WHERE DO ALLIANCES COME FROM? THE EFFECTS OF UPPER ECHELONS ON ALLIANCE FORMATION

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Abstract

Alliances with established organizations provide young firms with resources necessary for survival. We build on recent organizational research examining the effect of upper echelons on attracting powerful intermediaries to understand how young biotechnology firms establish alliances with established organizations. Drawing upon the concept of homophily, we test hypotheses regarding the extent to which young firms and partners match along specific homophily dimensions. Our findings from an event-history analysis of 3,200 career histories of managers who took biotechnology firms public between 1979 and 1996 show that alliance formation is related to status homophily and role-based homophily between young and established organizations.

1. Introduction

Do firms partner with similar or dissimilar firms? If one views an inter-firm collaboration as a vehicle for achieving specific objectives, maximizing the range of competencies that can be pooled together is most advantageous. Strategy scholars have long emphasized the importance of complementary resources (Penrose, 1959), and have argued that firms tend to create value when partnering with firms that can complement weaknesses in capabilities (Hamel, Doz, and Prahalad,

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1989; Teece, 1986). Not only are partnerships between complementary firms more successful, they are also more common (Gulati, 1995; Nohria and Garcia-Pont, 1991), as firms naturally recognize the potential in collaborating with firms possessing different capabilities. While complementarity as a driver of alliance formation can be observed in a number of industry settings (e.g. Chung, Singh, and Lee, 2000; Nohria and Garcia-Pont, 1991), it is most obvious in the life-sciences domain where the division of labor between firms with vast resources and firms that are small but innovative is the dominant form of organization (Powell, White, Koput, and Owen-Smith, 2005).

The benefits of and tendency to choose partners that are different do not necessarily imply that firms are attracted to firms that differ across all dimensions. Inter-firm relationships are by no means created in a social vacuum, and are often governed by social mechanisms independent of functional considerations (Granovetter, 1985). In particular, the well-established principle that similarity breeds connection—coined homophily (Lazarsfeld and Merton, 1954)—suggests that firms seek out partners that are similar along various dimensions. Similar actors are easier to trust, like, and understand, leading to reduced search and transaction costs for inter-firm collaborations. Confirming this view, Gulati (1995) found that firms sharing common third-party ties had a higher rate of forming alliances, and Stuart (1998) found that firms in crowded technological niches, and hence more potential partners with similar knowledge bases, had a higher propensity to collaborate.

This tendency to seek out different, yet similar, alliance partners suggest that firms simultaneously optimize convergence or divergence with potential partners along different aspects. Partnerships are most successful, and hence, most common when firms are dissimilar on certain dimensions such as resources or capabilities, yet similar enough to provide the social

bonding that can ease the transition and hold strong through difficult times. Similar to the key insight provided by contingency theorists that high levels of differentiation within the organization necessitate stronger measures of integration (Lawrence and Lorsch, 1967), logic suggests that the higher the degree of role differentiation built into an alliance partnership, the greater the need for suitable dimensions upon which partners can find and share common ground.

Viewed in this light, the task of attracting suitable partners can be an especially daunting task for young entrepreneurial entities such as biotechnology firms. Young firms, by definition, lack an organizational history that creates a distinct organizational identity (Aldrich and Fiol, 1994; Lounsbury and Glynn, 2001). While firm-level parameters such as size, age, or experience are easily observable, they are more often used as a basis for differentiation, rather than integration. Furthermore, the tendency to focus in highly specialized knowledge areas that make the new entities so attractive to large and diversified firms paradoxically limits the ability of the entrepreneurial firm to signal its similarity to potential partners. In other words, the strong role-differentiation or division of labor observed in the life sciences domain (Pisano, 1997; Arora, Fosfuri, and Gambardella, 2001) exacerbate the challenges of creating social similarity that help bridge distances between partners.

We propose that the career affiliations of a young firm's upper echelon provide an important source of homophily between an alliance partner and a young firm that can facilitate alliance formation. We begin by examining the extent to which a firm's upper echelon backgrounds attract the attention of prestigious alliance partners. We thereby directly extend prior research that has argued that upper echelon affiliations act as a signal of the firm's legitimacy to key outsiders (Higgins and Gulati, 2003; Certo, 2003; Westphal and Zajac, 1998); here, we examine whether these previously espoused relationships hold true in the context of

alliance formation. We then build upon this work as well as research on alliance formation by examining characteristics of both the young firm and its alliance partner to better understand antecedents to alliance formation. Unlike prior research focusing on homophily at the organizational level, we explore the dual nature of inter-organizational partnerships using detailed individual-level career histories to investigate if and how the degree of match along specific homophily dimensions relates to specific kinds of alliance formation. We draw upon sociological and psychological theories of homophily to build our arguments regarding two forms of homophily: status-based homophily and role-based homophily.

We test our ideas with a comprehensive time-varying dataset on the 3,200 career histories of top managers who took biotechnology firms public between 1979 and 1996 and with a time-varying dataset on these firms' alliance partnerships with three different kinds of partners: prominent pharmaceutical firms, biotechnology firms, and academic institutions. For early stage biotechnology firms, alliances such as these provide access to markets without the required investments in complementary assets, and therefore can be critical to firm viability (Pisano, 1997). Indeed, prior research has shown that the performance of entrepreneurial firms is strongly related to the prominence of a firm's strategic partners, making prestigious alliances a much coveted asset (Stuart, Hoang, and Hybels, 1999; Baum, Calabrese, and Silverman, 2000). As a result, we believe that this is an ideal setting to investigate the role of homophily between firms and alliance formation.

2. Theory and hypotheses

2.1 Upper echelon affiliations and alliance formation

Given the growing importance of strategic alliances (Mowery, et al., 1996; Gulati, 1998), it is not surprising that much scholarly attention has been paid to the factors that enhance or decrease the establishment of organizational alliances. Most of the early work focuses on firms' *incentives* to collaborate with others (Ahuja, 2000). Industry-level factors such as the extent of competition, development of the market, and competitive uncertainty (e.g. Harrigan, 1988; Eisenhardt and Schoonhoven, 1996), or firm-level characteristics such as size, age, product diversity, and financial resources (e.g. Oliver, 1990; Barley, Freeman, and Hybels, 1992; Burgers et al., 1993) generate resource and strategic needs to form interfirm linkages.

Recently, scholars have shifted attention towards the *opportunities* provided by a firm's position in the network structure (Ahuja, 2000) to explain the propensity of firms to collaborate. Embeddedness in existing networks is seen as an asset which allows firms to gain valuable information regarding the reliability, capabilities, and trustworthiness of potential partners (Mizruchi and Galaskiewicz, 1993; Gulati, Dialdin, and Wang, 2002). In particular, a firm's participation in an established alliance network is a direct source of embeddedness that has received a great deal of attention (Gulati, 1995; Gualti and Gargiulo, 1999). Repeated alliance ties between firms reduce the hazard of opportunism, breed trust, and establish routines that create momentum and opportunities for future relationships. Beyond prior alliance ties, the extent to which firms are embedded in existing technology networks (Stuart, 1998) or status hierarchies (Podolny, 1994) also determine the opportunities for collaboration, influencing the rate at which firms enter into inter-organizational relationships.

