance of alliance longevity. Alliance managers need to recognize that greater alliance longevity translates to more time to work on the alliance to yield satisfactory results. They should also realize that alliances that show satisfactory intermediate results are likely to get subsequent chances of surviving and producing more advanced results. This positive spiral not only extends alliance longevity, but also positively affects alliance performance. Awareness of the structural determinants of alliance longevity would enable practitioners to extend the longevity of their alliances by incorporating appropriate structural mechanisms.

To that end, this study conceptually argued that there are five structural determinants of alliance longevity: alliance type, hierarchy of alliance structure, alliance experience with partner, number of partners with alliance units, and asymmetry-adjusted combined alliance experience. With the exception of hierarchy of alliance structure, the other four structural variables positively influenced alliance longevity at statistically significant levels. The results inform alliance managers about the specific structural conditions they need to focus on to increase the likelihood of achieving greater longevity for their alliances. The relative magnitude of their effects allows managers to prioritize among structural determinants and decide which ones they want to focus on before the others.

For example, since vertical alliances last longer than horizontal alliances, alliance practitioners would be better off seeking partners that are not direct competitors. However, this may not be a realistic option in many instances. In horizontal alliances, managers should adopt a more hierarchical structure (e.g., joint venture or minority equity) to govern the collaborative venture. This is because the results suggest that more hierarchical structures would decrease the difference in expected longevity of horizontal and vertical alliances.

Also, alliance practitioners should consider engaging in repeated ties with the same partner. Results of this study suggest that relational and operational difficulties of managing collaborative projects decrease when partnering firms have had prior alliance experience with each other. It is also important to realize that general alliance experience can extend alliance longevity. However, if partnering firms of an alliance have different levels of general alliance experience, that difference may have potential negative effects on the focal alliance's longevity. I accounted for such asymmetry in partnering firms in two steps. First, I added general alliance experience of both partnering firms. Then, I subtracted from the sum the difference in alliance experience between the partnering firms. Therefore, alliance practitioners need to be concerned with general alliance experience of their own firms as well as that of their prospective partners. General alliance experience of the potential partner should be included in the checklist when managers engage in partner selection process.

Furthermore, alliance practitioners should take note of the value of establishing a dedicated alliance role or unit. Such a role or unit is not only involved in interpreting, codifying, and disseminating alliance-specific knowledge throughout the firm (so that the knowledge can be used in other alliances), but also exclusively engaged in effectively managing all alliances of the firm. Ironically enough, such a structural feature is present in just 5% of the partnering firms in this study. Allocating a Vice President of Alliances position with necessary office staff would meet this need. Alliance managers should seriously consider investing in a dedicated alliance role or unit, particularly if their firm might engage in many alliances in the future.

Notwithstanding the merits of an alliance role or unit, managing such a role or unit is expensive. Thus, alliance practitioners planning to invest in this structural feature should take into account their firms' expected number of alliances and their significance. The dynamic capabilities of alliancing generated by the alliance unit have to be applicable to a large pool of significant alliances in order to realize a net gain from the alliance unit investment. The greater the expected number of alliances and their significance, the higher would be the potential benefits from an alliance role or unit.

Lastly, as the results suggest, adopting more hierarchical structure is unlikely to lengthen alliance longevity. This finding is at odds with the transaction cost logic.

Moreover, several very well known joint ventures that have survived for decades (e.g., GE-SNECMA and Dow-Corning) influence managerial perception that more hierarchical alliance structures are associated with greater longevity. Given the theoretical view and managerial perception of a positive association between hierarchy of alliance structure and alliance longevity, the results of a negative relationship between these variables in this study are startling. Alliance practitioners should note that unless very high relational hazards are anticipated, hierarchy of alliance structure will negatively influence alliance longevity. The marginal benefit of having more hierarchical alliance structure will not be enough to offset the incremental bureaucratic costs of managing such structures, especially when severe relational hazards are not apprehended (e.g., in vertical alliances).

Given the discussion above, alliance managers should consider having a hierarchical structure more so when their alliances are of the horizontal type as opposed to the vertical type. However, as discussed earlier, results suggest that the concerns for high bureaucratic costs weigh in so much on managers of both horizontal and vertical alliances that alliance type has no significant relationship with hierarchy of alliance structure. This is alarming, because hierarchy of alliance structure may have substantial transaction cost economizing effect in horizontal alliances to offset its bureaucratic costs. In short, the lesson for alliance practitioners regarding alliance structuring is twofold. One, adopting a more hierarchical alliance structure without much consideration to its real need and usage will most likely have an adverse effect on alliance longevity. Additionally, despite high bureaucratic costs of more hierarchical structures, alliance managers ought to carefully consider adopting such a structure when engaging in horizontal alliances with a competitor for the first time (i.e., since relational hazards are apprehended to be very high).

6.4 Limitations and Future Research

Notwithstanding the theoretical and applied contributions of this research, various limitations exist. The current research may also be extended in several paths. A key limitation of this research stems from the assumption that greater alliance longevity is a desirable and positive state. The validity of this assumption is questionable, because partnering firms' inertia can allow poorly performing, undesirable alliances to continue with their survival. The research model of this study is unable to account for such phenomenon.

Second, in this study, no distinction was made between alliance terminations with and without the dissolution of the partnering firms. Of the 261 termination cases, 10 were associated with the bankruptcy of one of the partnering firms. Whether poor alliance performance caused a partnering firm to go bankrupt or the bankruptcy of a partnering firm forced the alliance to terminate is indeterminable from the secondary data examined here. Future research collecting primary data on alliances should consider this issue and account for this limitation. If primary data were to suggest that bankruptcies of the firms caused the termination of their alliances, then such bankruptcy events would have to be controlled for before testing alliance longevity models.

Third, this research integrated structural determinants derived from transaction cost and dynamic capabilities perspectives. These theories were considered because of their distinct but complementary nature. However, it may be possible to enrich the current structural model of alliance longevity by including variables from game and network theories. Future research should incorporate insights from game theory and network theory to introduce new structural determinants of alliance longevity.

For example, the type of game (e.g., TIT FOR TAT, STAG HUNT, and DEADLOCK) characterizing the alliance may affect the nature of relationship between the relational ties, limiting or extending alliance longevity. In his lab experiment, Axelrod (1984) observed that the TIT FOR TAT game performed better than any other games. He argued that fear of future retributions (i.e., shadow of the future) encouraged cooperative behavior rather than defection. In another study, Parkhe (1993) found that pattern of payoffs (i.e., payoffs from mutual or unilateral cooperation and mutual or unilateral defection) is significantly related to alliance performance. Thus, game type characterizing an alliance relationship may be an influential determinant of alliance longevity.

Concepts from network theory have the potential to explain alliance longevity too. For example, the resources available within the network would determine the extent to which member firms value their network membership. This in turn is likely to decrease the probability of defection by any partnering firm as long as the alliance is with another firm within the same network. Also, indirect linkages between partnering firms through common suppliers or vendors may have a strong influence in fostering interfirm trust. The "strength of weak ties" may positively influence alliance longevity (Granovetter, 1973).

Another limitation of this study is that it cannot explain longevity of multi-partner alliances. While dyadic alliances comprise 87.5 percent of the alliance population, another 12.5% are multi-partner alliances. To date, there has been very little empirical research on multi-partner alliance outcomes. This is partly due to the assumption that results of dyadic alliance research can be extended to understand multi-partner alliance dynamics. Moreover, the increasing difficulty and confusion in collecting multi-partner alliance data has resulted in a dearth of empirical research on multi-partner alliances. Recent conceptual research by Das and Teng (2002) and Zeng and Chen (2003) suggests that dyadic and multi-partner alliances have different dynamics. Given their different dynamics, offering a separate longevity model for multi-partner alliances (in addition to the current model for dyadic alliances) would be beyond the scope of this dissertation.

