Inter-Organizational Imitation and Acquisitions of High-Tech Ventures

ABSTRACT

This paper suggests and finds that there is a positive association between the changes in the number of prior acquisitions (the changes in the prominence of prior acquirers) within the focal venture's subfield and the venture's likelihood to be acquired. Results are in line with the existence of frequency and trait based imitation in acquisitions targeting tech ventures. More importantly, we suggest and show that these positive associations are more pronounced when (i) the exogenous technological uncertainty within the venture's subfield increases and (ii) there is high difference between the focal venture's and acquirer's technological resources. Our findings are in accord with the suggestion that uncertainty in the technology domain might be an important boundary condition in moderating the extent of frequency- and trait-based imitation in technology acquisitions. We discuss alternative explanations for the above associations and related robustness tests in detail.

INTRODUCTION

It is well known that technology ventures (or simply ventures, henceforth) present uncertainty to potential acquirers given that these ventures generally lack established track records, are privately held, and their knowledge resources are tacit (e.g., Amit, Glosten, and Muller, 1990; Ransbotham and Mitra, 2010; Stuart, Hoang, and Hybels, 1999). Faced with such uncertainties, potential acquirers may not acquire a venture, and deals that would be valuable for acquirers and targets alike may fail to occur (e.g., Higgins and Rodriguez, 2006; Shane and Cable, 2002). It is therefore important to investigate the factors that can facilitate acquisitions of ventures (Arikan, 2005; Arikan and Capron, 2010; Arikan and McGahan, 2010; Brau, Francis, and Kohers, 2003; DeTienne, 2010; Sanders and Boivie, 2004).

When faced with uncertainty, potential acquirers may be substantially influenced by other firms' actions and hence imitate previous acquisitions by others (e.g., Lieberman and Asaba, 2006). In this paper, we first analyze frequency- and trait-based imitation (Haunschild and Miner, 1997) in acquisitions involving technology ventures. Specifically, we first suggest that there is a positive within subfield level association between (i) the changes in the number of acquisitions targeting the focal venture's rivals in the subfield, and (ii) the changes in the prominence of acquirers in such acquisitions, and the venture's likelihood to be acquired (in line with frequency and trait based imitation, respectively).

Even though previous studies show that when there is higher uncertainty imitation is more likely to occur (e.g., Lieberman and Asaba, 2006), such studies focus on the uncertainty pertaining to non-tech industries as well as sources of uncertainty relevant to established, public companies (e.g., Haunschild and Miner, 1997). For example, imitation studies have considered the roles played by policy-related uncertainties in international investments or dispersion in analysts' earnings forecasts in amplifying imitation in M&A behavior (e.g., Haunschild and Miner, 1997;

Henisz and Delios, 2001). However, research has yet to attend to the dimensions of uncertainty that might be especially relevant for tech ventures and hence might particularly affect the extent of imitation within a subfield regarding the acquisitions of tech ventures. Considering that the value of a tech venture's resources, capabilities, and prospects is closely associated with the tech venture's activities in the technology domain, technology-related dimensions of uncertainty might be especially relevant for acquirers of tech ventures (Folta, 1998; Mitchell, 1988; Anderson and Tushman, 2001).

By focusing on technology-related uncertainty, we expand the types of uncertainty that might moderate imitative behavior and hence intensify the positive association between the changes in acquisition activity within a tech venture's subfield and the future acquisition activity within the subfield. For this purpose, we first introduce exogenous technological uncertainty within the focal tech venture's industry subfield as a critical dimension of technological uncertainty. This uncertainty reflects the uncertainty in the technological landscape of the focal venture's subfield that is unaffected by the venture's own actions (Folta, 1998; Mitchell, 1988). Specifically, we first suggest that as the exogenous technological uncertainty within the focal venture's subfield increases over time, there is a more positive association between the changes in the number of acquisitions within the focal venture's subfield (changes in the prominence of acquirers in these acquisitions) and the venture's own likelihood to be acquired.

Second, we suggest that technological distance between the focal venture and its acquirer is another important boundary condition on the extent of imitation in technology acquisitions. Previous studies on imitation in acquisition markets have mainly focused on public targets and related dispersion in analysts' earnings estimates when analyzing the moderating role of transaction specific uncertainty on potential imitative behavior in M&As. However, this type of

transaction-specific uncertainty cannot be applied to tech ventures as they are private companies, for which a significant portion of M&A activity occurs. Tech distance represents the differences between the venture's and its acquirer's technological resources and knowledge bases (Fleming, 2001; Folta, 1998). As a result, tech distance limits the acquirer's ability to understand and assess the target's underlying technological resources (Lane and Lubatkin, 1998). Therefore the technological distance between bidders and targets is apt to be one of the most important factors that might contribute to the transaction specific uncertainty faced by the acquirers of tech ventures (Folta, 1998; Levitt and March, 1988). This lack of technical information and understanding of the target's resources, in turn, might increase the acquirer's receptivity to the social information conveyed by other acquisitions within a subfield and hence increase the likelihood of imitation. Consistent with our hypotheses, we find that positive associations between the changes in the number of prior acquisitions (changes in acquirer prominence) within a focal tech venture's subfield and the tech venture's own likelihood to be acquired is more pronounced when the tech distance between the focal venture and its acquirer is high.

Instead of suggesting a causal relationship, in this paper we suggest a positive association between the changes in the number of prior acquisitions within a venture's subfield through time (changes in the prominence of prior acquirers) and the venture's likelihood to be acquired. In addition, while our findings are consistent with theoretical suggestions on imitative behavior, M&A activities we observed might be influenced by a number of alternative explanations that we explore through various control variables and robustness analyses. Hence, we cautiously suggest that our findings are in line with the imitation-related hypotheses that we have presented even though alternative mechanisms are also plausible.

Inasmuch as our findings are consistent with social influence and imitative behavior, our study complements previous M&A-related studies considering how firms select alternative deal structures (e.g., Chari and Chang, 2009; Malhotra and Gaur, 2013) or organizational forms (e.g., Balakrishnan and Koza, 1993; Folta, 1998; Vanhaverbeke, Duysters, and Noorderhaven, 2003; Wang and Zajac, 2007) to deal with technological uncertainty. We also build upon and extend studies in corporate strategy and finance on imitation in M&A decisions involving targets other than privately-held tech ventures that are subject to different types of uncertainty (c.f., Chatterjee, 1986; Eckbo, 1983; Song and Walkling, 2000). Even more broadly, our paper also contributes to and extends prior studies on entrepreneurship and research on interfirm transactions by presenting new theoretical arguments and findings in line with the suggestion that imitation can be an important means by which potential exchange partners deal with the technology related uncertainty they are facing when transacting with tech ventures (e.g., Gaba and Terlaak, 2013).

THEORY AND HYPOTHESES

Frequency-Based Imitation for Acquisitions of Ventures

Acquisitions of technology ventures have become an essential means by which established firms can obtain new technological knowledge, access new products, and upgrade their technological assets (e.g., Ahuja and Katila, 2001; Puranam, Singh, and Chaudhuri, 2009). However, technology ventures typically entail high uncertainty because they do not have established track records or even products (e.g., Shane and Cable, 2002; Stuart *et al.*, 1999). As a result, potential acquirers of a technology venture might face substantial uncertainty regarding the quality of the venture's resources and its prospects when they are assessing the venture as an acquisition target (e.g., Stuart *et al.*, 1999). In the presence of uncertainty, potential acquirers might be influenced by other firms'

actions within the focal venture's subfield when making acquisition decisions. One important social influence factor is the previous actions of other firms that have carried out similar acquisitions in the past (e.g., Lieberman and Asaba, 2006; Haunschild and Miner, 1997).

In particular, we first suggest that potential acquirer of a tech venture might engage in frequency-based imitation within the venture's subfield as a means of coping with the technological uncertainty surrounding its acquisition decision (e.g., Garcia-Pont and Nohria, 2002; Haunschild and Miner, 1997; Lieberman and Asaba, 2006). Previous studies suggest that frequency-based imitation occurs when firms imitate the actions conducted by a large number of other firms (Haunschild and Miner, 1997). There might be various reasons for such imitation in acquisition decisions. First, potential acquirers may infer relevant information cues about the opportunities for acquisitions by observing the acquisitions conducted by other firms –such as the acquisitions targeting a focal venture's rivals within the venture's subfield (e.g., Haunschild and Miner, 1997; Lieberman and Asaba, 2006). Second, legitimacy might be another possible motivator for imitation, whereby an action becomes taken-for-granted or institutionalized once a number of other firms take similar actions. For instance, Lieberman and Asaba (2006) note that legitimation is an important concept, "where once a threshold number of model actions occur, this institutionalizes, or legitimizes, the action and leads to further imitation" (p.372).

Previous studies report findings that are in line with frequency based imitation. For instance, Haunschild and Miner (1997) show that the number of other firms that hire a particular investment bank in their acquisitions, is positively related to the likelihood that the focal acquirer will hire this particular investment bank. The frequency of previous adopters is also shown to be associated with increases in a firm's likelihood of pursuing a diversification strategy (Fligstein, 1991), forming alliances (Garcia-Pont and Nohria, 2002), entering new product or geographic markets (e.g.,

Belderbos *et al.*, 2011; Guillén, 2002; Henisz and Delios, 2001), or exiting from an industry (Gaba and Terlaak, 2013).

For a model firm's actions to influence a potential imitator, the model firm's actions must be seen as sufficiently similar to those of the imitator (e.g., Belderbos et al., 2011; Garcia-Pont and Nohria, 2002; Guillen, 2002). In high tech industries, firms that operate within the same industry subfield, i.e., firms that are rivals, are more likely to work on similar technologies and products in comparison to firms across different subfields (e.g., DiMasi 2001; DiMasi, Feldman, Secker, and Wilson, 2010; Pisano, 1990). Consequently, we focus on the within-subfield level imitation in a focal tech venture's subfield and define the model acquisitions as the previous acquisitions targeting the other ventures, i.e. focal venture's rivals, within the focal venture's subfield. (For brevity, we also refer to model acquisitions as "previous acquisitions in the focal venture's subfield"). In particular, within the focal venture's subfield, frequency based imitation would occur if the focal venture's potential acquirers observe the previous acquisitions in the venture's subfield targeting the focal venture's rivals, and imitate these acquisitions by acquiring the focal venture. We therefore specify the following baseline hypothesis for within-subfield level frequency-based imitation:

Hypothesis 1: There is a positive association between the changes in the number of prior acquirers within the focal venture's subfield targeting the venture's rivals and the focal venture's likelihood of being acquired.

Trait-Based Imitation and Acquisitions of Ventures

Trait-based imitation is a more selective imitation mechanism than frequency-based imitation (Haunschild and Miner, 1997), wherein certain characteristics of the model firms affect the extent

of imitation. In particular, previous studies suggest that successful or larger firms are more likely to be imitated because such firms might be "perceived as likely to have superior information" (e.g., Lieberman and Asaba, 2006, p. 371). Previous studies also suggest that the actions of successful firms might legitimize such actions and further facilitate imitation. For instance, Lieberman and Asaba (2006) point out that successful retailers' activities in online retailing helped "legitimize" the efforts of other firms in online retailing and hence facilitated imitation.

Haunschild and Miner (1997) show that the size and success of previous acquirers hiring a particular investment banker is positively associated with the likelihood that the focal acquiring firm hires this particular investment banker, and they suggest that this association occurs due to trait-based imitation. Various other studies also provide related findings that are in line with trait-based imitation. Williamson and Cable (2003), for instance, show that there is a positive association between the size of the previous firms that have hired from a particular source, and other firms' likelihood to hire from the same source. Strang and Tuma (1993) show that the prestige, size, or success of model firms undertaking a particular practice is positively associated with the likelihood that others will engage in similar actions. These studies suggest that the prominence of the model firms as indicated by the model firms' size or profitability can be an important trait that can lead to imitation (Haunschild and Miner, 1997; Lieberman and Asaba, 2006). This indicates that if potential acquirers within a focal venture's subfield engage in trait-based imitation regarding whether or not to acquire the focal venture, then potential acquirers would attach more importance to acquisitions within the venture's subfield that are conducted by prominent acquirers. So, we hypothesize:

Hypothesis 2: There is a positive association between the changes in the prominence of prior acquirers within the focal venture's subfield targeting the venture's rivals, and the focal venture's likelihood of being acquired.

Technological Uncertainty as a Contingency Shaping Imitation within Subfields

While above hypotheses specify baseline predictions for frequency- and trait-based imitation for technology ventures, our primary aim is to consider the role of the changes in the level of technology-related uncertainty within-the focal venture's subfield as a potential contingency shaping imitation for acquisitions of tech ventures. In broad terms, uncertainty refers to a firm not knowing exactly which state of the world will emerge looking forward (Arrow 1974; McGrath, 1997; Radner, 1968), and researchers have long noted that firms seek ways to cope with uncertainty surrounding their decisions (Cyert and March, 1963; Thompson, 1967). It is suggested that when the uncertainty a firm faces regarding a particular decision increases through time, the firm's managers are more likely to look at other firms' actions for clues regarding appropriate managerial decisions (Lieberman and Asaba, 2006). More specifically, it is well accepted that, as uncertainty increases within a particular environment, social considerations become more important for firm behavior (e.g., Festinger, 1954; DiMaggio and Powell, 1983; Abrahamson and Rosenkopf, 1993).