More recently, scholarly attention has turned to a different kind of indicator of a young firm's quality and potential–the backgrounds of a firm's upper echelon. This work has built upon well-established research on upper echelons that has traditionally been situated in the

context of well-established firms (e.g. Hambrick and Mason, 1984; Hambrick and D'Aveni, 1992; Finkelstein and Hambrick, 1996) and has extended it to the context of young firms. This more recent work finds that the composition of a young firm's board and top management team can positively affect its ability to attract important stakeholders and to perform well in the marketplace (Higgins and Gulati, 2003; Certo, 2003). For example, when top managers have prestigious backgrounds, firms receive more support from creditors (D'Aveni, 1990), enjoy enhanced IPO performance (Certo, 2003), and are more likely to secure endorsement of a prestigious underwriter (Higgins and Gulati, 2003). The underlying mechanism proposed for these positive effects is the firm's signaling of legitimacy through firms' upper echelons (Higgins and Gulati, 2003; Higgins and Gulati, 2006; Certo, 2003; D'Aveni, 1990). In the context of alliances, this suggests that the structure or characteristics of the upper echelons of a firm may also affect a firm's ability to obtain alliances. Indeed, prior research in the semiconductor industry has shown that entrepreneurial firms led by large, experienced, and well-connected top management teams form alliances at a higher rate (Eisenhardt and Schoonhoven, 1996).

We begin by building directly on these recent studies that examine how upper echelon composition influences the endorsement by external audiences by examining the extent to which prominent upper echelon affiliations influence the rate at which firms form alliances. Further, and extending prior upper echelon research to the context of alliance formation, we examine not just the status, but types of affiliations that characterize a young firm's upper echelon. Following this initial set of hypotheses, we introduce the notion of homophily to understand not just whether, but with whom a young firm is able to align itself.

Consistent with prior organizational research (e.g., Higgins and Gulati, 2003; Baum et al., 2000), we distinguish between three types of organizational affiliations—downstream, upstream, and horizontal—and we examine how each type of upper echelon affiliation influences alliance formation with young biotechnology firms. Downstream employment affiliations derive from top managers' employment at downstream organizations, namely, pharmaceutical companies (Powell et al., 1996). Downstream organizations have resources such as information, contacts, and funds that can help a young firm bring its core technology, product, and/or service to market (Pisano, 1991), and thus, members with prior employment experience in these firms can be valuable assets. Affiliations with prominent pharmaceutical companies are especially important, as they are particularly well equipped and have access to information critical to bringing a product to the market, such as experience in product testing, working with the Food and Drug Administration (FDA) approval process, in product marketing, and in selling a product or technology (Powell et al., 1996). Therefore, we expect young firms with members that have more prior employment experience in these prominent downstream firms to make attractive partners in the alliance market, and as a result have a higher rate of alliance formation.

Hypothesis 1a. The greater the number of upper echelon members with prominent downstream affiliations, the greater the rate at which the firm forms alliances.

Upstream affiliations in biotechnology derive from upper echelon members' employment affiliations with prominent organizations such as research institutions, think tanks, and universities. These affiliations signal a firm's ability to conduct high-quality research and to manage the research process (Zucker and Darby, 1996). In addition, the scientific credentials of

the upper echelon indicate the firm's membership and position in the scientific hierarchy (Abbott, 1981) and hence access to important resources that could enhance the quality of a young firm's research in the future (Zucker, Darby, and Armstrong, 1998). Thus, we expect that firms which have top management or board members with affiliations with prominent research institutions will be better positioned to form an alliance.

Hypothesis 1b. The greater the number of upper echelon members with prominent upstream affiliations, the greater the rate at which the firm forms alliances.

Finally, horizontal affiliations derive from upper echelon members' prior employment with prominent organizations in their own industry. These affiliations indicate the potential for access to industry-specific knowledge, such as how to secure resources such as cash, scientists, equipment, and laboratory space, as well as managerial knowledge of how to structure, design, and manage biotech organization to maximize innovation and learning (Powell et al. 1996; Pisano and Mang, 1993). Firms that possess this knowledge are naturally good potential partners, as they can provide guidance to firms that are behind them in the development stage, or assuage concerns regarding a firm's ability to compete and survive in the industry (Pisano and Mang, 1993). Therefore, we expect firms with members with previous employment in prestigious biotechnology firms to form alliances with greater frequency.

Hypothesis 1c. The greater the number of upper echelon members with prominent horizontal affiliations, the greater the rate at which the firm forms alliances.

2.2 Affiliations-based homophily and alliance formation

In the previous section, we argued that specific types of upper echelon affiliations would enhance the rate of alliance formation for young firms. We now extend these general ideas to understand how different types of affiliations might relate to certain kinds of alliance partnerships. Indeed, the majority of prior research on upper echelons has remained agnostic with regards to *which types of firms* young firms are able to partner with. Further, in the alliance literature, despite the proliferation of studies on alliance formation, the question of why a firm allies with a certain partner has received little attention (Chung et al., 2000). By drawing upon seminal research on homophily and extending that work to the context of entrepreneurial firms and their quest for partnerships, we aim to provide insight into how and why certain firms align themselves with certain others.

The term "homophily" refers to the tendency for connections to form between similar actors (Lazarsfeld and Merton, 1954). The homophily principle underlies a wide range of interpersonal associations, from the intimate, such as marriage ties (Kalmijn, 1998) or confiding relationships (Marsden, 1987), to the more bounded, such as career support (Ibarra, 1992, 1995) or entrepreneurial founding (Ruef, Aldrich, and Carter, 2004). Homophily may occur along many dimensions, including ascribed traits such as age, race, and sex (e.g. Marsden, 1987), attained characteristics such as education and social class (e.g. Louch, 2000), and even personal attributes such as beliefs and aspirations (e.g. Byrne, 1971).

Psychological theory on homophily has long focused on inter-personal attraction and the tendency for individuals to interact with similar others (Byrne, 1971; Huston and Levinger, 1978). According to psychologists, similarity in behavior confirms one's feeling of rightness or self-esteem (Leonard, 1975; Santee and Jackson, 1978). Others' similarity also makes it more

likely that positive affect will be reciprocated (Jones, Bell, and Aronson, 1972). More recently, similarity of an individual has been found to lead to positive individual-level outcomes such as satisfaction or promotion, which only reinforces the attraction and motivation to form relationships with similar others (Barsade, Ward, Turner, and Sonnenfeld, 2000).