Fifth, while alliance longevity may be affected by structural, market, legal, and political conditions, I focused exclusively on structural determinants of alliance longevity in this dissertation. Such a focused approach was adopted for a couple of reasons. First, partnering firms are more able to control their structural conditions vis-à-vis their market, legal, or political conditions. Second, structural conditions explain alliance longevity at the alliance level, whereas market, legal, or political conditions more likely explain alliance longevity at the industry level. Hence, an extension of the current research should explore market, legal, and political conditions affecting alliance longevity.

I also did not include international alliances in the empirical research, as the structural variables derived from transaction cost economics and the dynamic capabilities perspective do not explain the subtle complexities and challenges that international alliances face. Consequently, the results of this study pertain to U.S. domestic alliances only. Nevertheless, cultural differences may be a salient determinant of international alliance longevity. Accounting for cultural differences would complement the structural variables of the alliance longevity model developed in this study.

Finally, strategic alliances with different purposes, such as R&D, supply procurement, marketing, co-production, and co-development, may have different expectations and utilities of longevity. For example, R&D alliances may be destined to higher rates of failure than are marketing agreements because of the uncertainty associated with R&D. Thus, alliance longevity of a certain level may be considered adequate for R&D alliances, but inadequate for marketing alliances that assume ongoing marketing support from the partners.

In this final chapter of the dissertation, I have discussed both theoretical and applied contributions of this study. I also noted the limitations and the potentials for extensions of the current research. Scholars are encouraged to replicate this study while trying to overcome some of the limitations that are mentioned here. Such research coupled with various other extensions mentioned here will continue to further our theoretical and applied knowledge on effective management of alliances.

TABLE 1

DEFINITIONS AND OPERATIONALIZATIONS OF VARIABLES

	Definition	Operationalization	Scale	Studies with Similar Approach
Dependent Variable				
Alliance Longevity	The time span between an alliance's formation and its dissolution	- For Maximum Likelihood Tobit: Termination Date – Formation Date - (for Cox Proportional Hazard) $\hat{S}_{PL}(t) = \left(\frac{\text{number of surviving alliances after t1}}{\text{number of surviving alliances just prior to t1}}\right)\left(\frac{\text{number of surviving alliances after t2}}{\text{number of surviving alliances just prior to t2}}\right)\cdots\left(\frac{\text{number of surviving alliances after tj}}{\text{number of surviving alliances just prior to tj}}\right)$	Interval	Haunschild (1993); Hennart et al. (1998)
Independent Variables				
Alliance Type	The classification of alliances in terms of the nature of interfirm connection, i.e., horizontal vs. vertical	Horizontal alliances (same four-digit primary SIC code) = 0 Vertical alliances (different four-digit primary SIC code) = 1	Nominal (Dichotomous)	Mowery et al. (1996); Park & Russo (1996); Park & Ungson (1997)
Hierarchy of Alliance Structure	The degree to which control and coordination of joint activities are institutionalized and formalized	Nonequity structure = 1 Minority equity structure = 2 Joint venture = 3	Ordinal	Gulati & Singh (1998)
Alliance Experience with Partner	The number of all prior and current alliances that two partnering firms have engaged in with each other	Alliance Experience with $\text{Partner}_{ij} = N_{ij}$	Interval (Continuous)	Gulati (1995)
Asymmetry-Adjusted Combined Alliance Experience	Asymmetry-adjusted sum of the numbers of all prior and current alliances that each partnering firm has engaged in	$(N_i + N_j) - (\|N_i - N_j\|)$	Interval (Continuous)	(Zollo et al., 2002) Note: Previous studies have not adjusted for asymmetry in partnering firms' alliance experience
Number of Partners with Alliance Unit	Number of partners that have an organizational unit or senior executive position to exclusively manage all alliance activities of the firm	Neither partner has an alliance unit = 0 Only one firm has an alliance unit = 1 Both partners have alliance units = 2	Interval (Continuous)	Kale et al. (2002) Note: Previous studies have not converted this firm-level construct to an alliance-level one
Control Variables				
Predetermined Alliance Longevity	The existence of an explicitly stated alliance expiration date	Alliance longevity is determined during formation = 1 Alliance longevity is open-ended = 0	Nominal (Dichotomous)	Previous studies have not used this control variable
Size Differential	The difference between partnering firms' asset sizes	Size $\text{Differential}_{ij} = \|\text{Asset}_i - \text{Asset}_j\|$	Interval (Continuous)	Gulati & Singh (1998); Artz & Norman (2002)

TABLE 2

PEARSON PRODUCT MOMENT CORRELATIONS, MEANS, AND STANDARD DEVIATIONS

Variable	Mean	Standard Deviation	Alliance Longevity	Alliance Type	Hierarchy of Alliance Structure	Alliance Experience with Partner	Asymmetry-Adjusted Combined Alliance Experience	Number of Partners with Alliance Units	Alliance Type × Hierarchy of Alliance Structure	Hierarchy of Alliance Structure × Alliance Experience with Partner	Asymmetry-Adjusted Combined Alliance Experience × Number of Partners with Alliance Units	Pre-determined Longevity	Asset Differential
Alliance Longevity	30.7167	20.8484	1.0000										
Alliance Type	0.1923	0.3945	0.0035	1.0000									
Hierarchy of Alliance Structure	0.5055	0.8289	0.0083	-0.0622	1.0000								
Alliance Experience with Partner	0.2766	0.8665	-0.0009	-0.0002	-0.0851*	1.0000							
Asymmetry-Adjusted Combined Alliance Experience (log converted)	2.1804	1.6162	0.1461*	0.0249	-0.2260***	0.4413***	1.0000						
Number of Partners with Alliance Units	0.2802	0.5107	-0.0079	0.1054*	-0.2269***	0.2102***	0.3122***	1.0000					
Alliance Type × Hierarchy of Alliance Structure	0.0769	0.3654	0.0277	0.4318***	0.3318***	-0.0557	-0.0640	-0.0666	1.0000				
Hierarchy of Alliance Structure × Alliance Experience with Partner	0.0788	0.4839	0.0069	-0.0603	0.2528***	0.2674***	0.1062*	-0.0598	-0.0136	1.0000			
Asymmetry-Adjusted Combined Alliance Experience × Number of Partners with Alliance Units	0.8682	1.8919	-0.0075	0.1083*	-0.1961***	0.3917***	0.5147***	0.8542***	-0.0604	-0.0324	1.0000		
Predetermined Longevity	0.0952	0.2938	0.0069	0.0475	-0.0775†	-0.0820†	-0.0101	-0.0070	0.0171	-0.0529	-0.0282	1.0000	
Asset Differential	25096.4	52227.6	0.0373	-0.1277*	0.0225	0.0508	0.1138*	0.0751	-0.0337	0.0999*	0.1025*	-0.0067	1.0000

$\dagger$ $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 3A

BREUSCH-PAGAN TEST OF HETEROSKEDASTICITY IN STANDARD ERROR*

Variable Name	χ^2	Degrees of Freedom	Significance Level
Standard Error	79.05***	1	0.001

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

* A significance level less than 0.10 for the χ^2 statistic of the Breusch-Pagan test suggests that distribution of the standard error is not heteroskedastic

TABLE 3B

SCHOENFELD TEST TO VALIDATE COX PROPORTIONALITY ASSUMPTION*

Variable Name	χ^2	Degrees of Freedom	Significance Level
Alliance Type	0.38	1	0.5361
Hierarchy of Alliance Structure	0.02	1	0.8762
Alliance Experience with Partner Number	1.04	1	0.3083
Asymmetry-Adjusted Combined Alliance Experience	1.60	1	0.2058
Number of Partners with Alliance Units	0.05	1	0.8314
Type Hierarchy	0.29	1	0.5896
Hierarchy Partner Experience	0.01	1	0.9293
Unit Combined Experience	0.01	1	0.9416
Global Test	4.59	8	0.8000

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

* A significance level greater than 0.10 for each variable and the global test validates the proportionality assumption