Even though uncertainty in general is shown to moderate the extent of mimetic behavior, we expect that uncertainty in the technology domain can be particularly important in moderating the extent of imitation in acquisitions where technology ventures are acquisition targets (Stuart, 1998; Stuart, *et al*., 1999; Folta, 1998). As a consequence, in the following sections, we focus on two types of technology-related uncertainty, namely (i) exogenous technological uncertainty within the focal venture's subfield, and (ii) the transaction-specific uncertainty associated with the technological distance between the focal venture and its acquirer as important boundary conditions for frequency- and trait-based imitation for acquisitions involving technology ventures.

Exogenous technological uncertainty in a venture's subfield and imitation

Exogenous technological uncertainty (or exogenous tech uncertainty) is defined as uncertainty related to the technological environment in a venture's industry subfield that is largely unaffected by the venture's own actions (Mitchell, 1988). Exogenous tech uncertainty is highly related to the extent to which the technological landscape in a venture's subfield might change unexpectedly in the future (e.g., Anderson and Tushman, 2001; Mitchell, 1988; Oriani and Sobrero 2008). Relatedly, when exogenous tech uncertainty within a venture's subfield increases through time, it becomes more difficult to estimate or form expectations regarding which technology will emerge and potentially dominate the venture's environment (Anderson and Tushman, 2001). Above discussion suggests that as exogenous tech uncertainty within a focal tech venture's subfield increases through time, it will be more difficult to assess which capabilities, or what kind of technologies will be critical for future success within this particular subfield (e.g., Mitchell, 1988). Hence, exogenous tech uncertainty within a focal tech venture's subfield can be a critical dimension of uncertainty perceived by the venture's potential acquirers when assessing the value of the focal venture as a potential acquisition target (Folta, 1998).

Hence, based on the above discussion, we suggest that when the exogenous tech uncertainty within the focal venture's subfield increases through time, the positive within-subfield level association between the changes in the number of prior acquisitions (the changes in the prominence of prior acquirers) targeting the focal venture's rivals within the venture's subfield and the focal venture's own likelihood to be acquired is more pronounced (Lieberman and Asaba, 2006). Therefore:

Hypothesis 3: The positive association between the changes in the number of prior acquisitions within the focal venture's subfield targeting the venture's rivals, and the venture's

likelihood to be acquired, is more pronounced when exogenous tech uncertainty within the subfield increases.

Hypothesis 4: The positive association between the changes in the prominence of prior acquirers within the focal venture's subfield targeting the venture's rivals, and the venture's likelihood to be acquired, is more pronounced when exogenous tech uncertainty within the subfield increases.

Technological distance between acquirer and the focal tech venture, and imitation

Differences in the technological resources of an acquirer and a tech venture represent another important source of technology-related uncertainty for the acquirer, which can moderate the extent of association between the changes in the number of prior acquisitions (prominence of prior acquirers) in the venture's subfield and the venture's likelihood to be acquired.

Previous studies show that when firms face higher transaction specific uncertainty associated with acquiring a particular target, firms are more likely to be influenced by others' actions and hence more likely to imitate them (Haunschild and Miner, 1997). To incorporate transaction specific uncertainty, Haunschild and Miner (1997) focus on the variation in analysts' estimates of the target's earnings. However, this type of uncertainty does not apply to the acquisitions involving non-public targets.

One of the most important dimensions of uncertainty associated with economic exchanges in high tech contexts is the transaction-specific uncertainty stemming from the differences between the underlying technological resources of the firms (Folta, 1998; Makti et al., 2010; Lane and Lubatkin, 1998). In particular, technological distance (or tech distance) between two firms reflects the extent to which the underlying technologies and the knowledge bases of the firms are different (e.g., Ahuja, 2000; Folta, 1998; Makri, Hitt, and Lane, 2010). When tech distance is low, firms tend to be more similar to each other in terms of the underlying technological resources and

knowledge base they have been utilizing (Lane and Lubatkin, 1998; Makti et al., 2010). Above discussion suggest that if the tech distance between the acquirer and the tech venture is low, the acquirer has better information and understanding about the knowledge base of the venture and its technology (Ahuja, 2000; Gilsing, et al., 2008; Stuart, 1998). This, in turns makes it easier for the acquirer to understand the assumptions that shape the focal venture's knowledge and related cause-effect relationships (Ahuja, 2000; Fleming, 2001; Stuart, 1998). As a result, an acquirer is better able to define the set of criteria to assess the possible outcomes of integrating and utilizing the focal venture's technology (Fleming, 2001; Stuart, 1998).

On the other hand, when there is high tech distance between the focal venture and its potential acquirer, the potential acquirer does not have much information, or understanding of the associated costs, risks, or benefits of acquiring the focal venture (Lane and Lubatkin, 1998; Makti et al., 2010). Therefore, when an acquirer is assessing a technologically distant venture, the acquirer does not have as much information, or understanding regarding what kind of criteria to use to assess the value of the venture as an acquisition target (e.g., Folta, 1998; Lane and Lubatkin, 1998). This, in turn increases the transaction-specific uncertainty regarding the possible outcomes of acquiring the focal venture (e.g., Folta, 1998; Haunschild and Miner, 1997; Levitt and March, 1988).

Previous studies on social influence and imitation suggest that when a firm has relevant information, or understanding to assess a potential action, (and relatedly faces less transaction-specific uncertainty) the firm is more likely to act based on its own understanding and knowledge (Belderbos et al., 2011; Henisz and Delios, 2001). Under these conditions, marginal value of the social information inferred from others' actions is lower; decreasing the firm's likelihood of imitation (Haunschild and Miner, 1997; Belderbos et al., 2011; Henisz and Delios, 2001).

On the other hand, when the firm lacks relevant information and understanding to assess the factors that might affect the outcome of a particular action, the firm faces higher transaction specific uncertainty (Belderbos et al., 2011; Haunshcild and Miner, 1997; Henisz and Delios, 2001). Under these conditions the firm is more inclined to use the "social information" inferred from observing the others' actions and hence is more likely to engage in imitation (Galaskiewicz and Burt, 1991; Haunshcild and Miner, 1997; Henisz and Delios, 2001). Supporting above arguments, it is shown that when a firm lacks sufficient information and knowledge regarding investing in a particular country, the firm relies in a greater extent on the social information inferred from others' actions when making such investment decisions (Henisz and Delios, 2001; Belderbos et. al., 2011). Consistent with this view, Lieberman and Asaba (2006) emphasize that when firms have more difficulties in understanding the full range of potential consequences of their actions, firms are more perceptive to the information cues implicit in the actions of other firms, which facilitates the extent of imitation.

Above discussion suggests that in high-tech distance acquisitions, to the extent that the focal venture's acquirer lacks sufficient information and understanding to assess the possible outcomes of integrating and utilizing the venture's technology, the venture's acquirer is more likely to be influenced by the social information inferred from the previous acquisitions within the venture's subfield (Haunschild and Miner, 1997; Galaskiewicz and Burt, 1991). This suggests that the associations captured in our baseline hypotheses will be amplified for high-tech distance acquisitions, where acquirers face higher transaction specific uncertainty, in comparison to low tech distance acquisitions. Therefore:

Hypothesis 5: The positive association between the changes in the number of previous acquisitions within the focal venture's subfield targeting the venture's rivals, and the likelihood that the venture is acquired is more pronounced when the technological distance between the focal venture and its acquirer is high.

Hypothesis 6: The positive association between the changes in the prominence of previous acquirers within the focal venture's subfield targeting the venture's rivals, and the likelihood that the venture is acquired is more pronounced when the technological distance between the focal venture and its acquirer is high.

Alternative Explanations

There are some alternative mechanisms that might also suggest the hypotheses we have listed in our theory section. Relatedly, we want to emphasize that our hypotheses and related results should be interpreted as only suggestive of imitation and that there are alternative explanations that should be investigated in future research. In particular, apart from imitation, two main types of alternative explanations might be provided for our findings: (i) homophily, or similarity between the focal venture's acquirer and prior acquirers within the venture's subfield, and (ii) similarity in macroeconomic conditions faced by the focal venture's acquirer and prior acquirers within the venture's subfield.

Homophily. It is widely shown that similarity among individuals may make them more inclined toward higher levels of social affiliations in comparison to the levels expected by the individuals who do not have such similar attributes (e.g., Ruef et al., 2003). This mechanism is widely known as "homophily". Kossinets and Watz (2009) summarize homophily principle as "like to associate with like….Friends, spouses, romantic partners, co-workers, colleagues, and other professional and recreational associates all tend to be more similar to each other than randomly chosen members of the same population with respect to a variety of dimensions, including race, age, gender, socioeconomic status, and education" (Kossinets and Watz, 2009, page 405-406). Relatedly, homophily associated with various characteristics is shown to affect group and team formation and the communication between individuals (Kossinets and Wattz, 2009), as well as the formation of various relationships such as friendship, marriage (Kossinets

and Watz, 2009; McPherson et al., 2001; McPherson and Smith-Lovin 1987) and the formation of teams (Ruef et al., 2003).

Even though prior studies on homophily predominantly focus on the behaviors of individuals, the phenomenon might be also extended to the behaviors of the firms. In particular, firms with similar characteristics might face similar set of opportunities or be constrained in similar ways (Ahuja et al., 2009; Kossinets and Wattz, 2009). This discussion suggests that due to the similarities between the focal venture's potential acquirer and the previous acquires in the venture's subfield, the potential acquirer and prior acquirers might face similar opportunity sets, and consequently might make similar decisions regarding what type of targets to acquire (Kossinets and Watts, 2009; McPherson et al., 2001), even if there is no social influence or imitation per se.

Macroeconomic conditions. One of the dimensions of similarity among firms is the similarity in the firms' external environment, which might induce the firms to act in similar ways without social influence (e.g.,; Ahuja et al., 2009; Harford, 2005; Van de Bulte and Lilien, 2001). In particular, firms might act in similar ways not because they are influenced by each other, but because they are exposed to the same macroeconomic shocks (e.g., Haunschild, 1993; Harford, 2005; Van den Bulte and Lilien, 2001). This suggests that the focal venture's acquirer and the prior acquirers in the focal venture's subfield might be simply exposed to similar macroeconomic shocks, or aggregate trends, and as a result they might have responded in similar ways in their acquisition decisions.

Finally, a distinct alternative explanation related to the M&A context is that variations in the number of ventures within a subfield over time might shape the availability of ventures in the M&A market, which can affect the variations in previous acquisition activity within the venture's

subfield as well as the venture's likelihood of being acquired. We therefore conduct a number of empirical analyses and robustness tests to incorporate above alternative explanations.

METHODS

Sample and Data

In empirical analyses, we focus on the acquisitions in the biotechnology industry, given the high-technology nature of this industry as well as the prevalence of acquisitions targeting the biotechnology (i.e., tech) ventures (e.g., Ozmel, Robinson, Stuart, 2013). The sample consists of venture capital-backed ventures that received their first venture funding between 1980 and 2004, because VentureXpert's data is less complete prior to 1980. For this research, data is drawn from Thomson Reuters' VentureXpert database, which has been extensively used in prior research and has been shown to be a comprehensive database containing clear descriptions of venture financing (e.g., Barry, Muscarella, Peavy, and Vetsuypens, 1990; Katila, Rosenberger, and Eisenhardt, 2008; Lerner, 1995; Sorenson and Stuart, 2001).

We also used VentureXpert's classification for industry subgroups and assigned the sample into seven subfields: Biosensors, Biotech Equipment, Biotech Research, Biotech Animal, Biotech Human, Biotech Industrial, and Biotech Other. We collected data on all acquisitions of private firms in the sample from the mergers and acquisitions (M&A) module of Thomson Reuters' SDC database. We also excluded acquisitions that were coded as buyouts, divestitures, restructurings, recapitalizations, carveouts, and liquidations (e.g., Haunschild, 1993). Our final sample consisted of a total number of 1,369 ventures, of which 133 were acquired during our observation period.

Analytical Approach

We analyzed the likelihood of a technology venture being acquired in a given year with a hazard rate model, which allows analysis of both the timing and the occurrence of an event by incorporating longitudinal data with time-varying covariates (Allison, 1995). A given technology venture is at risk of acquisition when it received the first investment from venture capitalists (VCs) and remains at risk until it is sold to an acquirer, or does IPO, or reaches the end of the observation period. In general, hazard rate models can effectively handle right-censored data and the competing risks described below, thereby increasing the precision of estimates and reducing estimation biases.