In parallel, sociologists have drawn upon theories relating to homophily to focus on the structural causes for the tendency for similar actors to join up. For example, geography constrains one's ability to access diverse people, which can lead to increased homogeneity in contacts (Zipf, 1949). Organizational settings such as workgroup composition also segregate opportunities for tie formation (McPherson et al., 2001; Ibarra, 1992). Furthermore, the roles individuals play in society (spouse, boss, teacher, etc.) can create isomorphic pressure that leads to homophily. For example, employees are especially likely to have ties to others who occupy structurally equivalent positions, which further reinforce existing structural factors that segregate opportunities (Ibarra, 1992).

In addition to the strong evidence supporting homophily at the individual level, there is growing empirical support for homophily theory at the organization level—in other words, the notion that organizations form partnerships with similar others. As previously noted, firms that are embedded in similar alliance networks have a higher rate of forming alliances (Gulati and Gargiulo, 1999). Firms similar in their understanding of technologies are better equipped to collaborate on joint projects (Cohen and Levinthal, 1990; Mowery et al., 1996), resulting in greater alliance formation between similar firms in crowded technology areas (Stuart, 1998).

However, forms of organizational embeddedness, such as prior alliances, that can serve as a basis for inter-organizational homophily are often inaccessible to young firms (Stuart et al., 1999). That is, with limited history and track records, young firms may not have, as of yet,

cultivated a substantial network or a well-known reputation in a particular technological area (Aldrich and Fiol, 1994; Stuart, 1998). In the entrepreneurial context, other forms of organizational homophily may serve as the basis for interorganizational partnerships, such as homophily between an upper echelon's affiliations and the kinds of alliance partners a young firm is able to attract. In the following sections, we focus on the aforementioned proposition by considering two kinds of organizational homophily—status and role-based homophily–and how these two forms might influence alliance formation in the life sciences.

2.2.1 Status homophily

The first aspect of homophily we examine is that based upon status. While endorsement from any third-party is a positive signal for actors in a market setting, the benefits are greatly enhanced when the endorsement comes from prominent actors (Podolny, 1993; Stuart et al., 1999). Ties with prestigious firms have been shown to lead to better financial performance (Stuart et al., 1999), greater innovative learning (Powell et al., 1996), and subsequent alliance formation and endorsement (Gulati and Gargiulo, 1999) for firms.

Organizational research on status has advanced the view that an organization's position in the status hierarchy is mediated by its external ties to other actors in the market (Podolny, 1993, 1994), such that, high status necessarily implies a certain exclusivity in the formation of exchange relations (Goode, 1978). If so, then prestigious firms must be cautious in their selection of partners, lest they should dilute their status by associating with lower status actors (Podolny, 1993). This relational nature of status leads to a status-based homophily between firms, where high-status firms are predominantly inclined to partner with other high-status firms (Podolny,

1994). Confirming this view, Chung et al. (2000) find strong evidence for status homophily in underwriting syndication relationships among U.S. investment backs.

However, as young firms, biotechnology companies rarely have the accomplishments to form a strong reputation and obtain status that can place them into this virtuous cycle of status. We argue that market actors, in light of the difficulty in gauging the status of young biotechnology firms, rely upon the social status of the *individuals* that comprise the firm's upper echelon as a proxy of the firm's social standing (Higgins and Gulati, 2003). In particular, we contend that the status of the career affiliations of upper echelons act as a proxy of the firm's status in the absence of more objective quality measures (D'Aveni, 1990; Eisenhardt and Schoonhoven, 1996; Higgins and Gulati, 2003, 2006). The homophily between the status of the affiliations of a young firm's upper echelon and the status of a firm's alliance partners may thus influence who allies with whom. In the present context, prestigious pharmaceutical firms, research institutes, and other biotechnology companies will rely on the status of upper echelon affiliations to sort out promising partners and to protect their high status by avoiding inferior companies. Thus, we expect that the number of prominent affiliations of a young firm's upper echelon will be positively related to the frequency of alliance formation with prominent actors.

Hypothesis 2a. The greater the number of upper echelon members with prominent downstream affiliations, the greater the rate at which the firm forms alliances with prominent firms.

Hypothesis 2b. The greater the number of upper echelon members with prominent upstream affiliations, the greater the rate at which the firm forms alliances with prominent firms.

Hypothesis 2c. The greater the number of upper echelon members with prominent horizontal affiliations, the greater the rate at which the firm forms alliances with prominent firms.

2.2.2 Role homophily

Status is but one aspect of homophily that may exist between two firms. Borrowing from the sociological literature on roles and structural equivalence, we next focus on the role that firms play in the industry as a source of homophily between firms. One of the central insights of early social network research is the fact that people occupying similar positions in a network of relationships share similar roles to one other, and accordingly inherit similar obligations, status, and expectations (White, Boorman, and Breiger, 1976; Burt, 1980). This effect of structural equivalence occurs even in the absence of preexisting direct ties, suggesting that an implicit structural influence exists between actors in similar social positions or roles[2]. As a result, the propensity for those occupying similar roles in a social space to form relationships is higher than it is for those that have dissimilar role relationships. For example, employees are more likely to have ties to others who occupy their same job or a similar role within a profession (McPherson et al., 2001; Blau, 1974).

In the domain of entrepreneurial firms where indicators of firm quality are non-obvious and thus, entering into partnership is inherently uncertain, the same rationale for homophily may exist, even despite the strong desire of firms to achieve division of labor based on role differentiation. That is, under conditions of great uncertainty, actors have a stronger tendency to seek out similar others (Podolny, 1994). At the organizational level, Podonly (1994) finds that

[2] Winship and Mandel (1983) argue that roles and positions are conceptually distinct, with the latter indicating specific locations in a particular social structure (ties to specific actors), and the former providing a way to classify positions across any number of distinct social networks. However, the distinction is less meaningful for our purposes in this paper, and thus, we use the two interchangeably.

homophily between organizations is more common in non-investment grade markets which have higher uncertainty than investment grade markets. Podolny (1990) also finds experimental evidence that in political systems, uncertainty increases peoples' propensity to restrict social exchanges to those whose policy preferences are similar to their own.

In the life-sciences domain, in which there is tremendous uncertainty regarding product and market viability (Aldrich and Fiol, 1994), uncertainty regarding relationship formation may be especially pronounced. Here, we propose that established firms will be more open to partnering with firms that have upper echelon members that come from similarly positioned firms in the industry. In terms of homophily, then, we expect that prominent firms will be attracted to firms that employ members with matching types of affiliations. As examples, we expect that Merck will be more interested in young biotechnology firms that have upper echelon members from other prominent pharmaceutical firms such as Pfizer, Glaxo, etc.; Dana Farber will more attracted to firms with upper echelons from prominent research institutes such as Cal Tech; Amgen will be more interested in new firms that employ former Genentech employees and so forth.

As psychology and sociology research on homophily shows, similarly positioned individuals tend to possess similar attitudes and tendencies for behavior (Rice and Aydin, 1991; Wellman, 1983). At the firm level, homophily between roles of firms implies a similarity between the operating protocols and routines of a firm, which in turn allows firms to better exchange or jointly develop new technology (Cohen and Levinthal, 1990). Thus, even in the absence of direct ties with one another, firms that have individuals who share experiences in firms that ply similar roles in the market should develop similar outlooks and values, language, and behaviors. Role-based homophily should thus help alleviate the inherent aforementioned

uncertainty and risk associated with alliance formation with entrepreneurial firms in the life-sciences field.