TABLE 4A

ZERO-ORDER TOBIT COEFFICIENT, STANDARD ERROR, AND SIGNIFICANCE LEVEL OF ALLIANCE TYPE

	Model 1			Model 2		
Variables	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level
Predetermined Longevity	-41.3572***	2.9949	0.001	-40.5041***	2.9954	0.001
Asset Differential	0.000038*	0.000017	0.026	0.000032†	0.000017	0.063
Alliance Type				12.6744***	2.3789	0.001
Constant	172.9842***	1.4810	0.001	162.7586***	2.3695	0.001
Log Likelihood $L(\beta)$	-42937.214			-42923.068		
Likelihood Ratio χ^2 (significance)	193.36*** (0.001)			221.65*** (0.001)		
N	20293			20293		

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 4B

ZERO-ORDER COX COEFFICIENT, STANDARD ERROR, AND SIGNIFICANCE LEVEL OF ALLIANCE TYPE

Variables	**Model 1**			**Model 2**		
	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level
Predetermined Longevity	0.4390*	0.2208	0.047	0.4446*	0.2209	0.044
Asset Differential	0.000001	0.000001	0.534	0.000001	0.000001	0.428
Alliance Type				-0.3210†	0.1812	0.076
Log Likelihood $L(\beta)$	-852.6254			-851.1390		
Likelihood Ratio χ^2 (significance)	3.95 (0.14)			6.92† (0.10)		
N	18174			18174		

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 5A

ZERO-ORDER TOBIT COEFFICIENT, STANDARD ERROR, AND SIGNIFICANCE LEVEL OF HIERARCHY OF ALLIANCE STRUCTURE

	Model 1			Model 2		
Variables	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level
Predetermined Longevity	-41.3572***	2.9949	0.001	-45.4385***	2.9671	0.001
Asset Differential	0.000038*	0.000017	0.026	0.000068***	0.000017	0.001
Hierarchy of Alliance Structure				-21.0342***	1.1256	0.001
Constant	172.9842***	1.4810	0.001	182.0329***	1.6211	0.001
Log Likelihood $L(\beta)$	-42937.214			-42760.634		
Likelihood Ratio χ^2 (significance)	193.36*** (0.001)			546.52*** (0.001)		
N	20293			20293		

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 5B

ZERO-ORDER COX COEFFICIENT, STANDARD ERROR, AND SIGNIFICANCE LEVEL OF HIERARCHY OF ALLIANCE STRUCTURE

	Model 1			**Model 2**		
Variables	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level
Predetermined Longevity	0.4390*	0.2208	0.047	0.4784*	0.2218	0.031
Asset Differential	0.000001	0.000001	0.534	0.000001	0.000001	0.676
Hierarchy of Alliance Structure				-0.2120*	0.0945	0.025
Log Likelihood $L(\beta)$	-852.6254			-850.2771		
Likelihood Ratio χ^2 (significance)	3.95 (0.14)			8.65* (0.05)		
N	18174			18174		

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 6A

ZERO-ORDER TOBIT COEFFICIENT, STANDARD ERROR, AND SIGNIFICANCE LEVEL OF ALLIANCE EXPERIENCE WITH PARTNER

	Model 1			Model 2		
Variables	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level
Predetermined Longevity	-41.3572***	2.9949	0.001	-34.0818***	2.9637	0.001
Asset Differential	0.000038*	0.000017	0.026	0.000023	0.000017	0.172
Alliance Experience with Partner				15.2302***	0.8216	0.001
Constant	172.9842***	1.4810	0.001	162.4621***	1.4697	0.001
Log Likelihood $L(\beta)$	-42937.214			-42712.679		
Likelihood Ratio χ^2 (significance)	193.36*** (0.001)			642.43*** (0.001)		
N	20293			20293		

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 6B

ZERO-ORDER COX COEFFICIENT, STANDARD ERROR, AND SIGNIFICANCE LEVEL OF ALLIANCE EXPERIENCE WITH PARTNER

	Model 1			Model 2		
Variables	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level
Predetermined Longevity	0.4390*	0.2208	0.047	0.3456	0.2226	0.121
Asset Differential	0.000001	0.000001	0.534	0.000001	0.000001	0.488
Alliance Experience with Partner				-0.1761*	0.0725	0.015
Log Likelihood $L(\beta)$	-852.6254			-848.5483		
Likelihood Ratio χ^2 (significance)	3.95 (0.14)			12.10** (0.01)		
N	18174			18174		

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 7A

ZERO-ORDER TOBIT COEFFICIENT, STANDARD ERROR, AND SIGNIFICANCE LEVEL OF NUMBER OF PARTNERS WITH ALLIANCE UNITS

	Model 1			**Model 2**		
Variables	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level
Predetermined Longevity	-41.3572***	2.9949	0.001	-38.2887***	2.9527	0.001
Asset Differential	0.000038*	0.000017	0.026	0.000011	0.000017	0.526
Number of Partners with Alliance Units				39.8337***	1.8650	0.001
Constant	172.9842***	1.4810	0.001	160.0152***	1.4747	0.001
Log Likelihood $L(\beta)$	-42937.214			-42688.337		
Likelihood Ratio χ^2 (significance)	193.36*** (0.001)			691.11*** (0.001)		
N	20293			20293		

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 7B

ZERO-ORDER COX COEFFICIENT, STANDARD ERROR, AND SIGNIFICANCE LEVEL OF NUMBER OF PARTNERS WITH ALLIANCE UNITS

Variables	Model 1 Coefficient	Model 1 Standard Error	Model 1 Significance Level	Model 2 Coefficient	Model 2 Standard Error	Model 2 Significance Level
Predetermined Longevity	0.4390*	0.2208	0.047	0.4141†	0.2211	0.061
Asset Differential	0.000001	0.000001	0.534	0.000001	0.000001	0.442
Number of Partners with Alliance Units				-0.3737*	0.1605	0.020
Log Likelihood $L(\beta)$	-852.6254			-849.6239		
Likelihood Ratio χ^2 (significance)	3.95 (0.14)			9.95 (0.05)		
N	18174			18174		

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 8A

ZERO-ORDER TOBIT COEFFICIENT, STANDARD ERROR, AND SIGNIFICANCE LEVEL OF ASYMMETRY-ADJUSTED COMBINED ALLIANCE EXPERIENCE

	Model 1			Model 2		
Variables	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level
Predetermined Longevity	-41.3572***	2.9949	0.001	-38.9658***	2.9394	0.001
Asset Differential	0.000038*	0.000017	0.026	-0.000000	0.000017	0.987
Asymmetry-Adjusted Combined Alliance Experience				11.0520***	0.5842	0.001
Constant	172.9842***	1.4810	0.001	139.653***	2.0982	0.001
Log Likelihood $L(\beta)$	-42937.214			-42752.866		
Likelihood Ratio χ^2 (significance)	193.36*** (0.001)			562.05*** (0.001)		
N	20293			20293		

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 8B

ZERO-ORDER COX COEFFICIENT, STANDARD ERROR, AND SIGNIFICANCE LEVEL OF ASYMMETRY-ADJUSTED COMBINED ALLIANCE EXPERIENCE

	Model 1			Model 2		
Variables	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level
Predetermined Longevity	0.4390*	0.2208	0.047	0.3925†	0.2217	0.077
Asset Differential	0.000001	0.000001	0.534	0.000001	0.000001	0.408
Number of Partners with Alliance Units				-0.1057*	0.0476	0.026
Log Likelihood $L(\beta)$	-852.6254			-850.1503		
Likelihood Ratio χ^2 (significance)	3.95 (0.14)			8.90* (0.05)		
N	18174			18174		