Our hypotheses pertain to within-subfield estimations of the relation between the changes in the subfield level acquisition activity and the venture's likelihood to be acquired. To attain within-subfield estimates, we have conducted Cox Proportional Hazard models with subfield fixed effects following Allison (2009) and Greene (2001). The advantage of using within-subfield analysis is that, within subfield models are less likely to suffer from omitted variable bias (Allison, 2009) because such models incorporate the subfield level time invariant factors (Greene, 2001). Hence Cox proportional hazard models with subfield fixed effects is an appropriate approach for our analyses (Allison, 1995, 2009). We use below model:

(1) $h_i\ (t, \mathrm{X}) = h_0\,(t)\ \exp\{\mathrm{X}\boldsymbol{\beta}\}$,

where the hazard rate function $h_i(t,\mathrm{X})$ for a focal tech venture i is the product of an unspecified baseline function, $h_0(t)$, which corresponds to the probability of an event when all the explanatory variables are zero, X is the vector of the independent variables with values specified at time t, and incorporates subfield fixed effects. Finally, β is the vector of the estimated regression coefficients. This formulation offers the advantage that differences in hazard rates across technology ventures depend only on the covariates, not on the baseline hazard. As a result, the Cox model assumes that the hazard ratio at different levels of an independent variables is proportional to an unspecified

baseline function. To check this proportionality assumption, we examined the Schoenfeld residuals as a function of time, and found that there was no evidence that the proportional hazards assumption was violated in our study. The coefficients were estimated by partial likelihood estimation. Because there were multiple spells observed for the same technology venture, observations in the sample might not be independent. We therefore calculated robust standard errors, clustering residuals for each venture (Lin and Wei, 1989). As a robustness check, we also estimated exponential hazard models and found that the results were similar to those reported below.

Year dummies. In all our within-subfield models, in addition to the various control variables described below, we also include year dummies in order to control for the effect of unobserved aggregate trends or macro level factors (Wooldridge, 2010). If there are aggregate trends that are associated with both the changes in the prior acquisition activity (acquirer prominence) within a venture's subfield, and the venture's likelihood of being acquired; omitting such factors or trends might result in biased coefficient estimates (Wooldridge, 2010). In particular, the role of external aggregate factors in social contagion processes and in imitation is discussed in many studies. For instance, Haunschild (1993) emphasize that when the aggregate factors that grow over time and that affect the adoption of an innovation are excluded from the models, the positive observed relationship between the prevalence of the prior adoption of a practice and the likelihood of an agent's adoption of the practice might be produced by trends in some aggregate factors. Hence, it is strongly suggested that the effect of aggregate time trends is controlled for when analyzing the social influence processes (e.g., Haunschild, 1993; Van den Bulte and Lilien, 2001). Year dummies help us incorporate the changes in unobservable aggregate factors that might be correlated with the observed association between the changes in prior acquisition activity (acquirer prominence)

within a venture's subfield and the venture's likelihood to be acquired (Ahuja et al., 2009; Garciapont and Nohria, 2003; Haunschild, 1993; Van den Bulte and Lilien, 2001; Wooldridge, 2010).

Variables and Measurement

Dependent variable. The dependent variable is the hazard of the focal venture being acquired in a given year. *M&A Event* is thus denoted as whether or not the venture became the target of an acquisition in each spell. Ventures that were still operating independently without being acquired at the endpoint of the sample period were treated as right censored. In addition, we avoid the loss of timing information by treating two other events as competing risks. Specifically, we distinguished ventures that acquired resources by undertaking an IPO (e.g., DeTienne, 2010; Waguespack and Fleming, 2009) and those becoming "living dead," or not obtaining additional VC funding for at least seven years due to low financial returns (e.g., Mason and Harrison, 2002; Ruhnka, Feldman, and Dean, 1992). Furthermore, in testing Hypotheses 5 and 6, we separated the M&A Event variable into two competing risks based on the median value of the technological distance between the acquirer and the venture to determine if imitation effects are more pronounced when technological distance is greater between acquirers and targets.

Independent variables. We examined M&A announcements in each industry subfield and measured *the number of prior acquisitions in the venture's subfield targeting the venture's rivals*, *i.e., "the number of prior acquisitions in the subfield"*, which is equal to the number of prior acquisitions targeting the venture's rivals during the past three years. (Please note that, as we mention in the Theory section, when we refer to "prior acquisitions in the venture's subfield", we always refer to the prior acquisitions in the venture's subfield targeting the venture's rivals). Since this variable exhibited positive skewness, we transformed this count measure by taking the log of

one plus the number of rivals' acquisitions. In robustness tests, we also examined number of prior acquisitions in the venture's subfield by reducing the timeframe to one year or expanding it to five years, and obtained qualitatively similar results. Our second theoretical variable is "*the prominence of prior acquirers in the venture's subfield* –targeting the venture's rivals-". To identify prominent acquirers in those transactions and examine trait-based imitation, we used several alternative measures. First, we followed Haunschild and Miner (1997) by using the average return on equity of prior acquirers to operationalize the prominence of prior acquirers in the venture's subfield, and the return on equity is defined as net income divided by total equity (i.e., *Acquirer Prominence–ROE*). Second, also following Haunschild and Miner (1997), we used the average total assets of prior acquirers in the venture's subfield (i.e., *Acquirer Prominence – Total Assets*). In supplementary analyses, we also used the Number of Employees of the prior Acquirers and Number of prior acquirers among S&P 500 Firms (e.g., Chen, Hambrick, and Pollock, 2008; Pollock, Chen, Jackson, and Hambrick, 2010) as alternative measures of the prominence of prior acquirers in the venture's subfield targeting the venture's rivals, again using logarithmic transformations. We obtained very similar results as those reported.

We follow prior research and measure the *exogenous technological uncertainty* in the venture's subfield by calculating the monthly standard deviation of the returns for each biotech industry subfield index composed of publicly traded biotech firms (e.g., Folta, 1998; Vassolo, Anand, and Folta, 2004). To capture the returns across subfields, we first utilized the concordance table developed by Dushnitsky and Lenox (2005), and then mapped the subfields in VentureXpert into SICs. Data on monthly stock prices came from the Center for Research in Security Prices (CRSP) database. In robustness tests, we calculate exogenous technological uncertainty using the

product market uncertainty in the focal venture's subfield (Bergh, 1998; Bergh and Lawless, 1998) and received similar results.

Technological Distance between the venture and its acquirer is calculated based on their portfolio of patents over the most recent five years, and then is defined as the Euclidean distance between the firms' portfolios of three-digit patent classes categorized by the United States Patent and Trademark Office (USPTO), weighted by the number of patents in individual patent classes (e.g., Ahuja, 2000; Rosenkopf and Almeida, 2003). Before forming the interactions between the above two variables and rivals' M&A activity, we mean-centered the variables to reduce collinearity between the multiplicative terms and direct effects (Aiken and West, 1991).

Control variables. We controlled for many other factors such as the dollar amount of the focal venture's financial resources, its technology capabilities, characteristics of its top management team, and other factors that might be related to the venture's likelihood of being acquired and to the independent variables discussed above. In particular, we first controlled for the venture's *Firm Age*, using the number of years from the technology venture's founding date to each spell to capture the information available to acquirers (e.g., Davila, Foster, and Gupta, 2003; Sanders and Boivie, 2004), and the liability of newness (Stinchcombe, 1965). Second, *VC's Early Investment Stage* dummy denotes whether there is a VC fund focusing on the early stage among the investors of the technology venture in VentureXpert's classification. We calculated the *Number of Rounds* by tracking the number of financing rounds that the venture had successfully completed up until each spell (e.g., Guler, 2007; Li, 2008) to capture the venture's prospects and associated uncertainty. We also tracked information on each venture's clinical stage by referring to IMS Health's R&D Focus database (e.g., Hoang and Rothaermel, 2010), and calculated the *Ratio of Venture's Products at Early Stage* in the venture's product portfolio. A venture's technological

accomplishments through its patenting activity is measured by its *Citation-Weighted Patent Stock* by tracing the number of forward citations that a patent received in the subsequent years (e.g., Griliches, 1981; Hall, Jaffe, and Trajtenberg, 2005). All the patent information was collected from the USPTO database. Additionally, we measured the focal venture's *Alliance Prominence* based on its eigenvector centrality in the alliance network (e.g., Baum and Silverman, 2004; Benjamin and Podolny, 1999; Podolny, 1993, 1994), in order to consider both the direct and indirect connections formed by the venture. Following Bonacich (1987), we calculated the venture's alliance network prominence (alliance centrality) as follows:

(2) Alliance Prominence = $c_{i,t}(\alpha_t, \beta_t) = \sum_{j=1}^{N_t}(\alpha_t + \beta_t c_{j,t})\,\gamma_{i,j,t}$

where $c_{j,t}$ is the centrality of the technology venture i's alliance partner j in year t, $\gamma_{i,j,t}$ is the relationship matrix entry indicating the number of alliances formed between firm i and firm j during the last five years. α_t scales the measure to ensure the maximum centrality for each year is equal to one, whereas β_t represents weighting coefficients that are set equal to three-quarters of the reciprocal of the largest eigenvalue of $\gamma_{i,j,t}$ (e.g., Jensen, 2003; Podolny, 1993). We used the Recombinant Capital Database to identify the technology venture's R&D alliances with other firms, which provides extensive information on R&D alliance activity in the biotech and pharmaceutical industries. To capture the venture's relationship with VCs, we first measured *Venture Capitalist Funding* by accumulating the total USD amount of venture capital financing received by the venture up to the spell, using data from the VentureXpert database (e.g., Evans and Jovanovic, 1989). Accessing funding can be critical for a tech venture's survival, and ventures facing financial constraints might be more likely to find M&A offers attractive (e.g., Ransbotham and Mitra, 2010). Also, prior research has established that venture capitalists' expertise in identifying, evaluating, and investing in young firms makes affiliation with prominent VCs a

positive signal of the firm's quality (e.g., Gulati and Higgins, 2003; Hsu, 2004, 2006). We thus measured *Venture Capitalist Prominence* by examining the eigenvector centrality of the VCs investing in the technology venture within VC syndicate networks (e.g., Podolny, 1993, 1994). If there are multiple VCs investing in a particular technology venture, we picked the maximum of those VCs' centralities to denote the prominence of VCs with which the technology venture is affiliated (e.g., Gompers and Lerner, 1999), though similar results were obtained with mean values. We obtained all of the VC-related data from the VentureXpert database. In addition, we included three control variables for characteristics of the venture's top management team because these characteristics may affect a venture's willingness to be acquired as well as its valuation and performance. First, we controlled for *CEO Age* because older CEOs might have fewer opportunities to find equivalent jobs and focus more on career security (e.g., Buchholtz, Ribbens, and Houle, 2003; D'Aveni and Kesner, 1993), thereby affecting a venture's likelihood of being acquired. Second, ventures with executives who have previous experience in the industry of the venture are more likely to perform well because they have more industry-specific knowledge and better access to industry networks (e.g., Cohen and Dean, 2005; Shane and Stuart, 2002), which can make ventures more attractive. Thus, we incorporated *CEO Industry Experience*, which denotes the CEO's previous experience in the venture's industry. Data for the above variables were hand-collected from multiple sources, including Mergent Online and Bloomberg Business. Third, the size of the top management team may reflect the collective management resources available to a venture and thus could have a bearing on its performance and acquisition likelihood (e.g., D'Aveni and Kesner, 1993). Specifically, we measured *TMT Size* by identifying the number of key executives of the venture as reported in VentureXpert.

Next, as we discuss earlier, we controlled for *year fixed effects* as we detailed above in detail to account for the potential influence of economy-wide, or aggregate trends. We also control for *the number of ventures available to be acquired in the focal venture's subfield* to control for the mechanical relationship that as there are more ventures available to be acquired there will be more acquisitions in the future.

Macroeconomic conditions. First of all, since a growing industry may entail more growth opportunities and thus trigger more acquisitions (e.g., Owen and Yawson, 2010), we calculated the sales growth rate in the biotech industry one year before each spell (In alternative models, we include the median absolute change in the sales growth in the industry, following Harford, 2005). Data for this variable are from Compustat. Second, we control for the macroeconomic shocks using the *median absolute change in the asset turnover* in the biotech industry (Harford, 2005). In supplementary models, we also use alternative measures of economic shocks such as median absolute change- in capital expenditures, in employee growth, in ROA in the venture's industry. (Due to multicollinearity among these measures of macro level variables, we only include the median absolute change in the asset turnover, however the results are similar when we use alternative measures listed above). In addition, in alternative models we control for the lack of the availability of the liquidity in the market using the Commerical and industrial (C/I) rate spread, which is the spread above the FED funds rate (Harford, 2005). In unreported analyses we also controlled for the mean market value to book value in the industry as an indicator of the valuations in the industry (Harford, 2005).

RESULTS

In this section, we provide an overview of our findings. However, we should emphasize that any results should be interpreted as only suggestive of imitation due to alternative explanations. Relatedly, we do not intend to suggest causality, because in our models we analyze and show within subfield level associations between the changes in the number of prior acquisitions (or changes in the prominence of prior acquirers) in the focal venture's subfield targeting the venture's rivals and the focal venture's likelihood to be acquired. At the end of the results section, we present a number of supplemental analyses designed to explore alternative explanations for the findings. Table 1 presents descriptive statistics and correlations for the variables. There are not particularly large correlations among any of the independent variables, and examination of variance inflation factors suggested that multicollinearity is not a concern for model estimation.

Insert Table 1 here

Table 2 presents the results from the event history analysis. Model I is the baseline specification comprising all of the control variables. Models II, III, and IV augment Model I by separately adding the theoretical variables related to the number of prior acquisitions in the focal venture's subfield as well as the prior acquirers' prominence, along with their interactions with exogenous technological uncertainty. Models V and VI represent the full models. The coefficient estimate for the number of previous acquisitions in the focal venture's subfield targeting the focal venture's rivals is positive ($p=0.036$, $p=0.05$, and $p=0.049$ in Models II, V, and VI, respectively). When examining the economic significance of this effect based on Model V, we found that when all variables are at their means, a one standard deviation increase in the number of prior acquisitions in the focal venture's subfield is associated with an increase in the focal venture's hazard of being acquired by 1.98 times.