Hypothesis 3a. The greater the number of upper echelon members with prominent downstream affiliations, the greater the rate at which the firm forms alliances with prominent downstream firms.

Hypothesis 3b. The greater the number of upper echelon members with prominent upstream affiliations, the greater the rate at which the firm forms alliances with prominent upstream firms.

Hypothesis 3c. The greater the number of upper echelon members with prominent horizontal affiliations, the greater the rate at which the firm forms alliances with prominent horizontal firms.

3. Methods

3.1. Sample and data collection

Our sample frame includes U.S. biotechnology firms that were founded between 1961 and 1994. Of these 858 firms, 299 went public between 1979 and 1996. Approximately 86% of the public firms specialized in the development of therapeutics and/or human diagnostics; the majority of the remaining firms specialized in agriculture and/or other biological products, generally with the explicit intention of engaging in therapeutic applications in the future.

We compiled our data from both published and unpublished sources, striving to be as thorough as possible, yet focused on true, dedicated biotechnology firms. Our primary list of

public biotechnology firms was obtained from the *BioWorld Stock Report for Public Biotechnology Companies* in 1996 (n = 281). Unlike other sources (e.g. BioScan), this listing does not include large corporations (e.g. General Electric) that participate tangentially in the biotechnology industry; hence, ours is a narrower definition of biotechnology than that employed by other researchers (e.g. Barley et al., 1992) and is in line with more recent research on the industry (e.g. Powell et al., 1996).

Further, to guard against sample selection bias, we collected information on firms that went public in the same time frame as our sample but that did not survive in their original form by 1996. To do this, we obtained information from biotechnology research organizations including BIO, the North Carolina Center for Biotechnology Information, Recombinant Capital (Recap), and the Institute for Biotechnology Information. We also compared three editions of *Biotechnology Guide USA* (Dibner, 1988, 1991, 1995). From these sources, we identified an additional 18 dedicated U.S. biotechnology firms that went public but were not in existence in their original form in 1996; they had experienced name changes, merged, or had been acquired. These firms were founded in the same time period and had gone public by the end of 1996.

We also collected information on biotechnology firms that were founded in the same time period as our sample but that did not go public by 1996 (n = 468) from the 1998 edition of the Institute for Biotechnology Information (IBI) database. We added to this list private biotechnology companies that were listed as "dead," merged, or acquired in the first three editions of the *Biotechnology Guide USA* (Dibner, 1988, 1991, 1995) and that had a founding date in the same time period as our core sample (n = 90). Combining these private firms with our sample of firms that did go public yielded a final combined sample size of 858 firms.

Our main variables of interest were drawn from the career histories of the 3,200

managing officers and directors that comprise the top management teams of the 299 public firms in our core sample. Information on these individuals and their firms was manually obtained from the firms' final prospectuses. In filing with the SEC, firms are required to list the last five years of experience of the firm's managing officers; additional information (e.g., educational background) may be listed but is not required by the SEC. We consulted additional sources such as Dun and Bradstreet for cross-verification.

3.2. Dependent measures and analysis

Data for alliances were obtained from the Recombinant Capital (Recap) database, a comprehensive source of pharmaceutical and biotechnology alliances. Publicly traded firms are required by the SEC to file material documents such as the contracts specifying alliance terms. In addition, many states require privately held firms with employee stock options to file material documents as well (Lerner and Merges, 1998). Recap collects and analyzes these public filings along with company press releases to compile a database of over 13,000 alliances as of 2004.

We define an alliance as a licensing, joint venture, joint development, distribution, marketing, or manufacturing deal between a biotechnology company and a pharmaceutical firm, university, or research institute. To gauge whether particular downstream and horizontal employment affiliations were with prominent institutions, we used the amount of domain-specific firm revenues as a proxy for prominence. To gauge whether upstream employment affiliations were with prominent organizations, we employed external evaluations of the research institutions. A more detailed discussion on the specifics of classifying organizations into the categories can be found in the following section on the upper echelon affiliation measures.

As we frame our hypotheses in terms of the rate of alliance formation, we use an event history approach (Allison, 1984; Tuma and Hannan, 1984) to investigate the effects of upper echelon affiliations on alliances. We employed the proportional hazards model (Cox, 1972) to model the alliance rates of firms in our sample. The equation that we estimate takes the following specification:

$$h(t) = h_0(t)\exp[XB + Y(t)S]$$

where *h(t)* is the hazard or transition of alliance formation, $h_0(t)$ is an unspecified baseline rate for the hazard, *X* is a matrix of time-constant covariates, *Y(t)* is a matrix of time-varying covariates, and *B* and *S* are vectors of unknown regression parameters. The major benefit of this model is that we do not have to make assumptions regarding the shape of the baseline hazard $h_0(t)$ (Kalbfleisch and Prentice, 1980).

3.3. Independent measures: upper echelon affiliations

The affiliations of the upper echelon were assessed by manually identifying and classifying the last five years of 3,200 managing officers' employment and board memberships, as listed in the firms' final prospectuses. We assessed whether or not each upper echelon member had at least one tie to prominent upstream, horizontal, and downstream organizations, and also noted the exact year and month these individuals joined the firm. A running total of the number of individuals with prominent ties among the upper echelon was continually updated from the firm's founding date to the time of IPO.

For upper echelon *downstream employment affiliations*, we assessed the number of affiliations that upper echelon members had to prominent pharmaceutical and/or healthcare (e.g., major medical device) institutions through prior employment and/or board memberships. To determine which institutions were prominent, we generated a list of the top pharmaceutical and healthcare organizations by sales since 1979, using Compustat. International companies are only ranked by Compustat from 1988 on, so our rankings are based on the top 30 U.S. organizations from 1979 to 1987 and from the top 30 U.S. and international organizations from 1988 to 1996. We supplemented our list with major pharmaceutical and healthcare companies that were private or based in Europe or Japan that were not listed in Compustat but were listed in PharmaBusiness and had comparable sales. We classified organizations as prominent that appeared on these lists for every year of our sample. A total of 27 pharmaceutical/ healthcare companies were thus considered prominent.

For upper echelon *upstream employment affiliations*, we assessed the number of prominent research-based affiliations of members of a firm's top management team through board seats or employment (e.g., professorship). Seven editions of the *Gourman Report* (Gourman, 1980, 1983, 1985, 1987, 1989, 1993, 1996) were used to compile the list of prominent research institutions. For each of the 17 years in our dataset, we classified an academic institution as prominent if it appeared as one of the top 10 in any of the following disciplines: microbiology/ bacteriology, biochemistry, biomedical engineering/ bioengineering, molecular biology, cellular biology, chemistry, and medicine. A total of 21 academic institutions were thus classified as prominent. Nationally based government institutions such as the NIH were added to this list, as were non-university research institutions that received a high ratio of grant money per employee (e.g., the Salk Institute) (n = 9).