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 9A

SIMULTANEOUS TOBIT COEFFICIENTS, STANDARD ERRORS, AND SIGNIFICANCE LEVELS OF ALL INDEPENDENT VARIABLES

	Model 1			Model 2		
Variables	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level
Predetermined Longevity	-41.3572***	2.9949	0.001	-35.5289***	2.9226	0.001
Asset Differential	0.000038*	0.000017	0.026	0.000008	0.000017	0.634
Alliance Type				20.7548***	2.3715	0.001
Hierarchy of Alliance Structure				-14.1092***	1.1430	0.001
Alliance Experience with Partner				9.8188***	0.9109	0.001
Number of Partners with Alliance Units				26.9237***	1.9741	0.001
Asymmetry-Adjusted Combined Alliance Experience				3.1871***	0.6765	0.001
Constant	172.9842***	1.4810	0.001	137.3788***	2.9272	0.001
Log Likelihood $L(\beta)$	-42937.214			-42427.598		
Likelihood Ratio χ^2 (significance)	193.36*** (0.001)			1212.59*** (0.001)		
N	20293			20293		

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 9B

SIMULTANEOUS COX COEFFICIENTS, STANDARD ERRORS AND SIGNIFICANCE LEVELS OF ALL INDEPENDENT VARIABLES

	Model 1			Model 2		
Variables	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level
Predetermined Longevity	0.4390*	0.2208	0.047	0.3807†	0.2241	0.089
Asset Differential	0.000001	0.000001	0.534	0.000001	0.000001	0.393
Alliance Type				-0.4000*	0.1839	0.030
Hierarchy of Alliance Structure				0.1510	0.0989	0.127
Alliance Experience with Partner				-0.1351†	0.0817	0.098
Number of Partners with Alliance Units				-0.2600	0.1706	0.127
Asymmetry-Adjusted Combined Alliance Experience				-0.0135	0.0576	0.815
Log Likelihood $L(\beta)$	-852.6254			-843.6793		
Likelihood Ratio χ^2 (significance)	3.95 (0.14)			21.84** (0.01)		
N	18174			18174		

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 10A

MODERATED TOBIT COEFFICIENT, STANDARD ERROR, AND SIGNIFICANCE LEVEL OF ALLIANCE TYPE×HIERARCHY OF ALLIANCE STRUCTURE

Variables	Model 1			Model 2			Model 3		
	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level
Predetermined Longevity	-41.3572***	2.9949	0.001	-44.3791***	2.9660	0.001	-45.0481***	2.9778	0.001
Asset Differential	0.000038*	0.000017	0.026	0.000062***	0.000017	0.001	0.000060***	0.000017	0.001
Alliance Type				15.4203***	2.3597	0.001	18.8582***	2.6778	0.001
Hierarchy of Alliance Structure				-21.4818***	1.1275	0.001	-14.2152***	2.9154	0.001
Alliance Type×Hierarchy of Alliance Structure							-8.5105**	3.1528	0.007
Constant	172.9842***	1.4810	0.001	169.76***	2.4109	0.001	167.0874***	2.5878	0.001
Log Likelihood $L(\beta)$	-42937.214			-42739.357			-42735.701		
Likelihood Ratio χ^2 (significance)	193.36*** (0.001)			589.07*** (0.001)			596.38*** (0.001)		
N	20293			20293			20293		

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 10B

MODERATED COX COEFFICIENT, STANDARD ERROR, AND SIGNIFICANCE LEVEL OF ALLIANCE TYPE×HIERARCHY OF ALLIANCE STRUCTURE

Variables	Model 1			Model 2			Model 3		
	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level
Predetermined Longevity	0.4390*	0.2208	0.047	0.4852*	0.2217	0.029	0.4819*	0.2218	0.030
Asset Differential	0.000001	0.000001	0.534	0.000001	0.000001	0.561	0.000001	0.000001	0.558
Alliance Type				-0.3456†	0.1815	0.057	-0.2902	0.2088	0.165
Hierarchy of Alliance Structure				0.2232*	0.0949	0.019	0.3252	0.2032	0.109
Alliance Type×Hierarchy of Alliance Structure							-0.1283	0.2291	0.576
Log Likelihood $L(\beta)$	-852.6254			-848.5673			-848.4146		
Likelihood Ratio χ^2 (significance)	3.95 (0.14)			12.07 (0.017)			12.37* (0.030)		
N	18174			18174			18174		

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 11A

MODERATED TOBIT COEFFICIENT, STANDARD ERROR, AND SIGNIFICANCE LEVEL OF HIERACHY OF ALLIANCE STRUCTURE×ALLIANCE EXPERIENCE WITH PARTNER

Variables	Model 1			Model 2			Model 3		
	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level
Predetermined Longevity	-41.3572***	2.9949	0.001	-38.5398***	2.9466	0.001	-33.9066***	2.9188	0.001
Asset Differential	0.000038*	0.000017	0.026	0.000050**	0.000017	0.003	0.000057***	0.000017	0.001
Hierarchy of Alliance Structure				-18.3442***	1.1164	0.001	-9.1538***	1.2283	0.001
Alliance Experience with Partner				13.8492***	0.8168	0.001	18.8108***	0.9537	0.001
Hierarchy of Alliance Structure× Alliance Experience with Partner							-23.2060***	1.3922	0.001
Constant	172.9842***	1.4810	0.001	171.4386***	1.6235	0.001	167.0985***	1.6034	0.001
Log Likelihood $L(\beta)$	-42937.214			-42576.661			-42435.489		
Likelihood Ratio χ^2 (significance)	193.36*** (0.001)			914.46*** (0.001)			1196.81*** (0.001)		
N	20293			20293			20293		

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 11B

MODERATED COX COEFFICIENT, STANDARD ERROR, AND SIGNIFICANCE LEVEL OF HIERARCHY OF ALLIANCE STRUCTURE×ALLIANCE EXPERIENCE WITH PARTNER

	Model 1			Model 2			Model 3		
Variables	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level
Predetermined Longevity	0.4390*	0.2208	0.047	0.3890†	0.2240	0.082	0.3737†	0.2241	0.095
Asset Differential	0.000001	0.000001	0.534	0.000001	0.000001	0.607	0.000001	0.000001	0.666
Hierarchy of Alliance Structure				0.1730†	0.0956	0.070	0.1091	0.1047	0.298
Alliance Experience with Partner				-0.1607*	0.0726	0.027	-0.2014*	0.0828	0.015
Hierarchy of Alliance Structure× Alliance Experience with Partner							0.2035†	0.1122	0.070
Log Likelihood $L(\beta)$	-852.6254			-846.9954			-845.6005		
Likelihood Ratio χ^2 (significance)	3.95 (0.14)			15.21** (0.004)			18.00** (0.01)		
N	18174			18174			18174		

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 12A

MODERATED TOBIT COEFFICIENT, STANDARD ERROR, AND SIGNIFICANCE LEVEL OF NUMBER OF PARTNERS WITH ALLIANCE UNITS×ASYMMETRY-ADJUSTED COMBINED ALLIANCE EXPERIENCE

	Model 1			Model 2			Model 3		
Variables	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level
Predetermined Longevity	-41.3572***	2.9949	0.001	-37.2112***	2.9189	0.001	-376480***	2.9240	0.001
Asset Differential	0.000038*	0.000017	0.026	-0.000012	0.000017	0.463	-0.000014	0.000017	0.429
Number of Partners with Alliance Units				32.8081***	1.920	0.001	42.3140***	4.3069	0.001
Asymmetry-Adjusted Combined Alliance Experience				8.0819***	0.6006	0.001	8.8963***	0.6858	0.001
Number of Partners with Alliance Units×Asymmetry-Adjusted Combined Alliance Experience							-2.6405*	1.0639	0.013
Constant	172.9842***	1.4810	0.001	137.9751***	2.0835	0.001	135.7027***	2.2663	0.001
Log Likelihood $L(\beta)$	-42937.214			-42596.674			-42593.616		
Likelihood Ratio χ^2 (significance)	193.36*** (0.001)			874.44*** (0.001)			880.55*** (0.001)		
N	20293			20293			20293		