Insert Table 2 here

The coefficient estimate for *Acquirer Prominence–ROE* is positive in Model III (p=0.027) and Model V (p=0.012). This suggests that there is a within-subfield level positive association between the changes in the prominence of the prior acquirers targeting the venture's rivals in the subfield and the focal venture's hazard of being acquired in the future. This positive association is in line with Hypothesis 2 concerning trait-based imitation. According to Model V, with all variables at their means, a one standard deviation increase in acquirer prominence–ROE is associated with an increase in the focal venture's hazard of being acquired of by 1.5 times. In Models IV and VI of Table 2, the alternative size-based measure of prior acquirers' prominence (acquirer prominence-total assets) yields similar positive results (p=0.013 and p=0.045 in model IV and Model VI, respectively). Assessment of economic significance based upon Model VI suggests that a one standard deviation increase in the total assets of the prior acquirers within the venture's subfield is associated with an increase in the focal venture's hazard of being acquired by 1.65 times.

In Table 2, Models V-VI show the coefficients of the interactions of exogenous tech uncertainty within the focal venture's subfield between (i) the number of prior acquisitions targeting the venture's rivals in the focal venture's subfield and *(ii)* the acquirer prominence in these prior acquisitions (i.e., *p*=0.001, *p*=0.011, respectively in Model V where prior acquirers' prominence is measured using ROE; and, *p*=0.045 and p=0.016, respectively in Model VI where prior acquirers' prominence is measured using total assets). These findings are in line with our Hypotheses 3 and 4, suggesting that the positive associations between changes in the number of

prior acquisitions in the focal venture's subfield (or changes in the prominence of prior acquirers in the focal venture's subfield) and the venture's likelihood of being acquired, is more pronounced when the exogenous technological uncertainty within the focal venture's subfield increases through time. In interpreting these interaction effects, we first followed Haveman and Cohen (1994) and investigated their economic significance.

With all variables at their mean values, when the exogenous technological uncertainty within the focal venture's subfield increases by one standard deviation, the positive association between a one standard deviation increase in the number of prior acquisitions within the venture's subfield and the venture's hazard of being acquired increases by 2.9 times. With all variables at their mean values, when the exogenous technological uncertainty within the venture's subfield increases by one standard deviation, the positive association between a one standard deviation increase in the prominence of prior acquirers (ROE) within the venture's subfield and the venture's hazard of being acquired increases 2.7 times.

With all variables held at their mean plus one standard deviation levels, when the exogenous technological uncertainty within the focal venture's subfield increases by one standard deviation, the positive within-subfield association between the one standard deviation increase in the number of prior acquisitions within the venture's subfield and the venture's hazard of being acquired increases by 8 times. With all variables held at their mean plus one standard deviation values, when the exogenous technological uncertainty within the venture's subfield increases by one standard deviation, the positive within-subfield association between a one standard deviation increase in the prominence of prior acquirers (ROE) within the focal venture's subfield and the venture's hazard of being acquired increases by 7.4 times.

With all variables at their mean minus one standard deviation levels, when the exogenous technological uncertainty within the focal venture's subfield increases by one standard deviation, the positive within-subfield association between a one standard deviation increase in the number of prior acquisitions within the focal venture's subfield and the venture's hazard of being acquired increases by 2.6. With all variables held at their mean minus one standard deviation values, when the exogenous technological uncertainty within the venture's subfield increases by one standard deviation, the positive within-subfield association between one standard deviation increase in the prominence of prior acquirers (ROE) within the venture's subfield and the venture's hazard of being acquired increases by 1.3.

Figure 1 illustrate that the positive within-subfield association between the changes in the number of prior acquisitions within the focal venture's subfield and the focal venture's hazard of being acquired is more pronounced when the exogenous tech uncertainty within the focal venture's subfield increases. Figure 2 suggests that the positive within subfield association between the changes in the prominence of prior acquirers within the focal venture's subfield and the focal venture's hazard of being acquired is more pronounced when the exogenous tech uncertainty within the focal venture's subfield increases.

Insert Figures 1 and 2 here

Hypotheses 5 and 6 suggest that within-subfield level associations between changes in the number of prior acquisitions within the venture's subfield (changes in the prominence of the prior acquirers) and the venture's likelihood of being acquired is more pronounced when technological distance between the focal venture and its acquirer is high. To test these two hypotheses, we split

the M&A hazard into two competing risks and have rerun our analyses (Allison, 1995). In Table 3, Models I-V show the results of Cox hazard models to estimate the hazard that the focal venture is acquired in a high technological distance acquisition, and in Table 4 we repeated our analyses to estimate the hazard that the focal venture is acquired in a low technological distance acquisition, based upon the median value of the technological distance. Specifically, when we compare the coefficients of the number of prior acquisitions within the subfield targeting a venture's rivals across Table 3 (high-tech distance M&As) versus Table 4 (low tech distance M&As), we see that the coefficients are significantly higher in high tech distance M&As (i.e., χ^2=5.796, p=0.016, in Model I; χ^2=3.093, p=0.079, in Model IV; χ^2=3.937, p=0.047, in Model V).

The estimation results also indicate that the association between the changes in the number of prior acquisitions within the subfield and the venture's likelihood to be acquired is significant for high tech distance acquisitions (p=0.000 in Column I, p=0.028 in Column IV and p=0.002 Column V of Table 3), but this is not the case for low tech distance deals (p=0.578, p=0.998 and p=0.544, in columns I, IV and V, respectively, in Table 4). We also investigated the economic significance of the associations between the changes in prior acquisitions within the subfield and the venture's hazard of being acquired for high versus low tech distance acquisitions. At high technological distance, when all variables are at their means, a one standard deviation increase in the number of prior acquisitions within the venture's subfield is associated with an increase in the focal venture's hazard of being acquired by 2.9 times. However, the level of corresponding associated increase at low tech distance context is just 1.1 times.

Similarly, the coefficients for high tech and low tech distance deals across Tables 3 and 4 are also compared for Acquirer Prominence–ROE (i.e., χ^2=4.036, p=0.045, in Model II; χ^2=4.321, p=0.038 in Model IV) and Acquirer Prominence–Total Assets (i.e., χ^2=3.955, p=0.047, in Model

III; χ^2=1.584, p=0.208, in Model V). Assessments of economic significance support this observation. With all variables at their means, a one standard deviation increase in the prior acquirer prominence–ROE within the focal venture's subfield is associated with an increase in the focal venture's hazard of being acquired at high technological distance by 2.6 times, whereas the increase is 1.16 times at low tech distance. Taken together, our results therefore seem to suggest that the positive association between changes in the number of prior acquisitions (changes in the prominence of prior acquirers) within the focal venture's subfield and the venture's hazard of being acquired is more pronounced for transactions involving substantial technological distance between acquirers and targets.

Insert Tables 3 and 4 here

Turning to the control variables, several results are noteworthy (please see Table 2). The number of ventures in the focal venture's subfield is positively associated with the venture's hazard of being acquired (p=0.005 in model V, and p=0.013 in model VI). Taking Model VI of Table 2 as an example, as expected, the prominence of the VCs endorsing the focal venture (p= 0.009) and the venture's prominent position in alliance networks (p=0.000) are both positively associated with the venture hazard of being acquired. These results are in line with the suggestion that information generated through the venture's prominent positions in alliance networks and its affiliation with prominent VCs might convey to potential acquirers that the focal firm has good quality resources and future prospects. On the other hand, there is a negative association between the venture's hazard of being acquired and the venture's having products at early stages (i.e., preclinical stages) (p=0.006). In addition, it appears that ventures that obtained technological achievements as

evidenced by their citation weighted patent stock are associated with a higher likelihood of being acquired (p= 0.038).

Alternative Explanations

We need to interpret above findings with caution because some alternative mechanisms might generate such positive associations we observe above without any social influence, or imitation. Below we explain our efforts to address alternative explanations that we had discussed in the Alternative Explanations part of the Theory.

To begin with, to address the implications of the availability of ventures to be acquired, we have controlled for *the number of ventures in each subfield in a given year*. Second, as an alternative means of addressing macro level influences, we control for the macroeconomic factors using the *median absolute change in the asset turnover rate* and *the industry growth rate in sales in the venture's industry* (Harford, 2005). This complements the control for the *year dummies* noted earlier to control for the trends in unobservable aggregate factors that might be associated with both the acquisition activity within the venture's subfield and the ventures' likelihood to be acquired in the future (e.g., Garcia-Pont and Nohria, 2003; Haunschild, 1993; Van den Bulte and Lilien, 2001; Wooldridge, 2010). In alternative models, we also control for alternative measures of macroeconomic shocks and the availability of liquidity in the market (Rhodes-Kropf and Wishvanathan, 2004) and the results are robust. To control for time invariant subfield level differences across subfields that might be associated with the subfield level acquisition activity and the venture's own likelihood to be acquired, we use subfield fixed effects as we mentioned in the Methods section.

Supplementary Analyses to address homophily/similarity between the focal venture's acquirer and prior acquirers. In robustness tests we also investigated the implications of

homophily or similarity across acquirers. For this purpose, at first, in unreported robustness tests using the venture-year level data, we control for the similarities between the focal venture and the targets of the model acquisitions, ~~i.e. similarities between the focal venture and its rivals that got acquired in prior acquisitions, using the similarities~~ based on alliance and patenting activity, as well as ~~the similarities based on the~~ product stage~~s~~. We find that ~~the~~ results are qualitatively similar (Results are available upon request).

Second, we created a new dataset at the acquirer-venture-year level. For this purpose, for each year between 1982 and 2005, we have formed all possible pairs between biotech ventures (targets) and the firms that have acquired in the biotech industry during the past five years. We conducted robust logit regressions using acquirer-venture-year level data, where dependent variable is a dummy variable, which takes on one if the potential acquirer *i* of a focal venture *j* acquirers the focal venture *j* at year *t*. We have clustered error terms at the potential acquirer and venture level. All the right hand side variables are lagged one year. In acquirer-venture-year level robustness analyses, we control for the similarity between the potential acquirer of the focal venture (which we call "potential acquirer" from now on) and prior acquirers in the venture's subfield using the following dimensions of similarity: i) product market similarity, ii) similarity in size and profitability, iii) technological similarity, and iv) prior alliances between the potential acquirer and the prior acquirers in the venture's subfield (e.g., Ahuja, et al., 2009; Gulati, 1998). To the extent that potential acquirer *i* of a venture *j* and the prior acquirers in the venture's subfield are similar to each other, they might have similar opportunity sets in terms of possible investment opportunities available to them, and hence behave similarly (Ahuja et al., 2009; Kossinets and Wattz, 2009; McPherson et al., 2002; Ruef et al., 2003). Using the above dimensions of similarity based on the prior literature, we aim to control for the association between the acquisition decisions

of the potential acquirer of a venture and the prior acquisition activity within a venture's subfield that might be generated by homophily/similarity between the venture's potential acquirer and prior acquirers in the subfield, rather than imitation. (In the Online Appendix 1-Panel A at the end, we describe these and other new control variables we investigated in greater detail. In Online Appendix1-Panel B, we report a summary of the acquirer-venture-year results).

Acquirer-venture-year level robustness analyses suggests that even after controlling for an extensive set of variables to address alternative explanations, our findings are in accord with the hypotheses regarding frequency- and trait-based imitation, and we continue to see that the two dimensions of technological uncertainty are important moderators of the associations we suggest in our hypotheses.

DISCUSSION

Key Findings and Contributions

In this paper, we first show that the changes in the number of prior acquisitions targeting the focal venture's rivals within the focal venture's subfield (the changes in the prominence of prior acquirers within the venture's subfield) are positively associated with the focal venture's likelihood to be acquired. Our findings are in line with frequency and trait based imitation. More importantly, we show that these positive associations are more pronounced under two conditions reflecting uncertainty in the technology domain: (i) when the exogenous technological uncertainty within the focal venture's subfield increases through time, and (ii) for acquisitions in which the technological resources and knowledge base of the focal venture is distant from those of its acquirer.

We emphasize that we suggest and show associations between prior acquisition activity and the venture's likelihood to be acquired, rather than establishing causal relationship. In this

respect, we follow a significant stream of empirical research on mimetic behavior in general as well as imitation in the M&A context. We also acknowledge alternative theoretical mechanisms such as homophily, similarity between acquirers, as well as macroeconomic factors and supply conditions in the M&A markets, among others and try to address them using various controls and robustness tests. Nonetheless, we suggest that our findings be interpreted while keeping these potential alternative mechanisms in mind. Below we discuss additional limitations of the study and directions for future research that can extend this study.