For upper echelon *horizontal employment affiliations*, we assessed the number of affiliations that members of a firm's upper echelon had to prominent biotechnology firms through employment and/or board memberships. We generated the list of prominent biotechnology companies by taking the list of worldwide revenues for the top 30 biotechnology companies in each of the years 1990-1996, from POV Inc., "Biotechnology's Top 50 in Pharmaceuticals and Diagnostics: A Competitive Analysis" (1997).[3] Given the paucity of data prior to 1990, we used the 1990 rankings to classify affiliations as prominent from 1979 through 1989. A total of 38 companies were coded as prominent biotechnology firms.

3.4 Control Variables

3.4.1. Time varying control variables

As discussed, previous research has emphasized the fact that an established network of inter-organizational relationships is a resource that facilitates the establishment and governance of future alliances (Gulati, 1995; Powell et al., 1996). Therefore, we control for this effect of prior alliance "embeddedness" by including the running total of prestigious alliances firms have accumulated since their founding. We also included the age of the firm (time elapsed since founding of the firm) as a control variable.

3.4.2. Other control variables

We included several variables that could influence the propensity of firms to attract

[3] While revenue may not be the ideal measure for biotechnology (since revenue may be R&D money resulting from alliances rather than internal product/technology returns), market capitalization lists were not available consistently enough to be used, and after checking with data that were available for market capitalization, the top 10 firms do not appear to differ. Furthermore, research by Powell, Koput, and Smith-Doerr (1996) has shown that biotechnology firms that are centrally located in the industry tend also to be large revenue-generators.

alliances to ensure the robustness of our claims. Ideally, these variables would be included as time-varying covariates, given that they change as a firm grows over time, but for the current study, we include our measures as static time-constant variables measured at the *time-of-IPO*[4] for the firm.

First, we included two control variables for technological uncertainty: *product stage* and *number of patents*. We reviewed the company sections of the prospectuses to determine how advanced each firm's technology was (Pisano, 1991; Pisano and Mang, 1993). We first coded the product that was at the latest stage into one of the following nine categories: discovery stage, research and development, pre-clinical indication, Phases I through III clinical trials, new drug approval (NDA) filing/FDA approval pending, final market approval, and revenue-generating, relatively speaking. We also examined the use-of-proceeds section of the prospectus to confirm that the lead product, as defined above, was also that which was designated to receive the most funding. Since one of the most relevant thresholds for evaluation is the stage of clinical trials (Pisano, 1997), our measure of *product stage* was based upon a three-category classification: whether a company's lead product was in pre-clinical stages of development (coded as "1"), clinical stages of development (coded as "2") or in post-clinical stages of development (coded as "3"). In addition, we obtained the *number of patents* each firm had from the online database of the U.S. Patent and Trademark Office.

We included a measure for firm size by taking the number of employees at time of IPO. In addition, given prior research on the important role of the endorsement of venture capitalists (e.g., Gompers et al., 1998), we controlled for the *prominence of venture capital firms* at the time of the IPO. To determine whether each of our biotechnology firms had partnered with a

[4] This is a conservative measure of the effects of the control variables in our model, and thus, do not bias our results significantly. By using the time of IPO as the point of determining the time-constant variables of the model, we are allowing the firm the best possible conditions to attract an alliance from the date of founding.

prominent VC firm, we created lists of prominent venture capital firms for each IPO year in our dataset as follows. We obtained rankings of venture capital firms from VentureXpert, a Securities Data Corporation database; rankings were based on total dollars invested by each venture capital firm in each of the 18 years that comprise the timeframe of our dataset. Firms were coded as 1 if any of the biotechnology firm's venture capital firms (with a minimum of a 5% stake) were listed as among the top 30 venture capital firms on the list of prominent venture capital firms for the year prior to the firm's IPO date and 0 otherwise.

Finally, we coded firms for their geographical location. Young firms that are located in areas rich with industry-related activity will likely have greater access to resources, including qualified personnel, suitable lab space, and technology that can give them an advantage (Saxenian, 1994). Moreover, firms that are collocated in these "hotbeds" of research should have a greater chance of interacting with other firms and institutes both on an informal and formal basis (Zucker, Darby, and Brewer, 1998). Thus, we include a dummy variable for location that took a value of 1 if the main offices of a biotechnology company were located in one of the following areas that were consistently rated among the top four biotechnology locations for the period of our study (Burrill and Lee. 1990, 1993; Lee and Burrill, 1995): San Francisco, Boston, or San Diego.

4. Results

Insert Table 1

Correlations between the variables of interest at time-of-IPO are presented in Table 1.

Table 2 presents the Cox models of alliance formation rates. Figure 1 and 2 plot the baseline survivor curves for the different types of events. These curves show the relationship between "survival" (i.e. not forming an alliance) and analysis time when all covariates are equal to zero. Figure 1 shows the baseline survivor rates for all alliances (Hypothesis 1) and prestigious alliances (Hypothesis 2). Regular alliances have a steeper curve than prestigious alliances, indicating that all else being equal, forming an prestigious alliance is more difficult and takes relatively more time. Figure 2 shows the baseline survivor rates for prestigious alliances broken down into the three types—downstream, upstream, and horizontal. Upstream alliances are relatively easy to obtain, and mostly formed promptly after a person joins or a prior alliance was formed (i.e. in the early stages of a spell). This most likely reflects the fact that most biotechnology companies start off with close relationships with prominent research institutes (Zucker et al., 1998). The baseline survivor rate for downstream alliances decreases at a higher rate than horizontal alliances, which are not easily formed in the absence of prominent upper echelon members.

Insert Figure 1, 2, Table 2

Returning to the results of our model (Table 2), Model I tests the idea that upper echelon members' prominent employment affiliations lead to a higher rate of alliance formation (Hypothesis 1a-c). The results of this model show that downstream and horizontal affiliations have a significant effect on the hazard of obtaining an alliance supporting Hypotheses 1a and 1c, as do control variables such as previous alliances, product stage, and number of patents. To better understand what the magnitude of the coefficients indicates, we transform and present each coefficient into hazard ratios. For example, the hazard of obtaining an alliance increases

19%[5] (p<.01) above the baseline hazard rate with each additional upper echelon member with a prominent downstream affiliation. Similarly, the hazard of obtaining an alliance increases 16% (p<.01) with an additional horizontal affiliation. However, the effect of upstream affiliations was not statistically different from zero (Hypothesis 1b). As expected, the accumulated number of prestigious alliances had a strong effect (p<.01) on forming an alliance (35% increase with additional prestigious alliance). Both number of patents and product stage had a negative effect on alliance formation, decreasing the hazard by 4% and 14% respectively (p<.05). We interpret this result as firms with mature technologies being less inclined to split the economic benefits by allying with other firms, and as a result, becoming a less attractive alliance partner (Pisano, 1997).