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 12B

MODERATED COX COEFFICIENT, STANDARD ERROR, AND SIGNIFICANCE LEVEL OF NUMBER OF PARTNERS WITH ALLIANCE UNITS×ASYMMETRY-ADJUSTED COMBINED ALLIANCE EXPERIENCE

	Model 1			Model 2			Model 3		
Variables	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level
Predetermined Longevity	0.4390*	0.2208	0.047	0.3861†	0.2217	0.082	0.3932†	0.2221	0.077
Asset Differential	0.000001	0.000001	0.534	0.000001	0.000001	0.368	0.000001	0.000001	0.358
Number of Partners with Alliance Units				-0.3066†	0.1661	0.065	-0.49278	0.3746	0.188
Asymmetry-Adjusted Combined Alliance Experience				-0.0802	0.0497	0.107	-0.0941†	0.0555	0.090
Number of Partners with Alliance Units×Asymmetry-Adjusted Combined Alliance Experience							0.0508	0.0897	0.571
Log Likelihood $L(\beta)$	-852.6254			-848.3203			-848.1613		
Likelihood Ratio χ^2 (significance)	3.95 (0.14)			12.56* (0.014)			12.88* (0.05)		
N	18174			18174			18174		

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 13A

SIMULTANEOUS TOBIT COEFFICIENTS, STANDARD ERRORS, AND SIGNIFICANCE LEVELS OF ALL INDEPENDENT AND MODERATING VARIABLES

Variables	Model 1			Model 2			Model 3		
	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level
Predetermined Longevity	-41.3572***	2.9949	0.001	-35.5289***	2.9226	0.001	-32.9769***	2.9015	0.001
Asset Differential	0.000038*	0.000017	0.026	0.000080	0.000017	0.634	0.000011	0.000017	0.527
Alliance Type				20.7548***	2.3715	0.001	22.9190***	2.6677	0.001
Hierarchy of Alliance Structure				-14.1092***	1.1430	0.001	10.7439***	3.0631	0.001
Alliance Experience with Partner				9.8188***	0.9109	0.001	15.3570***	1.0467	0.001
Number of Partners with Alliance Units				26.9237***	1.9741	0.001	51.0661***	0.7326	0.001
Asymmetry-Adjusted Combined Alliance Experience				3.1871***	0.6765	0.001	6.0097***	4.5464	0.001
Alliance Type×Hierarchy of Alliance Structure							-16.6415***	3.1396	0.001
Hierarchy of Alliance Structure× Alliance Experience with Partner							-24.6276***	1.4100	0.001
Number of Partners with Alliance Units×Asymmetry-Adjusted Combined Alliance Experience							-7.2186***	1.1720	0.001
Constant	172.9842***	1.4810	0.001	137.3788***	2.9272	0.001	123.0489***	3.1658	0.001
Log Likelihood $L(\beta)$	-42937.214			-42427.598			-42259.014		
Likelihood Ratio χ^2 (significance)	193.36*** (0.001)			1212.59*** (0.001)			1549.76*** (0.0001)		
N	20293			20293			20293		

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 13B

SIMULTANEOUS COX COEFFICIENTS, STANDARD ERRORS, AND SIGNIFICANCE LEVELS OF ALL INDEPENDENT AND MODERATING VARIABLES

Variables	Model 1			Model 2			Model 3		
	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level
Predetermined Longevity	0.4390*	0.2208	0.047	0.3807†	0.2241	0.089	0.3656	0.2244	0.103
Asset Differential	0.000001	0.000001	0.534	0.000001	0.000001	0.393	0.000001	0.000001	0.412
Alliance Type				-0.4000*	0.1839	0.030	-0.3309	0.2109	0.117
Hierarchy of Alliance Structure				0.1510	0.0989	0.127	0.1360	0.2220	0.540
Alliance Experience with Partner				-0.1351†	0.0817	0.098	-0.2043*	0.0967	0.035
Number of Partners with Alliance Units				-0.2600	0.1706	0.127	-0.6894	0.4215	0.439
Asymmetry-Adjusted Combined Alliance Experience				-0.0135	0.0576	0.815	-0.0481	0.0622	0.102
Alliance Type×Hierarchy of Alliance Structure							-0.0767	0.2343	0.744
Hierarchy of Alliance Structure× Alliance Experience with Partner							0.2043†	0.1194	0.087
Number of Partners with Alliance Units×Asymmetry-Adjusted Combined Alliance Experience							0.1281	0.1074	0.233
Log Likelihood $L(\beta)$	-852.6254			-843.6793			-841.7380		
Likelihood Ratio χ^2 (significance)	3.95 (0.14)			21.84** (0.01)			25.72** (0.01)		
N	18174			18174			18174		

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 14A

ZERO-ORDER MARGINAL TOBIT EFFECT OF ALLIANCE TYPE*

	Model 1		Model 2	
Variables	Marginal Effect (unconditional expected value)	Marginal Effect (conditional on being uncensored)	Marginal Effect (unconditional expected value)	Marginal Effect (conditional on being uncensored)
Predetermined Longevity	-1.1252	-1.0389	-1.1223	-1.0381
Asset Differential	1.00000010	1.00000004	1.00000008	1.00000003
Alliance Type			1.0349	1.0118
Constant	1.4616	1.1601	1.4341	1.1509

* Unconditional marginal effect accounts for censored data, whereas conditional marginal effect does not. A marginal effect with a plus/minus sign reflects that the presence of the associated variable makes the alliance that many times more likely to experience a longer/shorter longevity (compared to the expected alliance longevity without the presence of the associated variable).

TABLE 14B

ZERO-ORDER COX HAZARD RATIO OF ALLIANCE TYPE*

	Model 1	Model 2
Variables	Hazard Ratio	Hazard Ratio
Predetermined Longevity	1.5512	1.5598
Asset Differential	1.000008	1.000001
Alliance Type		0.7254

* A hazard ratio of greater than 1 reflects an increased probability of alliance termination in the presence of the associated variable. Conversely, a hazard ratio of less than 1 reflects a decreased probability of alliance termination in the presence of the associated variable.

TABLE 15A

ZERO-ORDER MARGINAL TOBIT EFFECT OF HIERARCHY OF ALLIANCE STRUCTURE*

	Model 1		Model 2	
Variables	Marginal Effect (unconditional expected value)	Marginal Effect (conditional on being uncensored)	Marginal Effect (unconditional expected value)	Marginal Effect (conditional on being uncensored)
Predetermined Longevity	-1.1252	-1.0389	-1.1399	-1.0438
Asset Differential	1.00000010	1.00000004	1.00000018	1.00000006
Hierarchy of Alliance Structure			-1.0563	-1.0199
Constant	1.4616	1.1601	1.4874	1.1724

* Unconditional marginal effect accounts for censored data, whereas conditional marginal effect does not. A marginal effect with a plus/minus sign reflects that the presence of the associated variable makes the alliance that many times more likely to experience a longer/shorter longevity (compared to the expected alliance longevity without the presence of the associated variable).

TABLE 15B

ZERO-ORDER COX HAZARD RATIO OF HIERARCHY OF ALLIANCE STRUCTURE*

	Model 1	Model 2
Variables	Hazard Ratio	Hazard Ratio
Predetermined Longevity	1.5512	1.6135
Asset Differential	1.000008	1.000001
Hierarchy of Alliance Structure		1.2362

* A hazard ratio of greater than 1 reflects an increased probability of alliance termination in the presence of the associated variable. Conversely, a hazard ratio of less than 1 reflects a decreased probability of alliance termination in the presence of the associated variable.

TABLE 16A

ZERO-ORDER MARGINAL TOBIT EFFECT OF ALLIANCE EXPERIENCE WITH PARTNER*

Variables	Model 1		Model 2	
	Marginal Effect (unconditional expected value)	Marginal Effect (conditional on being uncensored)	Marginal Effect (unconditional expected value)	Marginal Effect (conditional on being uncensored)
Predetermined Longevity	-1.1252	-1.0389	-1.1006	-1.0327
Asset Differential	1.00000010	1.00000004	1.00000006	1.00000002
Alliance Experience with Partner			1.0403	1.0144
Constant	1.4616	1.1601	1.4296	1.1540

* Unconditional marginal effect accounts for censored data, whereas conditional marginal effect does not. A marginal effect with a plus/minus sign reflects that the presence of the associated variable makes the alliance that many times more likely to experience a longer/shorter longevity (compared to the expected alliance longevity without the presence of the associated variable).