Our paper builds upon studies on imitation in acquisition markets and contributes to this particular stream of research in a number of ways. First, few prior studies that have adopted an imitation lens in the M&A context (e.g., Haunschild and Miner, 1997), largely focus on imitation surrounding established, publicly-held targets. Yet, such studies have not paid much attention to the role of imitation when the acquisition targets are technology ventures, which are private startup companies in tech related industries (Lieberman and Asaba, 2006). This is noteworthy given that a substantial portion of the acquisitions in high tech contexts involve private targets than public targets. Furthermore, acquisitions involving private tech ventures in particular are a critical means by which the tech ventures can obtain much needed resources and acquirers can access external technologies. Hence, our study aims at complementing previous studies by investigating mimetic behavior in acquisitions targeting tech ventures.

Second, even though the role of uncertainty in moderating the extent of imitation in acquiring public firms has been analyzed in previous research (e.g., Haunschild and Miner 1997), the studies on the moderating role of uncertainty on social influence in high-tech environments in general and on the technology acquisitions in particular has not received much research attention. For instance, the few studies on the interaction between uncertainty and imitation in the

acquisitions context focus on uncertainty associated with acquisitions involving public targets (Haunschild and Miner, 1997). However, since acquisitions involving tech ventures may entail substantial uncertainty related to the value and prospects of tech venture's underlying resources, it is imperative to better understand the particular dimensions of uncertainty that are critical in moderating the extent of imitation in technology acquisitions. Hence, our paper also contributes to the studies on analyzing what type of uncertainties can be particularly important in shaping imitation in acquisitions especially in high-tech contexts.

In addition, previous studies on imitation in acquisition markets largely ignore the role of transaction-specific uncertainty related to the acquirer-target level factors. For instance, prior studies on transaction specific uncertainty in acquisitions predominantly use dispersion in analysts' estimates of a target's expected future earnings as indicators of transaction specific uncertainty faced by the acquirer. However, such analyses mainly focus on target related factors only and analyze only public targets. This, in turn limits our understanding about what types of uncertainties might be critical in moderating the imitative behavior when the targets are private, and especially when they are technology-based companies. We suggest that technological distance can be an important source of transaction-specific uncertainty, and our findings demonstrate how this aspect of uncertainty moderates the associations between the changes in the number of acquisitions in a venture's subfield (or prominence of acquirers carrying out these acquisitions) and the venture's likelihood to be acquired in the future (e.g., Folta, 1998; Lane and Lubatkin, 1998; Makti et al., 2010;).

Limitations

One limitation of our study as well as the majority of the previous studies on imitation is that we show the association - not causality - between prior actions of the other firms and the

likelihood of similar actions in the future. This is a quite prevalent issue in imitation studies as this research stream has developed over the years (e.g., Haunschild, 1993; Haunschild and Miner, 1997; Lieberman and Asaba, 2006; Williamson and Cable, 2003). Relatedly, future studies may search for new research designs to study imitation in the M&A context as well as other empirical settings. For instance, natural experiments or lab experiments might be useful to introduce exogenous variation in other firms' actions to which executives respond, and surveys might gauge the degree to which managers attend to social influences when making strategic decisions such as acquisitions. It would also be valuable to carryout fieldwork on the ways in which managers rely on imitation versus other remedial mechanisms to cope with uncertainty surrounding acquisitions and other strategic investments. Such research would enable an assessment of the relative importance of imitation compared to other coping mechanisms that have been studied in recent M&A research.

Another related and common issue in imitation analyses is the presence of various alternative mechanisms that might also generate the association between the actions of model firms in the past and the likelihood of other firms' conducting similar actions in the future (e.g., Haunschild, 1993; Haunschild and Miner, 1997; Guillen, 2002; Garcia-Pont and Nohria, 2002; Rao et al., 2001). In particular, alternative mechanisms such as homophily, or similarity between the focal venture's acquirers and prior acquirers in the venture's subfield might also lead to the associations we observed in this paper without any imitation mechanism per se being manifest. For instance, these firms might be just exposed to similar external macroeconomic trends. To address alternative explanations such as these, in our models we control for various factors such as the macroeconomic shocks or the number of ventures available to be acquired in the focal venture's subfield. In addition, in robustness tests at the acquirer-target-year level analyses, we control for various measures of similarity between a potential acquirer of a venture and the prior

acquirers in the venture's subfield. Future studies on imitation that use alternative methodologies we have noted above might also consider these alternative mechanisms contributing to follow-on acquisitions or other strategic investments.

Future Research Directions

Our paper also complements existing studies aimed at analyzing how firms deal with uncertainty associated with M&As. For instance, prior studies have shown that when faced higher uncertainty, acquirers may take partial equity stake (e.g., Chari and Chang, 2009; Malhotra and Gaur, 2013), or when a prospective acquirer and target have dissimilar technological resources and knowledge bases, firms may form alliances instead of engaging in acquisitions (e.g., Balakrishnan and Koza, 1993; Folta, 1998; Vanhaverbeke, Duysters, and Noorderhaven, 2003; Wang and Zajac, 2007). Our paper contributes to this stream of research by finding results that are in accord with social influence mechanisms that acquirers might be using to cope with uncertainty surrounding their acquisition decisions. It would therefore be valuable and interesting in future research to investigate alternative coping mechanisms that firms might utilize and relatedly examine how imitation might affect the ways that deals are structured and implemented. For instance, it would be interesting to see if these remedial mechanisms substitute or complement one another, and it would be valuable to determine if acquisitions subject to mimetic behavior are implemented differently than acquisitions that firms invest in through a more deliberate investment process to cope with uncertainty.

Our focus is on acquisitions involving technology ventures, in particular private startup companies in biotechnology, so it would be worthwhile for future studies to consider the generalizability of our findings to other industries and types of acquisitions. It is possible, for instance, that acquirers targeting high tech companies that are public might not face uncertainty to

the same degree, and this might lessen the extent of imitation by potential acquirers undertaking acquisition decisions. However, in M&A deals involving the acquisition of technologies, our results on the moderating role of uncertainty in the technology domain on the association between the changes in prior acquisition activity and the likelihood of acquisitions in the future may still hold and generalize to acquisitions targeting more established, public firms to the extent that technology related uncertainty is still prominent. Of course, other acquisitions might involve other facets of uncertainty than the ones we have considered here, and it would be worthwhile to see if mimetic behavior for other types of acquisitions is conditioned by other sources of uncertainty that acquirers face.

Future studies might also analyze the role of imitation in determining other types of acquisitions, such as international acquisitions, to gain a more complete understanding of the role of imitation in M&A strategies. It is worth noting that even though there is a substantial body of imitation research in analyzing entry into international markets (e.g., Delios, Gaur, and Makino, 2008; Guillen, 2002; Henisz and Delios, 2001), the role of imitation in fostering acquisitions as an entry mode has not yet received significant research attention. Relatedly, it could be worthwhile to investigate the moderating role of uncertainty associated with the political or the institutional environment of the foreign country in moderating the extent of social influence in international acquisition activities.

Extensions could also build off our paper and investigate the role of social influence for other types of strategic decisions such as alliances or other inter-organizational relationships. Among the few studies on imitation in alliance activity, Garcia-Pont and Nohria (2002) suggest that firms that are in the same strategic niche might be strongly influenced by each other's actions, so they might imitate one another's alliance formation strategies. However, the role of imitation

in determining alliance formation in high-tech industries and the factors that moderate the extent of imitation is left largely unexplored. For example, considering the substantial uncertainty regarding the value of the underlying resources and capabilities of tech ventures (e.g., Stuart, 1998; Stuart *et al*., 1999), it would be worthwhile to investigate the role of social influence and imitation in determining the formation of alliances involving tech ventures. In the alliance domain as in the M&A context we have studied, firms might rely on various mechanisms to cope with uncertainty such as selecting more familiar partners (e.g., Gulati, 1998), relying on common ties to VCs or other organizations (Lindsey, 2008), specifying narrow scope deals (Li *et al*, 2008), using network positions as signals of potential partner's quality (e.g., Stuart, 1998) or utilizing various contractual safeguards (Robinson and Stuart, 2007). Future research might consider how imitation shapes the role of such factors in determining the alliance formation and design.

The degree to which mimetic behavior accounts for investments by venture capitalists (VCs) and corporate venture capitalists (corporate VCs) would also be a quite interesting avenue to pursue in future research. Mimetic behavior is suggested to be influential in VCs' exit strategies (Gaba and Terlaak 2013). However, we still do not know much about the role of imitation in determining the VC firms' investment strategies in ventures in the first place. Considering that VC investment decisions are made under substantial uncertainty (Gompers and Lerner, 2000), one would expect that VC firms might infer information cues from each other's investments, which might facilitate imitation in determining the VCs' investment strategies (Lieberman and Asaba, 2006). Relatedly, it would be quite informative for the literature to investigate whether the highly reputable, or prominent, VC firms' investment strategies are more likely to be imitated. Similarly, parent firms of corporate VCs might also imitate investment strategies of other corporate VC firms. Considering that existing studies of investment strategies of venture capital firms or corporate

venture capital firms did not put much emphasis on the role of imitation in affecting the venture capitalists' investment strategies, we believe our paper can form a basis for future studies to analyze imitation and technology-related uncertainty in determining investment decisions in high-tech industries. We hope that our study stimulates research on imitation in other contexts such as these and facilitates work that considers the alternative ways in which firms cope with technological uncertainty when making acquisition, alliances, and other strategic investment decisions.

REFERENCES

Abrahamson E, Rosenkopf L. 1993. Institutional and competitive bandwagons: using mathematical modeling as a tool to explore innovation diffusion. *Academy of Management Review* **18**(3): 487-517.

Ahuja G. 2000. Collaboration networks, structural holes, and innovation: a longitudinal study. *Administrative Science Quarterly* **45**(3): 425-455.

Ahuja G, Katila R. 2001. Technological acquisitions and the innovation performance of acquiring firms: a longitudinal study. *Strategic Management Journal* **22**(3): 197-220.

Ahuja G., Polidoro F. Jr. Mitchell W. 2009. Structural Homophily or Social Asymmetry? The Fomraiton of Alliances by Poorly Embedded firms. Strategic Management Journal. (30). 941–958.

Aiken LS, West SG. 1991. *Multiple Regression: Testing and Interpreting Interactions*. Sage: Newbury Park, CA.

Allison PD. 1995. Survival Analysis Using the SAS System: A Practical Guide. SAS Institute: Cary, NC.

Allison, P. D. 1996. "Fixed Effects Partial Likelihood for Repeated Events." Sociological Methods & Research 25: 207-222.

Allison, Paul D. and Richard P. Waterman (2002) "Fixed-Effects Negative Binomial Regression Models." Forthcoming in Sociological Methodology 2002.

Allison P. D. 2005. Fixed Effect Regression Models. (Quantitative Applications in the Social Sciences). SAGE Publications Inc.

Amit R, Glosten L, Muller E. 1990. Entrepreneurial ability, venture investments, and risk sharing. *Management Science* **36**(10): 1232-1245.

Anderson P, Tushman, ML. 2001. Organizational environments and industry exit: the effects of uncertainty, munificence and complexity. *Industrial and Corporate Change* **10**(3): 675-711.

Arikan I. 2005. In the market for firms, how should a firm be sold? In *Advances in Mergers and Acquisitions*, Vol. 4, Cooper GL, Finkelstein S (eds). JAI Press: Greenwich, CT; 181-208.

Arikan AM, Capron L. 2010. Do newly public acquirers benefit or suffer from their pre-IPO affiliations with underwriters and VCs? *Strategic Management Journal* **31**(12): 1257-1289.

Arikan AM, McGahan AM. 2010. The development of capabilities in new firms. *Strategic Management Journal* **31**(1): 1-18.

Arrow KJ. 1974. Limited knowledge and economic. *American Economic Review* **64**(1): 1-10.

Asch SE. 1951 Effects of group pressure upon the modification and distortion of judgement. In *Groups, Leadership, and Men*, Guetzkow H (eds). Carnegie Press: Pittsburgh; 177-190.

Balakrishnan S, Koza MP. 1993. Information asymmetry, adverse selection and joint-ventures: theory and evidence. *Journal of Economic Behavior and Organization* **20**(1): 99-117.

Barry CB, Muscarella CJ, Peavy JW, Vetsuypens MR. 1990. The role of venture capital in the creation of public companies: evidence from the going-public process. *Journal of Financial Economics* **27**(2): 447-471.

Baum JAC, Li SX, Usher JM. 2000. Making the next move: how experiential and vicarious learning shape the locations of Chains' acquisitions. *Administrative Science Quarterly* **45**(4): 766-801.

Baum JAC, Silverman BS. 2004. Picking winners or building them? Alliance, intellectual, and human capital as selection criteria in venture financing and performance of biotechnology startups. *Journal of Business Venturing* **19**(3): 411-436.

Belderbos R, Olffen WV, Zou J. 2011. Generic and specific social learning mechanisms in foreign entry location choice. *Strategic Management Journal* **32**(12): 1309-1330.

Benjamin BA, Podolny JM. 1999. Status, quality, and social order in the California wine industry. *Administrative Science Quarterly* **44**(3): 563-589.

Bonacich P. 1987. Power and centrality: a family of measures. *American Journal of Sociology* **92**(5): 1170-1182.

Brau JC, Francis B, Kohers N. 2003. The choice of IPO versus takeover: empirical evidence. *Journal of Business* **76**(4): 583-612.

Buchholtz AK, Ribbens BA, Houle IT. 2003. The role of human capital in postacquisition CEO departure. *Academy of Management Journal* **46**(4): 506-514.