Model II tests the notion that high prestige in the upper echelons lead to alliances with *prominent* actors. Once again, downstream and horizontal affiliations had a significant effect on the hazard of forming an alliance with a prestigious partner (Hypotheses 2a and 2c). An additional member with prominent ties increased the hazard by 14% (p<.05) and 23% (p<.01) for downstream and horizontal affiliations. The effect of upstream affiliations was positive, but not statistically significant at the 95% level (Hypothesis 2b).

Model III-V test the matching hypothesis of types of affiliations and types of alliances. Model III shows that an additional downstream affiliation increases the chance of obtaining a prestigious downstream alliance by 40% (p<.01), confirming Hypothesis 3a. We find strong support for Hypothesis 3c, where an additional horizontal affiliation increases the hazard of horizontal alliances by 57% (p<.01). The results regarding prestigious upstream affiliations and upstream alliances (Hypothesis 3b) again failed to support our hypothesis.

[5] Percentage effects reported in the text are calculated by exponentiating the coefficients and multiplying the increase over 1.00 by 100. For example, the hazard of an alliance is 1.19 (=exp(0.17)) times the baseline hazard rate with each additional unit increase, which leads to 19% (.19 x 100) increase over the baseline hazard ratio.

To better understand the mechanisms that drive our findings for the matching models, we conducted additional analyses that separated alliances that were direct firm matches between affiliation and alliance (i.e. top manager with Pfizer affiliation leading to Pfizer alliance) and non-direct matches (i.e. top manager with Pfizer affiliation leading to Merck alliance). If our findings for a match between downstream affiliations and downstream alliances were the result of these firm-specific matches, then our reasoning that homophily (as opposed to direct social capital) play a role is less convincing. We present estimates from models predicting the hazard of obtaining alliances that were prominent and of a specific type (downstream, upstream, horizontal), but did not directly match with any affiliations of the upper echelon. The results show that prominent affiliations still had a big role in attracting these non-firm specific alliances for downstream (32% increase in hazard ratio, $p<.01$) and horizontal alliances (32% increase in hazard ration, $p<.05$), implying that our findings are more than simply having more access to organizations at which one had previous affiliations.

Of more interest is the negative and significant effect of horizontal affiliations on non-matching horizontal alliances (27% decrease in hazard of obtaining an upstream alliance, $p<.05$). This suggests that having more affiliations to prominent research institutions actually *hampers* a firm's ability to attract alliances with other research institutes. This explains the statistically insignificant effects of upstream affiliations—while upstream affiliations facilitate alliances with the specific organizations that match the upper echelon's affiliations, it has a negative effect on all other upstream alliances, canceling each other out and producing an insubstantial effect on average. More detailed discussion of this finding is presented in the ensuing discussion.

Figure 3 summarizes the results by showing the increased hazard rates as a result of an additional upper echelon member with a given type of affiliation, and a simplified matrix of the

influences between type of affiliation and alliance.

Insert Figure 3

One noteworthy fact is that the effects of horizontal affiliations were unexpectedly strong across the various alliance types. While the frequency of firms having an upper echelon member with ties to a prominent biotechnology company is low—mainly due to the fact that the population of prominent biotechnology firms is small given the maturity of the industry—when a firm does in fact have such a member on their top management team or board, it is extremely helpful in attracting an alliance. This, we believe, indicates that previous experience at a successful biotechnology company is an especially valuable asset for potential alliance partners.

5. Discussion

This study drew upon the idea of homophily to examine how young biotechnology firms became more attractive to potential partners that could provide access to critical resources. Extending prior work on upper echelon affiliations (e.g. Certo, 2003; Higgins and Gulati, 2003), we proposed that the prominence of members' prior careers influenced the rate at which companies form alliances. Then, further dissecting the relationship by examining the other side of the equation, the alliance partner, we also proposed that upper echelon affiliations provided a basis upon which homophily between firms occurs and acts as a catalyst to forming partnerships. More specifically, we argued that the nature of status dynamics and the inclination of firms to avoid dilution of their status lead prominent firms to choose biotechnology companies that are

comprised of members that have affiliations to other high-status firms. In addition to status-based homophily, we proposed that the role characteristics reflected by the career affiliations of upper echelon members also act as a dimension upon which homophily between firms arises. We argued that such role-based homophily leads to partnerships between the affiliation composition of a firm's upper echelon and the type of established firm that partners with the entrepreneurial firm.

Our findings extend prior research on entrepreneurial firms, particularly studies situated in the life sciences, by showing how young firms' upper echelon affiliations relate to the type of partners they attract. Furthermore, by exploring different aspects of organizational homophily, we were able to drill deeper into the multiple factors that influence alliance formation. First, we found that prominent upper echelon employment affiliations led to a higher rate of overall alliance formation. Extending prior research on top management teams (Eisenhardt and Schoonhoven, 1996), we found that the composition of upper echelons had an influence on alliance formation. Specifically, the presence of members that were previously affiliated with prominent downstream (pharmaceutical) and prominent horizontal (biotechnology) firms significantly increased the chance of obtaining any alliance. We found no evidence that the effect of prominent upstream (i.e. research institutes) affiliations influenced alliance formation.

Taking the analysis one step further, we theorized that homophily based on the prominence of prior employment affiliations of upper echelons would influence the propensity to form alliances with prominent partners. Our results show that the affiliations of upper echelon members not only catalyzed alliance formation in general, but more specifically, was a significant factor in attracting prominent partners, an extremely valuable resource for pre-IPO firms (Stuart et al., 1999). Once again, we found that downstream and horizontal affiliations had

a significant effect on the hazard of obtaining a prominent alliance, while the effect for upstream affiliations was not statistically significant.

We also considered a different type of homophily—that based on the role or position an upper echelon member's organization occupied and that of potential partner firms, In our examination of how different types of employment affiliations influenced specific types of alliance formation, we found that matching between employment affiliation type and alliance type occurred for downstream and horizontal alliances. We suggested that this may be the result of sharing similar beliefs and understandings on how products should be developed and how biotechnology firms should be run. This homophily mechanism not only allows us to answer the question of which firms ally with which, but it also provides a more tangible mechanism than prior explanations focused on legitimacy or signals.

In a supplemental analysis, we also found that prominent affiliations led to matching types of alliances, even when we exclude alliances that were potentially the result of direct social capital (i.e. former Pfizer employee securing an alliance with Pfizer). This suggests that a significant portion of the variance in alliance formation patterns can be attributed to indirect factors such as homophily. While our analysis cannot entirely rule out alternative explanations such as human capital or direct social capital, our evidence strongly suggests that commonality in backgrounds between a young firm's upper echelon and potential partner firms is an important factor in determining alliance propensities.