TABLE 16B

ZERO-ORDER COX HAZARD RATIO OF ALLIANCE EXPERIENCE WITH PARTNER*

	Model 1	Model 2
Variables	Hazard Ratio	Hazard Ratio
Predetermined Longevity	1.5512	1.4128
Asset Differential	1.000008	1.000001
Alliance Experience with Partner		0.8386

* A hazard ratio of greater than 1 reflects an increased probability of alliance termination in the presence of the associated variable. Conversely, a hazard ratio of less than 1 reflects a decreased probability of alliance termination in the presence of the associated variable.

TABLE 17A

ZERO-ORDER MARGINAL TOBIT EFFECT OF NUMBER OF PARTNERS WITH ALLIANCE UNITS*

Variables	Model 1		Model 2	
	Marginal Effect (unconditional expected value)	Marginal Effect (conditional on being uncensored)	Marginal Effect (unconditional expected value)	Marginal Effect (conditional on being uncensored)
Predetermined Longevity	-1.1252	-1.0389	-1.1152	-1.0370
Asset Differential	1.00000010	1.00000004	1.00000003	1.00000001
Number of Partners with Alliance Units			1.1061	1.0379
Constant	1.4616	1.1601	1.4262	1.1524

* Unconditional marginal effect accounts for censored data, whereas conditional marginal effect does not. A marginal effect with a plus/minus sign reflects that the presence of the associated variable makes the alliance that many times more likely to experience a longer/shorter longevity (compared to the expected alliance longevity without the presence of the associated variable).

TABLE 17B

ZERO-ORDER COX HAZARD RATIO OF NUMBER OF PARTNERS WITH ALLIANCE UNITS*

	Model 1	Model 2
Variables	Hazard Ratio	Hazard Ratio
Predetermined Longevity	1.5512	1.5130
Asset Differential	1.000008	1.000001
Number of Partners with Alliance Units		0.6882

* A hazard ratio of greater than 1 reflects an increased probability of alliance termination in the presence of the associated variable. Conversely, a hazard ratio of less than 1 reflects a decreased probability of alliance termination in the presence of the associated variable.

TABLE 18A

ZERO-ORDER MARGINAL TOBIT EFFECT OF ASYMMETRY-ADJUSTED COMBINED ALLIANCE EXPERIENCE*

	Model 1		Model 3	
Variables	Marginal Effect (unconditional expected value)	Marginal Effect (conditional on being uncensored)	Marginal Effect (unconditional expected value)	Marginal Effect (conditional on being uncensored)
Predetermined Longevity	-1.1252	-1.0389	-1.1178	-1.0376
Asset Differential	1.00000010	1.00000004	-1.00000000	-1.00000000
Asymmetry-Adjusted Combined Alliance Experience			1.0296	1.0105
Constant	1.4616	1.1601	1.3734	1.1328

* Unconditional marginal effect accounts for censored data, whereas conditional marginal effect does not. A marginal effect with a plus/minus sign reflects that the presence of the associated variable makes the alliance that many times more likely to experience a longer/shorter longevity (compared to the expected alliance longevity without the presence of the associated variable).

TABLE 18B

ZERO-ORDER COX HAZARD RATIO OF ASYMMETRY-ADJUSTED COMBINED ALLIANCE EXPERIENCE*

	Model 1	**Model 2**
Variables	Hazard Ratio	Hazard Ratio
Predetermined Longevity	1.5512	1.4807
Asset Differential	1.000008	1.000001
Asymmetry-Adjusted Combined Alliance Experience		0.8997

* A hazard ratio of greater than 1 reflects an increased probability of alliance termination in the presence of the associated variable. Conversely, a hazard ratio of less than 1 reflects a decreased probability of alliance termination in the presence of the associated variable.

TABLE 19A

SIMULTANEOUS MARGINAL TOBIT EFFECTS OF ALL INDEPENDENT VARIABLES*

Variables	Model 1		Model 3	
	Marginal Effect (unconditional expected value)	Marginal Effect (conditional on being uncensored)	Marginal Effect (unconditional expected value)	Marginal Effect (conditional on being uncensored)
Predetermined Longevity	-1.1252	-1.0389	-1.1060	-1.0354
Asset Differential	1.00000010	1.00000004	1.00000002	1.00000001
Alliance Type			1.0582	1.0205
Hierarchy of Alliance Structure			-1.0374	-1.0139
Alliance Experience with Partner			1.0260	1.0096
Number of Partners with Alliance Units			1.0713	1.0265
Asymmetry-Adjusted Combined Alliance Experience			1.0084	1.0031
Constant	1.4616	1.1601	1.3640	1.1350

* Unconditional marginal effect accounts for censored data, whereas conditional marginal effect does not. A marginal effect with a plus/minus sign reflects that the presence of the associated variable makes the alliance that many times more likely to experience a longer/shorter longevity (compared to the expected alliance longevity without the presence of the associated variable).

TABLE 19B

SIMULTANEOUS COX HAZARD RATIOS OF ALL INDEPENDENT VARIABLES*

	Model 1	**Model 2**
Variables	Hazard Ratio	Hazard Ratio
Predetermined Longevity	1.5512	1.4633
Asset Differential	1.000008	1.000001
Alliance Type		0.6703
Hierarchy of Alliance Structure		1.1630
Alliance Experience with Partner		0.8736
Number of Partners with Alliance Units		0.7710
Asymmetry-Adjusted Combined Alliance Experience		0.9866

* A hazard ratio of greater than 1 reflects an increased probability of alliance termination in the presence of the associated variable. Conversely, a hazard ratio of less than 1 reflects a decreased probability of alliance termination in the presence of the associated variable.

TABLE 20A

MODERATED MARGINAL TOBIT EFFECT OF ALLIANCE TYPE×HIERARCHY OF ALLIANCE STRUCTURE*

Variables	Model 1		Model 2		Model 3	
	Marginal Effect (unconditional expected value)	Marginal Effect (conditional on being uncensored)	Marginal Effect (unconditional expected value)	Marginal Effect (conditional on being uncensored)	Marginal Effect (unconditional expected value)	Marginal Effect (conditional on being uncensored)
Predetermined Longevity	-1.1252	-1.0389	-1.1363	-1.0429	-1.1387	-1.0435
Asset Differential	1.00000010	1.00000004	1.00000016	0.00000006	0.00000016	0.00000006
Alliance Type			1.0430	1.0147	1.0530	1.0180
Hierarchy of Alliance Structure			-1.0575	-1.0204	-1.0381	-1.0135
Alliance Type×Hierarchy of Alliance Structure					-1.0228	-1.0081
Constant	1.4616	1.1601	1.4544	1.1612	1.4474	1.1587

* Unconditional marginal effect accounts for censored data, whereas conditional marginal effect does not. A marginal effect with a plus/minus sign reflects that the presence of the associated variable makes the alliance that many times more likely to experience a longer/shorter longevity (compared to the expected alliance longevity without the presence of the associated variable).

TABLE 20B

MODERATED COX HAZARD RATIO OF ALLIANCE TYPE×HIERARCHY OF ALLIANCE STRUCTURE*

Variables	Model 1	Model 2	Model 3
	Hazard Ratio	Hazard Ratio	Hazard Ratio
Predetermined Longevity	1.5512	1.6246	1.6191
Asset Differential	1.000008	1.000001	1.000001
Alliance Type		0.7078	0.7481
Hierarchy of Alliance Structure		1.2501	1.3844
Alliance Type×Hierarchy of Alliance Structure			0.8796

* A hazard ratio of greater than 1 reflects an increased probability of alliance termination in the presence of the associated variable. Conversely, a hazard ratio of less than 1 reflects a decreased probability of alliance termination in the presence of the associated variable.