Chamberlain, Gary A. (1985) "Heterogeneity, omitted variable bias, and duration dependence." Pp. 3-38 in Longitudinal Analysis of Labor Market Data, edited by J. J. Heckman and B. Singer. Cambridge: Cambridge University Press.

Chari MDR, and Chang K. 2009. Determinants of the share of equity sought in cross-border acquisitions. *Journal of International Business Studies* **40**(8): 1277-1297.

Chatterjee S. 1986. Types of synergy and economic value: the impact of acquisitions on merging and rival firms. *Strategic Management Journal* **7**(2): 119-139.

Chen G, Hambrick DC, Pollock TG. 2008. Puttin' on the Ritz: pre-IPO enlistment of prestigious affiliates as deadline-induced remediation. *Academy of Management Journal* **51**(5): 954-975.

Cohen BD, Dean TJ. 2005. Information asymmetry and investor valuation of IPOs: top management team legitimacy as a capital market signal. *Strategic Management Journal* **26**(7): 683-690.

Cox DR. 1972. Regression models and life-tables. *Journal of the Royal Statistical Society* **B34**(2): 187-220.

Cyert RM, March JG. 1963. *A Behavioral Theory of the Firm*. Prentice-Hall: Englewood Cliffs, NJ.

D'Aveni RA, Kesner IF. 1993. Top managerial prestige, power and tender offer response: a study of elite social networks and target firm cooperation during takeovers. *Organization Science* **4**(2): 123-151.

Davila A, Foster G, Gupta M. 2003. Venture capital financing and the growth of startup firms. *Journal of Business Venturing* **18**(6): 689-708.

Delios A, Gaur AS, Makino S. 2008. The timing of international expansion: information, rivalry and imitation among Japanese firms, 1980–2002. *Journal of Management Studies* **45**(1): 169-195.

DeTienne DR. 2010. Entrepreneurial exit as a critical component of the entrepreneurial process: theoretical development. *Journal of Business Venturing* **25**(2): 203-215.

DiMaggio PJ, Powell WW. 1983. The iron cage revisited: institutional isomorphism and collective rationality in organizational fields. *American Sociology Review* **48**(2): 147-160.

DiMasi JA. 2001. New drug development in the United States from 1963 to 1999. *Clinical Pharmacology and Therapeutics* **69**(5): 286-296.

DiMasi JA, Feldman L, Secker A, Wilson A. 2010. Trends in risks associated with new drug development: success rates for investigational drugs. *Clinical Pharmacology and Therapeutics* **87**(3): 272-277.

Dushnitsky G, Lenox MJ. 2005. When do incumbents learn from entrepreneurial ventures? Corporate venture capital and investing firm innovation rates. *Research Policy* **34**(5): 615-639.

Eckbo BE. 1983. Horizontal mergers, collusion, and stockholder wealth. *Journal of Financial Economics* **11**(1): 241-273.

Evans DS, Jovanovic B. 1989. An estimated model of entrepreneurial choice under liquidity constraints. *Journal of Political Economy* **97**(4): 808-827.

Festinger L. 1954. A theory of social comparison processes. *Human Relations* **7**(2): 117-140.

Fleming L. 2001. Recombinant uncertainty in technological search. *Management Science* **47**(1): 117-132.

Fligstein N. 1991. The structural transformation of American industry: an institutional account of the causes of diversification in the largest firms, 1919-1979. In *The New Institutionalism in Organization Analysis*, Powell WW, DiMaggio PJ (eds). University of Chicago Press: Chicago; 311-336.

Folta TB. 1998. Governance and uncertainty: the trade-off between administrative control and commitment. *Strategic Management Journal* **19**(11): 1007-1028.

Gaba V, Terlaak A. 2013. Decomposing uncertainty and its effects on imitation in firm exit decisions. *Organization Science* **24**(6): 1847-1869.

Galaskiewicz and Burt. 1991. Interorganization Contagion in Corporate Philanthropy.
Administrative Science Quarterly. Vol. 36, No. 1 (Mar., 1991), pp. 88-105

Garcia-Pont C, Nohria N. 2002. Local versus global mimetism: the dynamics of alliance formation in the automobile industry. *Strategic Management Journal* **23**(4): 307-321.

Greene, William. 2001. "Estimating Econometric Models with Fixed Effects." Unpublished paper available at http://www.stern.nyu.edu/~wgreene.

Gompers P, Lerner J. 1999. *The Venture Capital Cycle*. MIT Press: Cambridge, MA.

Griliches Z. 1981. Market value, R&D, and patents. *Economics Letters* **7**(2): 183-187.

Guillén MF. 2002. Structural inertia, imitation, and foreign expansion: South Korean firms and business groups in China, 1987-95. *Academy of Management Journal* **45**(3): 509-525.

Gulati R. 1998. Alliances and networks. *Strategic Management Journal* **19**(4): 293-317.

Gulati R, Higgins MC. 2003. Which ties matter when? The contingent effects of interorganizational partnerships on IPO success. *Strategic Management Journal* **24**(2): 127-144.

Guler I. 2007. Throwing good money after bad? Political and institutional influences on sequential decision making in the venture capital industry. *Administrative Science Quarterly* **52**(2): 248-285.

Gutierrez RG. 2002. Parametric frailty and shared frailty survival models. *Stata Journal* **2**(1): 22-44.

Hall BH, Jaffe A, Trajtenberg M. 2005. Market value and patent citations. *RAND Journal of Economics* **36**(1): 16–38.

Haleblian J., McNamara G., Kolev K., and B. Dykes. 2012. Exploring Firm Characteristics that differentiate Leaders form Followers in Industry Merge Waves: A Competitive Dynamics Perspective. Strategic Management Journal. V: (33). 1037-1052.

Haunschild PR. 1993. Interorganizational imitation: the impact of interlocks on corporate acquisition activity. *Administrative Science Quarterly* **38**(4): 564-592.

Haunschild PR. 1994. How much is that company worth?: Interorganizational relationships, uncertainty, and acquisition premiums. *Administrative Science Quarterly* **39**(3): 391-411.

Haunschild PR, Miner AS. 1997. Modes of interorganizational imitation: the effects of outcome salience and uncertainty. *Administrative Science Quarterly* **42**(3): 472-500.

Haveman, H. A. 1993. Follow the leader: Mimetic iso-morphism and entry into new markets. Administra-tive Science Quarterly, 38: 593-627.

Haveman HA, Cohen LE. 1994. The ecological dynamics of careers: the impact of organizational founding, dissolution, and merger on job mobility. *American Journal of Sociology* **100**(1): 104-152.

Henisz WJ, Delios A. 2001. Uncertainty, imitation, and plant location: Japanese multinational corporations, 1990-1996. *Administrative Science Quarterly* **46**(3): 443-475.

Higgins MJ, Rodriguez D. 2006. The outsourcing of R&D through acquisitions in the pharmaceutical industry. *Journal of Financial Economics* **80**(2): 351-383.

Hoang H, Rothaermel FT. 2010. Leveraging internal and external experience: exploration, exploitation, and R&D project performance. *Strategic Management Journal* **31**(7): 734-758.

Hsu DH. 2004. What do entrepreneurs pay for venture capital affiliation? *Journal of Finance* **59**(4): 1805-1844.

Hsu DH. 2006. Venture capitalists and cooperative start-up commercialization strategy. *Management Science* **52**(2): 204-219.

Jensen M. 2003. The role of network resources in market entry: commercial banks' entry into investment banking, 1991-1997. *Administrative Science Quarterly* **48**(3): 466-497.

Katila R, Rosenberger JD, Eisenhardt KM. 2008. Swimming with sharks: technology ventures, defense mechanisms and corporate relationships. *Administrative Science Quarterly* **53**(2): 295-332.

Kossinets G., and Watts, D. 2009. Origins of Homophily in an Evolving Social Networks. American Journal of Sociology, Vol. 115, No. 2 (September 2009), pp. 405-450.

Krishnan V, Bhattacharya S. 2002. Technology selection and commitment in new product development: the role of uncertainty and design flexibility. *Management Science* **48**(3): 313-327.

Lane PJ, Lubatkin M. 1998. Relative absorptive capacity and interorganizational learning. *Strategic Management Journal* **19**(5): 461-477.

Lerner J. 1995. Venture capitalists and the oversight of private firms. *Journal of Finance* **50**(1): 301-318.

Li D, Eden L, Hitt MA, Ireland RD. 2008. Friends, acquaintances, or strangers? Partner selection in R&D alliances. *Academy of Management Journal* **51**(2): 315-334.

Li Y. 2008. Duration analysis of venture capital staging: a real options perspective. *Journal of Business Venturing* **23**(5): 497-512.

Lieberman MB, Asaba S. 2006. Why do firms imitate each other? *Academy of Management Review* **31**(2): 366-385.

Lin DY, Wei LJ. 1989. The robust inference for the Cox proportional hazards model. *Journal of the American Statistical Association* **84**(408): 1074-1078.

Lindsey L. 2008. Blurring firm boundaries: The role of venture capital in strategic alliances. *Journal of Finance* **63**(3): 1137-1168.

Makri M, Hitt MA, Lane PJ. 2010. Complementary technologies, knowledge relatedness, and invention outcomes in high technology mergers and acquisitions. *Strategic Management Journal* **31**(6): 602-628.

Malhotra S, Gaur AS. 2013. Spatial geography and control in foreign acquisitions. *Journal of International Business Studies* **45**(2): 191-210.

Manski, C.F. 1993. "Identification of Endogenous Social Effects: The Reflection Problem", *Review of Economic Studies.* 60: 531-542.

Mason CM, Harrison RT. 2002. Is it worth it? The rates of return from informal venture capital investments. *Journal of Business Venturing* **17**(3): 211-236.

McGrath RG. 1997. A real options logic for initiating technology positioning investments. Academy of Management Review 22(4): 974-996.

McPherson, J. Miller, and Lynn Smith-Lovin. 1982. "Women and Weak Ties: Sex Differences in the Size of Voluntary Associations." *American Journal of Sociology* 87:883–904.

McPherson, J. Miller, and Lynn Smith-Lovin. 1987. "Homophily in Voluntary Organizations: Status Distance and the Composition of Face-to-Face Groups." American Sociological Review 52:370–79.

McPherson, J. Miller, Lynn Smith-Lovin, and James M. Cook. 2001. "Birds of a Feather: Homophily in Social Networks*." Annual Review of Sociology* 27:415–44.

Meyer JW, Scott WR. 1983. Organizational Environments: Ritual and Rationality. Sage: Beverly Hills, CA.

Mitchell, W. G. (1988). 'Dynamic commercialization: An organizational economic analysis of innovation in the medical diagnostic imaging industry', unpublished doctoral dissertation, University of California at Berkeley.

Mollica, Kelly A., Barbara Gary, and Linda K. Trevino. 2003. "Racial Homophily and Its Persistence in Newcomers' Social Networks." Organization Science 14:123–36.

Mowery DC, Oxley JE, Silverman BS. 1998. Technological overlap and interfirm cooperation: implications for the resource-based view of the firm. *Research Policy* **27**(5): 507-523.

Nooteboom B, Vanhaverbeke W, Duysters G, Gilsing V, van den Oord A. 2007. Optimal cognitive distance and absorptive capacity. *Research Policy* **36**(7): 1016-1034.

Oriani R, Sobrero M. 2008. Uncertainty and the market valuation of R&D within a real options logic. *Strategic Management Journal* **29**(4): 343-361.

Owen S, Yawson A. 2010. Corporate life cycle and M&A activity. *Journal of Banking and Finance* **34**(2): 427-440.

Ozmel U, Robinson D, Stuart TE. Strategic alliances, venture capital, and exit decisions in early stage high-tech firms. Journal of Financial Economics. V. 107, 655-670.

Pisano GP. 1990. The R&D boundaries of the firm: an empirical analysis. Administrative Science Quarterly 35(1): 153-176.

Podolny JM. 1993. A status-based model of market competition. *American Journal of Sociology* **98**(4): 829-872.

Podolny JM. 1994. Market uncertainty and the social character of economic exchange. *Administrative Science Quarterly* **39**(3): 458-483.

Pollock TG, Chen G, Jackson EM, Hambrick DC. 2010. How much prestige is enough? Assessing the value of multiple types of high-status affiliates for young firms. *Journal of Business Venturing* **25**(1): 6-23.

Puranam P, Singh H, Chaudhuri S. 2009. Integrating acquired capabilities: when structural integration is (un)necessary. *Organization Science* **20**(2): 313-328.

Radner R. 1968. Competitive equilibrium under uncertainty. *Econometrica* **36**(1): 31-58.

Ransbotham S, Mitra S. 2010. Target age and the acquisition of innovation in high-technology industries. *Management Science* **56**(11): 2076-2093.

Reuer JJ, Lahiri N. 2013. Searching for alliance partners: effects of geographic distance on the formation of R&D collaborations. *Organization Science* **25**(1): 283-298.

Ruef M. Aldrich H., Carter N. The Structure of Founding Teams: Homophily, Strong Ties, and Isolation among U.S. Entrerepneurs. *American Sociological Review.* Vol. 68, No. 2 (Apr., 2003), pp. 195-222

Robinson D. and Stuart T. 2007. Network Effects in the Governance of Strategic Alliances. The Journal of Law, Economics, & Organization, Vol. 23.