This conclusion that role-based homophily matching upper echelon affiliations with similar types of alliance partners is an important mechanism in understanding how firms choose specific partners was further confirmed in our conversations with entrepreneurs in the biotechnology domain. A recurring theme in practitioners' comments was the benefits of having

people who "share the same language" when working through complex deals with alliance partners. From the viewpoint of prominent alliance partners, having people who share similar industry perspectives and understand the specific needs of the organization may be inherently more attractive as partners (Gulati, 1999). This is especially true as alliances are not one-shot market transactions, but rather long-term mutual commitments that involve repeated interaction and cooperation (Powell, 1990). Not having to revisit basic assumptions about operating procedures or industry norms makes the entire process smoother for both parties, enhancing the chances that prominent partners will seek out entrepreneurial firms whose top managers share similar perspectives.

However, as seen in the lack of a significant effect for upstream affiliations, the extent to which homophily between firms arises is contingent on the context of the potential relationship. Rather than exhibiting role-based homophily, upstream affiliations turned out to be an *impediment* to striking alliance deals with other prominent upstream organizations. We conjecture that this negative effect of upstream affiliations may stem from the specific context of knowledge flows in academic research. When a firm employs members from a prominent research institute, it signals that the firm engages in a particular strand of research that could preclude a firm from attracting research institutes that engage in competing research agendas. Given the mostly unidirectional flow of knowledge from academic/research institutions to biotechnology companies (Zucker, Darby, and Armstrong, 2002; Jaffe, 1989), prominent research institutes should have less to gain and more to fear (spillovers to other academic labs) when a biotechnology company is perceived to be locked in to a different research institute. In other words, the prominence of upper echelon members' prior affiliations may ironically act as a constraint to their ability to engage in future research opportunities. The strong negative effect of

upstream affiliations excluding "direct" ties on upstream alliance formation supports our claim and suggests an avenue for future research.

The findings from this research have several important implications for organizational research. First, we extend prior research investigating the external value of the composition of a firm's top management team and board. The characteristics of boards of directors (e.g. Certo, 2003; Hillman and Dalziel, 2003) and top-management teams (e.g. D'Aveni, 1989; Higgins and Gulati, 2003) have been shown to influence organizational legitimacy, and thus, market performance such as IPO performance. We present another external value of upper echelon characteristics in the relationship between upper echelon composition and alliance formation. Although prior studies suggest that upper echelon backgrounds signal legitimacy to outsiders, without a detailed examination of both the types of backgrounds of upper echelon members and the types of partners involved, underlying mechanisms become difficult to disentangle. Here, with time varying and detailed data, we were able to unpeel this general proposition to examine the specific ways in which firms may be attracted to one another.

Second, this study extends the literature on alliance formation by extending prior work on the "embedded ties" view of alliance formation. For nascent firms who have yet to establish themselves, explanations besides previous alliance relationships are necessary in explaining the propensities to form alliances. Positioning in the technology and market spaces have been identified as factors that influence alliance formation (Stuart, 1998; Eisenhardt and Schoonhoven, 1996). The current study adds career affiliations of the upper echelons as an important form of embeddedness that can help relationship formation for young firms. Of course, our study is not presented as an alternative or refutation of the well-established claim that prior alliance ties are critical. To the contrary, we believe that upper echelon affiliations present an

alternative form of embeddedness enabling young firms to establish positions in alliance or technology networks.

Third, we extend research on homophily. This study turns the prism on the vast majority of homophily research that has centered on the joining up of individuals to focus on the joining up of firms. Early alliance research touted complementarity as the main driver of external relationship formations (Hamel et al., 1989; Teece, 1986). This implies strong division of labor and differentiation between partners of firms. Recently, scholars have focused on the social aspects of inter-firm relationships, arguing that trust and other social lubricants are essential in maintaining smooth relationships (Gulati, 1998). We argued that this need to both differentiate and integrate presents a challenge for firms contemplating a inter-firm relationship. Here, we presented upper echelon affiliations as a means by which firms are homophilous while also differentiated on other dimensions.

Our study is not without limitations. The use of constant measures for firm size, patents, and product stage at the time of IPO as opposed to reflecting their true time varying nature is an issue we hope to address in future studies. An additional limitation is the fact that we only look at the pre-IPO time-period for firms. Alliance formation certainly possesses different value and importance for pre-IPO and post-IPO firms. Thus, the current study's boundary conditions limit our ability to generalize beyond the scope of young firms that have yet to go public. At the same time, this presents an interesting future research opportunity to examine how the role of upper echelon affiliations changes once there is somewhat more objective information regarding the quality and viability of a firm become transparent post-IPO. Finally, one issue not addressed is how upper echelon members' affiliations influence different progressions of alliances—in other words, do the affiliations of upper echelon members' have the greatest influence for first

alliances and subsequently decline in their influence or are they uniform in their effect on alliance formation? This is an issue that is open to future research.

In addition to the aforementioned contribution to academic research on entrepreneurial firms, this work should have implications for entrepreneurs and scientists currently or contemplating running a biotechnology firm. If alliances are crucial to a young biotechnology firm's survival and success as previous studies have shown, then creating the best possible conditions to attract these alliances is imperative for managers of these firms. In addition to having quality products or research that are attractive to more prestigious firms, one factor that managers have significant control over in the early stages of a company is the composition of their upper echelons. By attracting people with the "right" type of backgrounds, as indicated here, young companies can enhance their attractiveness to large firms or institutes and get a leg up on the many other companies that are competing in the fiercely competitive entrepreneurial space.

Table 1
Means, Standard Deviations, and Correlations

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Product Stage	1.85	0.84	1.00												
2. Number of Patents	1.66	3.48	0.27**	1.00											
3. Firm Size	85.58	119.93	0.26**	0.02	1.00										
4. Firm Age	4.90	2.89	0.30**	0.27**	0.28**	1.00									
5. VC Prominence	0.32	0.47	0.02	0.01	0.05	0.04	1.00								
6. Location	0.51	0.50	-0.21**	-0.12*	-0.14*	0.02	0.03	1.00							
7. Downstream Employment Affiliations	1.73	1.57	0.16**	0.08	0.12*	0.08	0.13*	-0.08	1.00						
8. Upstream Employee Affiliations	1.33	1.45	-0.16**	-0.11	0.02	0.06	0.04	0.39**	0.05	1.00					
9. Horizontal Employment Affiliations	0.89	1.33	-0.15*	-0.08	0.00	-0.03	0.15**	0.16**	0.10	0.19**	1.00				
10. Alliances	2.83	3.63	-0.11	-0.06	0.03	0.22**	0.11	0.06	0.20**	0.19**	0.27**	1.00			
11. Prominent Alliances	0.80	1.42	-0.21**	-0.04	0.01	0.12*	0.19**	0.09	0.16**	0.18**	0.34**	0.74**	1.00		
12. Downstream Alliances	0.33	0.72	-0.14*	0.03	0.05	0.14*	0.14*	0.05	0.24**	0.13*	0.16**	0.56**	0.71**	1.00	
13. Upstream Alliances	0.38	0.95	-0.21**	-0.08	-0.02	0.06	0.17**	0.09	0.01	0.15**	0.27**	0.54**	0.78**	0.18**	1.00
14. Horizontal Alliances	0.09	0.36	-0.03	-0.02	0.00	0.04	0.03	0.01	0.11	0.05	0.29**	0.39**	0.49**	0.33**	0.11