TABLE 21A

MODERATED MARGINAL TOBIT EFFECT
OF HIERARCHY OF ALLIANCE STRUCTURE×ALLIANCE EXPERIENCE WITH PARTNER*

Variables	Model 1		Model 2		Model 3	
	Marginal Effect (unconditional expected value)	Marginal Effect (conditional on being uncensored)	Marginal Effect (unconditional expected value)	Marginal Effect (conditional on being uncensored)	Marginal Effect (unconditional expected value)	Marginal Effect (conditional on being uncensored)
Predetermined Longevity	-1.1252	-1.0389	-1.1158	-1.0378	-1.1003	-1.0337
Asset Differential	1.00000010	1.00000004	1.00000013	1.00000005	1.00000015	1.00000006
Hierarchy of Alliance Structure			-1.0486	-1.0177	-1.0242	-1.0090
Alliance Experience with Partner			1.0367	1.0134	1.0497	1.0184
Hierarchy of Alliance Structure×Alliance Experience with Partner					-1.0613	-1.0227
Constant	1.4616	1.1601	1.4546	1.1653	1.4411	1.1638

* Unconditional marginal effect accounts for censored data, whereas conditional marginal effect does not. A marginal effect with a plus/minus sign reflects that the presence of the associated variable makes the alliance that many times more likely to experience a longer/shorter longevity (compared to the expected alliance longevity without the presence of the associated variable).

TABLE 21B

MODERATED COX HAZARD RATIO
OF HIERARCHY OF ALLIANCE STRUCTURE×ALLIANCE EXPERIENCE WITH PARTNER*

	Model 1	Model 2	Model 3
Variables	Hazard Ratio	Hazard Ratio	Hazard Ratio
Predetermined Longevity	1.5512	1.4755	1.4532
Asset Differential	1.000008	1.000001	1.000001
Hierarchy of Alliance Structure		1.1889	1.1152
Alliance Experience with Partner		0.8516	0.8176
Hierarchy of Alliance Structure× Alliance Experience with Partner			1.2257

* A hazard ratio of greater than 1 reflects an increased probability of alliance termination in the presence of the associated variable. Conversely, a hazard ratio of less than 1 reflects a decreased probability of alliance termination in the presence of the associated variable.

TABLE 22A

MODERATED MARGINAL TOBIT EFFECT
OF NUMBER OF PARTNERS WITH ALLIANCE UNITS×ASYMMETRY-ADJUSTED COMBINED ALLIANCE EXPERIENCE*

	Model 1		Model 2		Model 3	
Variables	Marginal Effect (unconditional expected value)	Marginal Effect (conditional on being uncensored)	Marginal Effect (unconditional expected value)	Marginal Effect (conditional on being uncensored)	Marginal Effect (unconditional expected value)	Marginal Effect (conditional on being uncensored)
Predetermined Longevity	-1.1252	-1.0389	-1.1120	-1.0365	-1.1135	-1.0370
Asset Differential	1.00000010	1.00000004	-1.00000003	-1.00000001	-1.00000004	-1.00000001
Number of Partners with Alliance Units			1.0875	1.0317	1.1130	1.0409
Asymmetry-Adjusted Combined Alliance Experience			1.0216	1.0078	1.0238	1.0086
Number of Partners with Alliance Units×Asymmetry-Adjusted Combined Alliance Experience					-1.0071	-1.0026
Constant	1.4616	1.1601	1.3680	1.1334	1.3623	1.1313

* *Unconditional marginal effect accounts for censored data, whereas conditional marginal effect does not. A marginal effect with a plus/minus sign reflects that* the presence of the associated variable makes the alliance that many times more likely to experience a longer/shorter longevity (compared to the expected alliance longevity without the presence of the associated variable).

TABLE 22B

MODERATED COX HAZARD RATIO
OF NUMBER OF PARTNERS WITH ALLIANCE UNITS×ASYMMETRY-ADJUSTED COMBINED ALLIANCE EXPERIENCE*

	Model 1	Model 2	Model 3
Variables	Hazard Ratio	Hazard Ratio	Hazard Ratio
Predetermined Longevity	1.5512	1.4712	1.4817
Asset Differential	1.000008	1.000001	1.000001
Number of Partners with Alliance Units		0.7360	0.6109
Asymmetry-Adjusted Combined Alliance Experience		0.9229	0.9102
Number of Partners with Alliance Units×Asymmetry-Adjusted Combined Alliance Experience			1.0521

* A hazard ratio of greater than 1 reflects an increased probability of alliance termination in the presence of the associated variable. Conversely, a hazard ratio of less than 1 reflects a decreased probability of alliance termination in the presence of the associated variable.

TABLE 23A

SIMULTANEOUS MARGINAL TOBIT EFFECTS OF ALL INDEPENDENT AND MODERATING VARIABLES*

Variables	Model 1		Model 2		Model 3	
	Marginal Effect (unconditional expected value)	Marginal Effect (conditional on being uncensored)	Marginal Effect (unconditional expected value)	Marginal Effect (conditional on being uncensored)	Marginal Effect (unconditional expected value)	Marginal Effect (conditional on being uncensored)
Predetermined Longevity	-1.1252	-1.0389	-1.1060	-1.0354	-1.0979	-1.0336
Asset Differential	1.00000010	1.00000004	1.00000002	1.00000001	1.00000003	1.00000001
Alliance Type			1.0582	1.0205	1.0648	1.0232
Hierarchy of Alliance Structure			-1.0374	-1.0139	1.0285	1.0108
Alliance Experience with Partner			1.0260	1.0096	1.0407	1.0154
Number of Partners with Alliance Units			1.0713	1.0265	1.1353	1.0513
Asymmetry-Adjusted Combined Alliance Experience			1.0084	1.0031	1.0159	1.0060
Alliance Type×Hierarchy of Alliance Structure					-1.0441	-1.0167
Hierarchy of Alliance Structure× Alliance Experience with Partner					-1.0653	-1.0247
Number of Partners with Alliance Units×Asymmetry-Adjusted Combined Alliance Experience					-1.0191	-1.0073
Constant	1.4616	1.1601	1.3640	1.1350	1.3261	1.1236

* Unconditional marginal effect accounts for censored data, whereas conditional marginal effect does not. A marginal effect with a plus/minus sign reflects that the presence of the associated variable makes the alliance that many times more likely to experience a longer/shorter longevity (compared to the expected alliance longevity without the presence of the associated variable).

TABLE 23B

SIMULTANEOUS COX HAZARD RATIOS OF ALL INDEPENDENT AND MODERATING VARIABLES*

	Model 1	Model 2	Model 3
Variables	Hazard Ratio	Hazard Ratio	Hazard Ratio
Predetermined Longevity	1.5512	1.4633	1.4414
Asset Differential	1.000008	1.000001	1.000001
Alliance Type		0.6703	0.7183
Hierarchy of Alliance Structure		1.1630	1.1457
Alliance Experience with Partner		0.8736	0.8152
Number of Partners with Alliance Units		0.7710	0.9530
Asymmetry-Adjusted Combined Alliance Experience		0.9866	0.5019
Alliance Type×Hierarchy of Alliance Structure			0.9262
Hierarchy of Alliance Structure× Alliance Experience with Partner			1.2267
Number of Partners with Alliance Units×Asymmetry-Adjusted Combined Alliance Experience			1.1366

* A hazard ratio of greater than 1 reflects an increased probability of alliance termination in the presence of the associated variable. Conversely, a hazard ratio of less than 1 reflects a decreased probability of alliance termination in the presence of the associated variable.