Rosenkopf L, Almeida P. 2003. Overcoming local search through alliances and mobility. *Management Science* **49**(6): 751-766.

Ruhnka JC, Feldman HD, Dean TJ. 1992. The "living dead" phenomenon in venture capital investments. *Journal of Business Venturing* **7**(2): 137-155.

Sanders WMG, Boivie S. 2004. Sorting things out: valuation of new firms in uncertain markets. *Strategic Management Journal* **25**(2): 167-186.

Shane S, Cable D. 2002. Network ties, reputation, and the financing of new ventures. *Management Science* **48**(3): 364-381.

Shane S, Stuart TE. 2002. Organizational endowments and the performance of university start-ups. *Management Science* **48**(1): 154-170.

Smith KG, Ferrier WJ, Ndofor H. 2001. Competitive dynamics research: critique and future directions. In Handbook of Strategic Management, Hitt MA, Freeman E, Harrison JR (eds). Blackwell: Oxford, UK; 315–361.

Song MH, Walkling RA. 2000. Abnormal returns to rivals of acquisition targets: a test of the 'acquisition probability hypothesis'. *Journal of Financial Economics* **55**(2): 143–171.

Sorenson O, Stuart TE. 2001. Syndication networks and the spatial distribution of venture capital investments. *American Journal of Sociology* **106**(6): 1546-1588.

Stinchcombe AL. 1965. Organizations and social structure. In *Handbook of Organizations*, March JG (eds). Rand McNally: Chicago, IL; 153-193.

Strang D, Tuma NB. 1993. Spatial and temporal heterogeneity in diffusion. *American Journal of Sociology* **99**(3): 614–639.

Stuart TE. 1998. Network Positions and Propensities to Collaborate. An investigation of Strategic Allaince Formation in a high-Technology Industry. Administrative Science Quarterly, vo. 43, 668-698.

Stuart TE, Hoang H, Hybels RC. 1999. Interorganizational endorsements and the performance of entrepreneurial ventures. *Administrative Science Quarterly* **44**(2): 315-349.

Thompson JD. 1967. *Organizations in Action: Social Science Bases of Administrative Theory*. McGraw-Hill: New York.

Toh PK, Kim T. 2013. Why put all your eggs in one basket? A competition-based view of how technological uncertainty affects a firm's technological specialization. *Organization Science* **24**(4): 1214-1236.

Van den Bulte, C. G. and L. Lilien. 2001. Medical Innovation revisited: Social contagion versus marketing effort. *Amer. J. Sociol.* 106 1409-1435.

Vanhaverbeke W, Duysters G, Noorderhaven N. 2002. External technology sourcing through alliances or acquisitions: an analysis of the application-specific integrated circuits industry. *Organization Science* **13**(6): 714-733.

Vassolo RS, Anand J, Folta TB. 2004. Non-additivity in portfolios of exploration activities: a real options-based analysis of equity alliances in biotechnology. *Strategic Management Journal* **25**(11): 1045-1061.

Waguespack DM, Fleming L. 2009. Scanning the commons? Evidence on the benefits to startups participating in open standards development. *Management Science* **55**(2): 210-223.

Wang L, Zajac EJ. 2007. Alliance or acquisition? A dyadic perspective on interfirm resource combinations. *Strategic Management Journal* **28**(13): 1291-1317.

Williamson IO, Cable DM. 2003. Organizational hiring patterns, interfirm network ties, and interorganizational imitation. *Academy of Management Journal* **46**(3): 349-358.

J. Econometric Analysis of Cross Section and Panel Data. Edition1. 2001.

Xia J, Tan J, Tan D. 2008. Mimetic entry and bandwagon effect: the rise and decline of international equity joint venture in China. *Strategic Management Journal* **29**(2): 195-217.

Wooldridge, J. 2010. Econometric Analysis of Cross Section and Panel Data - 2nd edition. MIT Press.

TABLE 1
Descriptive Statistics and Correlation Matrix [a]

Variables	Mean	S.D.	1	2	3	4	5	6	7	8	9
1. M&A Event	0.02	0.14									
2. Number of prior acquisitions within the venture's subfield (log)	1.96	1.21	0.046								
3. Acquirer Prominence – ROE	0.01	0.29	0.001	-0.278							
4. Acquirer Prominence – Total Assets (log)	4.88	2.89	0.026	0.668	-0.054						
5. Technological Uncertainty (%)	62.18	50.86	0.017	0.451	-0.228	0.355					
6. Technological Distance	0.65	0.34	-0.039	-0.011	-0.010	0.019	-0.083				
7. Firm Age	7.75	25.59	-0.008	0.014	-0.015	0.008	0.008	0.014			
8. VC's Early Investment Stage	0.53	0.50	-0.056	-0.071	0.048	-0.050	-0.075	0.063	-0.066		
9. Number of Rounds	2.69	2.27	0.047	0.047	0.003	0.038	-0.057	0.035	0.072	-0.407	
10. Ratio of Products at Preclinical Stage	0.01	0.06	-0.014	0.022	0.011	0.019	-0.009	0.019	0.018	0.013	-0.005
11. Citation Weighted Patent Stock	0.21	0.67	0.044	0.064	-0.054	0.043	0.058	0.035	0.045	-0.117	0.201
12. Alliance Prominence	0.01	0.04	0.019	-0.026	0.071	-0.017	-0.109	0.019	0.016	-0.072	0.165
13. Venture Capitalist Funding	0.11	0.16	0.025	0.228	-0.099	0.144	0.152	-0.093	0.066	-0.352	0.390
14. VC Prominence	0.17	0.30	0.043	-0.038	0.055	-0.028	-0.134	0.069	0.035	-0.172	0.325
15. CEO Age	48.60	7.32	0.013	0.082	-0.060	0.043	0.084	0.027	0.049	-0.116	0.211
16. CEO Industry Experience	6.47	7.04	-0.018	0.114	-0.070	0.068	0.105	0.117	-0.010	-0.043	0.018
17. TMT Size	4.16	2.90	-0.019	0.089	-0.012	0.028	0.022	-0.057	0.065	-0.099	0.078
18. Number of Venture in Focal Subfield (log)	5.06	1.14	0.040	0.409	-0.196	0.573	0.455	0.014	0.016	-0.051	0.027
19. Industry Growth Rate	0.09	0.06	-0.004	-0.205	0.158	-0.011	-0.151	0.017	-0.004	0.029	0.012
20. (Median absolute) Change of Industry Asset Turnover Rate	0.01	0.01	-0.003	-0.058	0.171	0.092	-0.076	0.024	-0.005	0.018	-0.001

TABLE 1
Descriptive Statistics and Correlation Matrix [a] (continued)

Variables	10	11	12	13	14	15	16	17	18	19
1. M&A Event										
2. Number of prior acquisitions within the venture's subfield (log)										
3. Acquirer Prominence – ROE										
4. Acquirer Prominence – Total Assets (log)										
5. Technological Uncertainty (%)										
6. Technological Distance										
7. Firm Age										
8. VC's Early Investment Stage										
9. Number of Rounds										
10. Ratio of Products at Preclinical Stage										
11. Citation Weighted Patent Stock	-0.011									
12. Alliance Prominence	0.050	0.169								
13. Venture Capitalist Funding	-0.005	0.148	0.158							
14. VC Prominence	-0.009	0.091	0.171	0.241						
15. CEO Age	-0.050	0.143	0.027	0.109	0.069					
16. CEO Industry Experience	-0.032	-0.005	0.022	0.165	0.021	0.376				
17. TMT Size	0.036	0.045	0.143	0.267	0.126	0.043	0.173			
18. Number of Venture in Focal Subfield (log)	0.028	0.057	0.009	0.223	-0.046	0.088	0.119	0.098		
19. Industry Growth Rate	0.014	-0.036	0.031	-0.076	0.037	-0.052	-0.047	0.004	-0.201	
20. (Median absolute) Change of Industry Asset Turnover Rate	0.008	-0.022	-0.030	-0.040	0.015	-0.028	-0.003	-0.008	-0.051	0.151

TABLE 2-Cox Regression Results [a]

Parameter	I	II	III	IV	V	VI
Year Fixed Effects	Included	Included	Included	Included	Included	Included
Subfield Fixed Effects	Included	Included	Included	Included	Included	Included
Firm Age	-0.067	-0.065	0.001	-0.058	0.000	-0.116
	(0.065)	(0.067)	(0.003)	(0.060)	(0.003)	(0.061)
	[*0.307*]	[*0.329*]	[*0.807*]	[*0.332*]	[*0.882*]	[0.055]
VC's Early Investment Stage	-0.630	-0.617	-0.617	-0.786	-0.566	-0.737
	(0.211)	(0.212)	(0.208)	(0.222)	(0.213)	(0.238)
	[*0.003*]	[*0.004*]	[*0.003*]	[*0.000*]	[*0.008*]	[0.002]
Number of Rounds	-0.001	-0.002	-0.004	-0.004	-0.001	-0.014
	(0.045)	(0.045)	(0.043)	(0.044)	(0.043)	(0.048)
	[*0.976*]	[*0.960*]	[*0.927*]	[*0.919*]	[*0.985*]	[0.779]
Venture Capitalist Funding	-0.705	-0.725	-0.503	-0.666	-0.506	-0.925
	(0.721)	(0.722)	(0.612)	(0.689)	(0.620)	(0.660)
	[*0.328*]	[*0.315*]	[*0.411*]	[*0.334*]	[*0.415*]	[0.161]
VC Prominence	0.570	0.593	0.498	0.627	0.715	0.686
	(0.254)	(0.253)	(0.255)	(0.249)	(0.251)	(0.263)
	[*0.025*]	[*0.019*]	[*0.051*]	[*0.012*]	[*0.004*]	[0.009]
CEO Age	-0.003	-0.002	-0.003	-0.002	-0.003	-0.006
	(0.015)	(0.015)	(0.014)	(0.015)	(0.015)	(0.016)
	[*0.863*]	[*0.911*]	[0.817]	[*0.916*]	[*0.853*]	[0.719]
CEO Industry Experience	-0.021	-0.021	-0.023	-0.022	-0.027	-0.019
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.015)
	[*0.123*]	[*0.116*]	[*0.110*]	[*0.117*]	[*0.062*]	[0.190]
TMT Size	-0.072	-0.069	-0.080	-0.068	-0.066	-0.052
	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.041)
	[*0.064*]	[*0.072*]	[*0.040*]	[*0.076*]	[*0.089*]	[0.213]
Number of Ventures in Focal Subfield	1.725	1.706	1.482	1.709	1.478	1.690
	(0.570)	(0.567)	(0.571)	(0.496)	(0.531)	(0.680)
	[*0.003*]	[*0.003*]	[*0.010*]	[*0.001*]	[*0.005*]	[0.013]
Industry Growth Rate	5.943	5.807	6.996	5.446	5.476	1.642
	(4.019)	(3.598)	(3.588)	(3.390)	(3.528)	(5.766)
	[*0.139*]	[*0.107*]	[*0.051*]	[*0.108*]	[*0.121*]	[0.776]
Change of Industry Asset Turnover Rate	-6.708	-8.147	-6.873	-3.137	-1.173	-5.354
	(12.010)	(11.425)	(11.537)	(8.256)	(9.286)	(8.770)
	[*0.577*]	[*0.476*]	[*0.551*]	[*0.704*]	[*0.900*]	[0.542]
Technological Uncertainty	-0.009	-0.014	-0.005	-0.013	-0.008	-0.014
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.010)
	[*0.229*]	[*0.050*]	[*0.516*]	[*0.052*]	[*0.254*]	[0.193]
Citation Weighted Patent Stock	0.205	0.196	0.192	0.204	0.204	0.200
	(0.096)	(0.099)	(0.093)	(0.094)	(0.093)	(0.097)
	[*0.033*]	[*0.048*]	[*0.038*]	[*0.031*]	[*0.028*]	[0.038]
Ratio of Products at Preclinical Stage	-1.001	-1.013	-1.126	-1.002	-0.980	-1.162
	(0.382)	(0.384)	(0.409)	(0.386)	(0.393)	(0.422)
	[*0.009*]	[*0.008*]	[*0.006*]	[*0.009*]	[*0.013*]	[0.006]
Alliance Prominence	4.415	4.816	3.820	4.377	4.211	5.848
	(1.898)	(1.974)	(1.849)	(1.757)	(1.902)	(1.572)
	[0.020]	[*0.015*]	[*0.039*]	[*0.013*]	[*0.027*]	[0.000]
Number of Prior acquisitions within the venture's subfield		0.459			0.564	0.551
		(0.219)			(0.288)	(0.280)
		[*0.036*]			[*0.050*]	[0.049]
Acquirer Prominence – ROE			1.024		1.383	
			(0.464)		(0.552)	
			[*0.027*]		[*0.012*]	
Acquirer Prominence – Total Assets				0.150		0.174
				(0.060)		(0.087)
				[*0.013*]		[0.045]
Exogenous Technological Uncertainty * Number of prior acquisitions within the venture's subfield		0.006			0.009	0.007
		(0.002)			(0.003)	(0.003)
		[*0.006*]			[*0.001*]	[0.045]
Exogenous Technological Uncertainty * Acquirer Prominence – ROE			0.028		0.032	
			(0.010)		(0.013)	
			[*0.006*]		[*0.011*]	
Technological Uncertainty* Acquirer Prominence – Total Assets				0.004		0.005
				(0.002)		(0.002)
				[0.004]		[0.016]
χ^2	96.010	103.432	100.060	107.032	112.554	121.395
	[*0.000*]	[*0.000*]	[*0.000*]	[0.000]	[0.000]	[0.000]
Log likelihood, $L(\boldsymbol{\beta})$	-851.493	-847.783	-836.499	-826.856	-813.042	-813.245
$-2[L(\boldsymbol{\beta}_{baseline}) - L(\boldsymbol{\beta}_i)] \sim \chi^2$		7.421	29.989	49.274	76. 903	76.496
		[*0.025*]	[*0.000*]	[0.000]	[0.000]	[0.000]

[a] N=7,338. Robust standard errors appear in parentheses. P-values in brackets.