N=292, *p<.05, **p<.01

Table 2
Cox Proportional Models Predicting Rate and Type of Alliance Formation

Alliance Type	Any I	Prominent II	Downstream III	Upstream IV	Horizontal V	Non-Direct Downstream VI	Non-Direct Upstream VII	Non-Direct Horizontal VIII
Previous Alliances	0.30**	0.32**	0.30**	0.36**	0.31*	0.34**	0.43**	0.39*
	(0.03)	(0.06)	(0.07)	(0.09)	(0.13)	(0.07)	(0.11)	(0.15)
Product Stage	-0.16*	-0.43**	-0.39*	-0.61**	0.05	-0.29	-0.71**	0.12
	(0.08)	(0.12)	(0.16)	(0.17)	(0.41)	(0.16)	(0.19)	(0.46)
Number of Patents	-0.04*	-0.01	0.02	-0.06	-0.16	0.02	-0.08	-0.07
	(0.02)	(0.02)	(0.03)	(0.04)	(0.10)	(0.03)	(0.05)	(0.08)
Firm Size	0.00	0.00	0.00	0.00	0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Firm Age	0.00**	0.00*	0.00	0.00**	0.00	0.00	-0.00*	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
VC Prominence	-0.07	0.13	0.04	0.36	-0.29	0.07	0.28	-0.35
	(0.12)	(0.15)	(0.23)	(0.25)	(0.41)	(0.24)	(0.28)	(0.48)
Location	0.02	0.19	0.23	0.15	0.21	0.20	0.15	-0.35
	(0.13)	(0.17)	(0.26)	(0.25)	(0.50)	(0.28)	(0.30)	(0.62)
Downstream Employment Affiliations	0.17**	0.13*	0.34**	-0.18	0.28**	0.28**	-0.20	0.28*
	(0.04)	(0.06)	(0.07)	(0.10)	(0.11)	(0.08)	(0.11)	(0.12)
Upstream Employee Affiliations	0.07	0.06	0.07	0.05	0.01	0.02	-0.32*	0.22
	(0.04)	(0.05)	(0.08)	(0.09)	(0.14)	(0.09)	(0.16)	(0.13)
Horizontal Employment Affiliations	0.15**	0.21**	0.13	0.23**	0.46**	0.14	0.30**	0.38**
	(0.04)	(0.06)	(0.09)	(0.09)	(0.11)	(0.09)	(0.10)	(0.11)
Log Likelihood	-5042.75**	-1575.42**	-689.37**	-731.98**	-187.22**	-533.67**	-484.01**	-160.62**

*p<.05, **p<.01
Numbers in parentheses are standard errors.

Figure 1
Baseline Survivor Rates for Alliances and Prominent Alliances

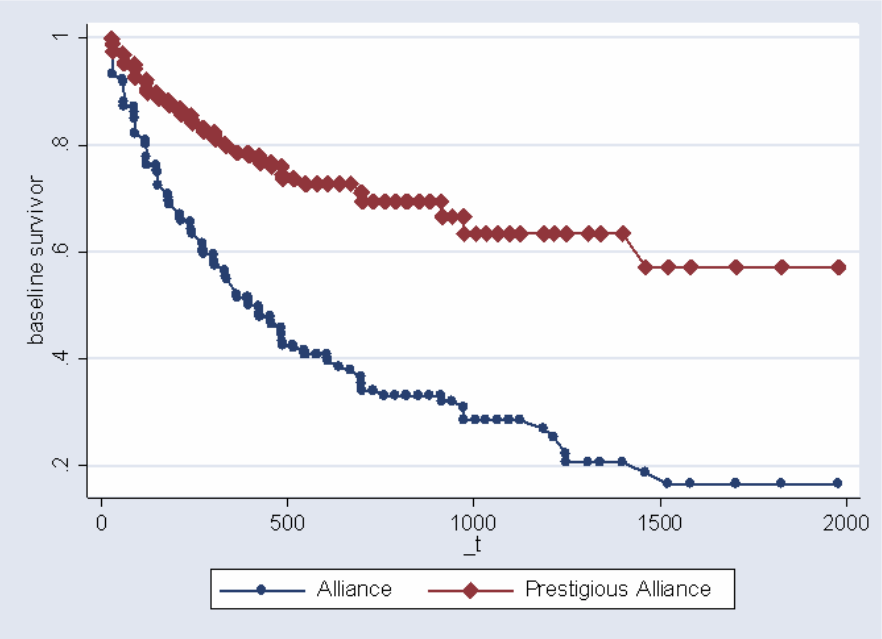

Figure 2
Baseline Survivor Rates for Alliances by Type

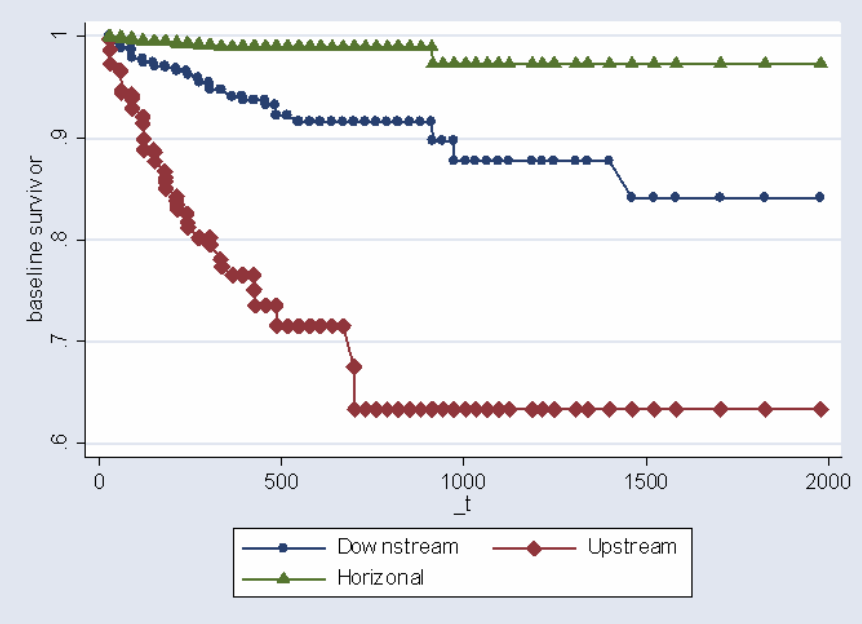

Figure 3
Summary of Effect of Affiliation on Alliance Types

Affiliation	Alliance Type		
	Downstream	Upstream	Horizontal
Downstream	**++**	-	++
Upstream	0	--	+
Horizontal	**+**	++	++

*Note: +/- denote positive/negative effects on alliance formation rates. ++/-- indicate significant effects at the .05 level

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