TABLE 24

ORDERED LOGIT COEFFICIENTS, STANDARD ERRORS, AND SIGNIFICANCE LEVELS OF ALLIANCE TYPE AND ALLIANCE EXPERIENCE WITH PARTNER

	Model 1			Model 2			Model 3		
Variables	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level	Coefficient	Standard Error	Significance Level
Alliance Type	0.3376	0.2493	0.176				0.3337	0.2500	0.182
Alliance Experience with Partner				-0.3083*	0.1610	0.055	-0.3052†	0.1605	0.057
Log Likelihood $L(\beta)$	-413.5002			-412.0240			-411.0979		
Likelihood Ratio χ^2 (significance)	1.91 (0.1673)			4.86** (0.0275)			6.71** (0.0349)		
N	546			546			546		

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 25

ORDERED LOGIT EFFECTS OF ALLIANCE TYPE AND ALLIANCE EXPERIENCE WITH PARTNER ON HIERARCHY OF ALLIANCE STRUCTURE

	Model 1	**Model 2**	**Model 3**
Variables	Effect of 1 standard deviation Δ	Effect of 1 standard deviation Δ	Effect of 1 standard deviation Δ
Alliance Type	0.1332		0.1317
Alliance Experience with Partner		-0.2672	-0.2645

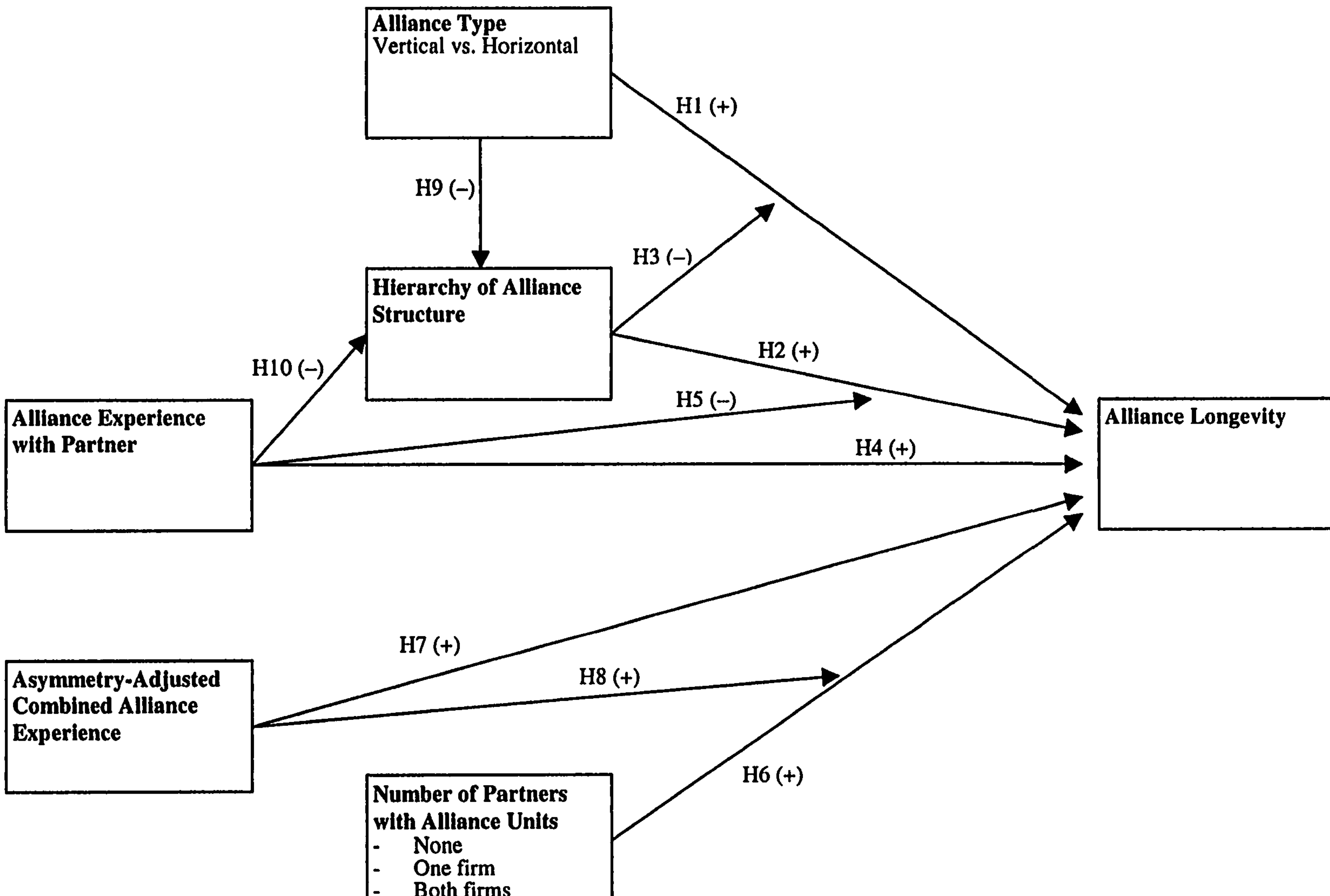
TABLE 26

SUMMARY OF RESULTS*

Hypotheses	Support	Statistical Significance		Effect Size		Evidence from Prior Studies	Remarks
		Tobit	Cox	Tobit – Marginal Effect	Cox – Hazard Ratio		
H1: Vertical alliances experience greater longevity than horizontal alliances.	Partial	$p < 0.001$ ($p < 0.001$)	$p < 0.117$ ($p < 0.10$)	1.0648 (1.0349)	0.7183 (0.7254)	Park & Ungson (1997)	
H2: Hierarchy of alliance structure is positively related to alliance longevity.	No	NS (NS)	NS (NS)	1.0285 (-1.0563)	1.1457 (1.2362)	Pangarkar (2003)	Reduction of transaction costs does not match incremental bureaucratic costs.
H3: Hierarchy of alliance structure increases the longevity of horizontal alliances more than it increases the longevity of vertical alliances.	Partial	$p < 0.001$ ($p < 0.01$)	NS (NS)	-1.0441 (-1.0228)	0.9262 (0.8796)	N/A	
H4: Alliance experience with partner is positively related to alliance longevity.	Yes	$p < 0.001$ ($p < 0.001$)	$p < 0.05$ ($p < 0.05$)	1.0407 (1.0403)	0.8152 (0.8386)	Zollo et al. (2002)	
H5: Greater alliance experience with partner weakens the relationship between hierarchy of alliance structure and alliance longevity.	Yes	$p < 0.001$ ($p < 0.001$)	$p < 0.10$ ($p < 0.10$)	-1.0653 (-1.0613)	1.2267 (1.2257)	N/A	
H6: The number of partners with alliance units is positively related to alliance longevity.	Partial	$p < 0.001$ ($p < 0.001$)	$p < 0.102$ ($p < 0.05$)	1.1353 (1.1061)	0.5019 (0.6882)	Kale et al. (2002)	
H7: Asymmetry-adjusted combined alliance experience is positively related to alliance longevity.	Partial	$p < 0.001$ ($p < 0.001$)	NS ($p < 0.05$)	1.0159 (1.0296)	0.9530 (0.8997)	Pangarkar (2003)	
H8:Asymmetry-adjusted combined alliance experience strengthens the relationship between number of partners with alliances units and alliance longevity.	No	NS (NS)	NS (NS)	-1.0191 (-1.0071)	1.1366 (1.0521)	N/A	Alliance units are less effective when they are preoccupied analyzing asymmetry-adjusted combined alliance experience.
		Ordered Logit		Ordered Logit			
H9:Hierarchy of alliance structure is greater in horizontal alliances than in vertical alliances.	No	NS		0.1317		Oxley (1997)	Reduction of transaction costs does not match incremental bureaucratic costs.
H10: Alliance experience with partner us negatively related to hierarchy of alliance structure.	Yes	$p < 0.10$		0.2645		Gulati (1995)	

* Zero-order results are in parentheses

FIGURE 1: ANTECEDENTS OF ALLIANCE LONGEVITY



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