TABLE 3-
Cox Regression Results for High Tech Distance M&As [a]

Parameter	I	II	III	IV	V
Year Fixed Effects	Included	Included	Included	Included	Included
Subfield Fixed Effects	Included	Included	Included	Included	Included
Firm Age	-0.022	-0.090	-0.112	-0.011	-0.141
	(0.062)	(0.073)	(0.084)	(0.031)	(0.086)
	[0.716]	[0.220]	[0.181]	[0.722]	[0.100]
VC's Early Investment Stage	-0.812	-0.590	-0.769	-0.582	-0.904
	(0.302)	(0.287)	(0.301)	(0.289)	(0.320)
	[0.007]	[0.040]	[0.011]	[0.044]	[0.005]
Number of Rounds	-0.031	-0.002	-0.028	-0.027	-0.038
	(0.056)	(0.064)	(0.065)	(0.057)	(0.063)
	[0.578]	[0.980]	[0.668]	[0.638]	[0.548]
Venture Capitalist Funding	-0.945	-1.247	-1.972	-0.359	-1.776
	(0.964)	(0.944)	(0.971)	(0.865)	(0.971)
	[0.327]	[0.186]	[0.042]	[0.678]	[0.068]
VC Prominence	0.879	0.763	0.953	0.715	0.880
	(0.368)	(0.413)	(0.380)	(0.405)	(0.391)
	[0.017]	[0.065]	[0.012]	[0.077]	[0.024]
CEO Age	-0.011	-0.011	-0.007	-0.009	-0.002
	(0.020)	(0.020)	(0.021)	(0.022)	(0.021)
	[0.604]	[0.575]	[0.746]	[0.671]	[0.917]
CEO Industry Experience	-0.005	0.006	-0.012	-0.009	-0.006
	(0.020)	(0.020)	(0.022)	(0.022)	(0.022)
	[0.796]	[0.769]	[0.579]	[0.669]	[0.796]
TMT Size	-0.084	-0.137	-0.072	-0.108	-0.059
	(0.056)	(0.065)	(0.060)	(0.058)	(0.058)
	[0.137]	[0.035]	[0.227]	[0.063]	[0.311]
Number of Ventures in Focal Subfield	1.397	2.189	0.528	1.767	0.837
	(0.689)	(1.184)	(0.320)	(0.941)	(0.471)
	[0.043]	[0.064]	[0.099]	[0.060]	[0.075]
Industry Growth Rate	-5.848	-8.884	-7.441	-7.898	-4.335
	(6.970)	(9.036)	(5.338)	(4.249)	(2.692)
	[0.401]	[0.326]	[0.163]	[0.063]	[0.107]
Change of Industry Asset Turnover Rate	31.160	20.421	9.781	45.309	11.262
	(15.071)	(10.112)	(14.778)	(19.123)	(13.952)
	[0.039]	[0.043]	[0.508]	[0.018]	[0.420]
Technological Uncertainty	-0.023	-0.030	-0.002	-0.001	-0.006
	(0.008)	(0.073)	(0.005)	(0.009)	(0.004)
	[0.005]	[0.679]	[0.708]	[0.903]	[0.140]
Citation Weighted Patent Stock	0.235	0.255	0.243	0.203	0.273
	(0.123)	(0.108)	(0.133)	(0.129)	(0.138)
	[0.056]	[0.018]	[0.068]	[0.114]	[0.047]
Ratio of Products at Preclinical Stage	-0.851	-0.934	-0.780	-1.013	-1.015
	(0.531)	(0.577)	(0.526)	(0.579)	(0.576)
	[0.109]	[0.106]	[0.138]	[0.080]	[0.078]
Alliance Prominence	4.467	5.320	5.909	3.950	4.333
	(2.301)	(2.337)	(2.363)	(2.313)	(1.911)
	[0.052]	[0.023]	[0.012]	[0.088]	[0.023]
Number of prior acquisitions within the venture's subfield	1.015			0.881	1.251
	(0.251)			(0.402)	(0.406)
	[0.000]			[0.028]	[0.002]
Acquirer Prominence – ROE		4.280		3.261	
		(1.480)		(1.249)	
		[0.004]		[0.009]	
Acquirer Prominence – Total Assets			0.385		0.292
			(0.100)		(0.110)
			[0.000]		[0.008]
χ^2	77.668	87.543	75.165	88.264	83.606
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Log likelihood, $L(\boldsymbol{\beta})$	-400.394	-357.010	-359.196	-353.527	-344.842

[a] N=7,338. Robust standard errors appear in parentheses. P-values in brackets.

TABLE 4
Cox Regression Results for Low Tech Distance M&As [a]

Parameter	I	II	III	IV	V
Year Fixed Effects	Included	Included	Included	Included	Included
Subfield Fixed Effects	Included	Included	Included	Included	Included
Firm Age	0.002	0.002	0.004	0.004	0.003
	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
	[0.479]	[0.489]	[0.043]	[0.110]	[0.334]
VC's Early Investment Stage	-0.805	-0.791	-0.659	-1.070	-0.706
	(0.311)	(0.310)	(0.318)	(0.372)	(0.325)
	[0.010]	[0.011]	[0.038]	[0.004]	[0.030]
Number of Rounds	-0.021	-0.018	-0.020	-0.014	-0.016
	(0.067)	(0.066)	(0.076)	(0.070)	(0.071)
	[0.748]	[0.783]	[0.792]	[0.836]	[0.817]
Venture Capitalist Funding	-0.276	-0.232	-0.580	-1.214	-0.295
	(0.861)	(0.839)	(1.072)	(0.902)	(0.915)
	[0.748]	[0.782]	[0.588]	[0.178]	[0.747]
VC Prominence	0.394	0.408	0.434	0.437	0.366
	(0.331)	(0.327)	(0.351)	(0.389)	(0.345)
	[0.234]	[0.213]	[0.217]	[0.261]	[0.288]
CEO Age	0.009	0.009	0.019	0.011	0.010
	(0.021)	(0.021)	(0.022)	(0.024)	(0.022)
	[0.666]	[0.662]	[0.393]	[0.662]	[0.632]
CEO Industry Experience	-0.034	-0.034	-0.028	-0.039	-0.023
	(0.019)	(0.019)	(0.019)	(0.023)	(0.019)
	[0.076]	[0.080]	[0.150]	[0.095]	[0.232]
TMT Size	-0.054	-0.053	-0.119	-0.029	-0.073
	(0.055)	(0.055)	(0.059)	(0.055)	(0.061)
	[0.323]	[0.333]	[0.043]	[0.602]	[0.226]
Number of Ventures in Focal Subfield	2.347	1.783	3.512	1.480	1.210
	(1.318)	(0.938)	(1.498)	(0.689)	(0.832)
	[0.075]	[0.057]	[0.019]	[0.032]	[0.146]
Industry Growth Rate	9.388	3.686	9.883	6.187	4.558
	(4.706)	(5.887)	(4.969)	(3.816)	(3.989)
	[0.046]	[0.531]	[0.047]	[0.105]	[0.253]
Change of Industry Asset Turnover Rate	-13.730	-15.934	-17.263	-20.421	-19.835
	(6.857)	(10.946)	(11.023)	(14.728)	(13.324)
	[0.046]	[0.145]	[0.117]	[0.165]	[0.136]
Technological Uncertainty	-0.032	-0.013	-0.078	-0.003	-0.002
	(0.059)	(0.039)	(0.067)	(0.005)	(0.004)
	[0.581]	[0.741]	[0.244]	[0.537]	[0.588]
Citation Weighted Patent Stock	0.185	0.203	0.233	0.276	0.103
	(0.126)	(0.122)	(0.125)	(0.125)	(0.139)
	[0.143]	[0.096]	[0.062]	[0.027]	[0.456]
Ratio of Products at Preclinical Stage	-0.882	-0.854	-2.192	-1.250	-0.843
	(0.528)	(0.530)	(0.977)	(0.713)	(0.538)
	[0.095]	[0.108]	[0.025]	[0.080]	[0.117]
Alliance Prominence	4.026	4.062	9.043	5.316	4.720
	(2.375)	(2.273)	(2.385)	(2.080)	(2.332)
	[0.090]	[0.074]	[0.000]	[0.011]	[0.043]
Number of prior acquisitions within the venture's subfield	0.145			0.001	0.205
	(0.260)			(0.298)	(0.337)
	[0.578]			[0.998]	[0.544]
Acquirer Prominence – ROE		1.145		0.509	
		(0.495)		(0.439)	
		[0.021]		[0.247]	
Acquirer Prominence – Total Assets			0.134		0.123
			(0.077)		(0.077)
			[0.083]		[0.107]
χ^2	58.035	59.075	73.809	67.509	61.079
	[0.011]	[0.005]	[0.000]	[0.000]	[0.001]
Log likelihood, $L(\boldsymbol{\beta})$	-420.196	-419.678	-362.382	-324.160	-355.718

[a] N=7,338. Robust standard errors appear in parentheses. P-values in brackets.

Figure 1. Prior acquisition activity within the venture's subfield and Exogenous Technological Uncertainty

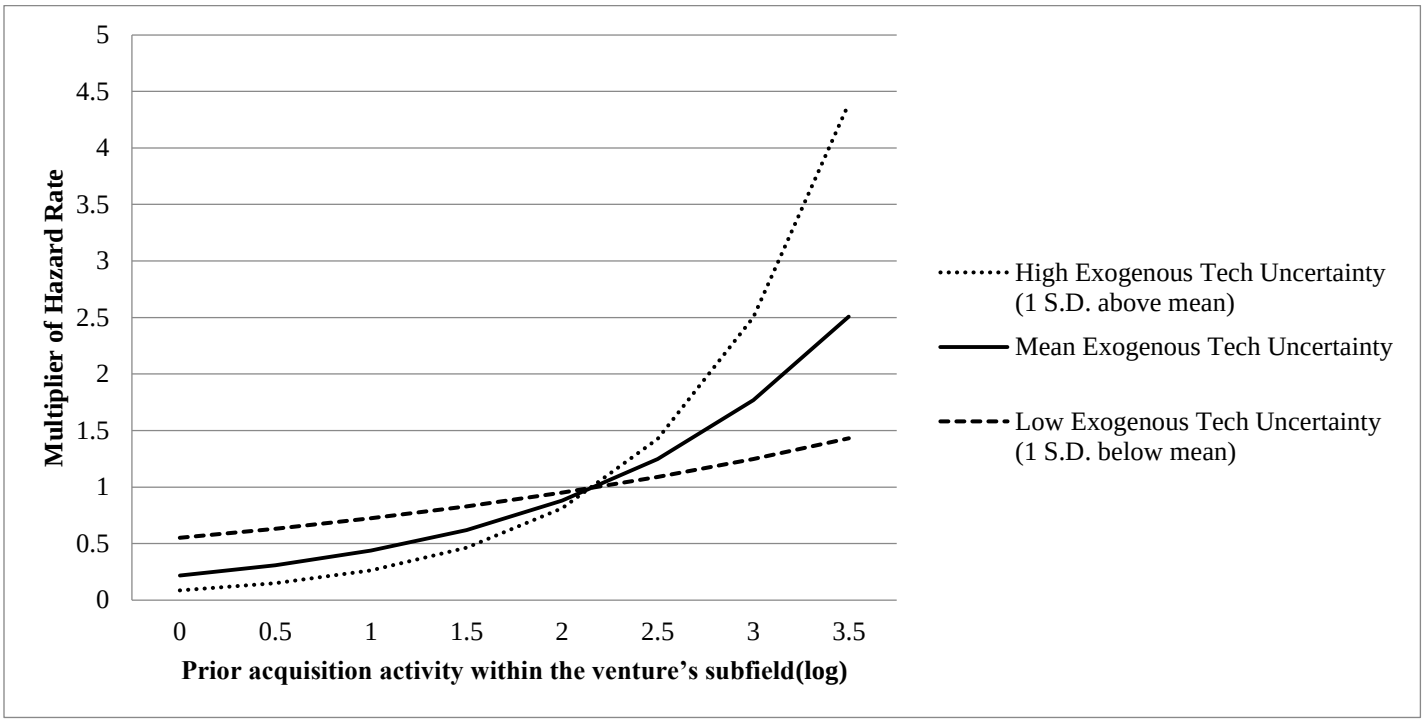
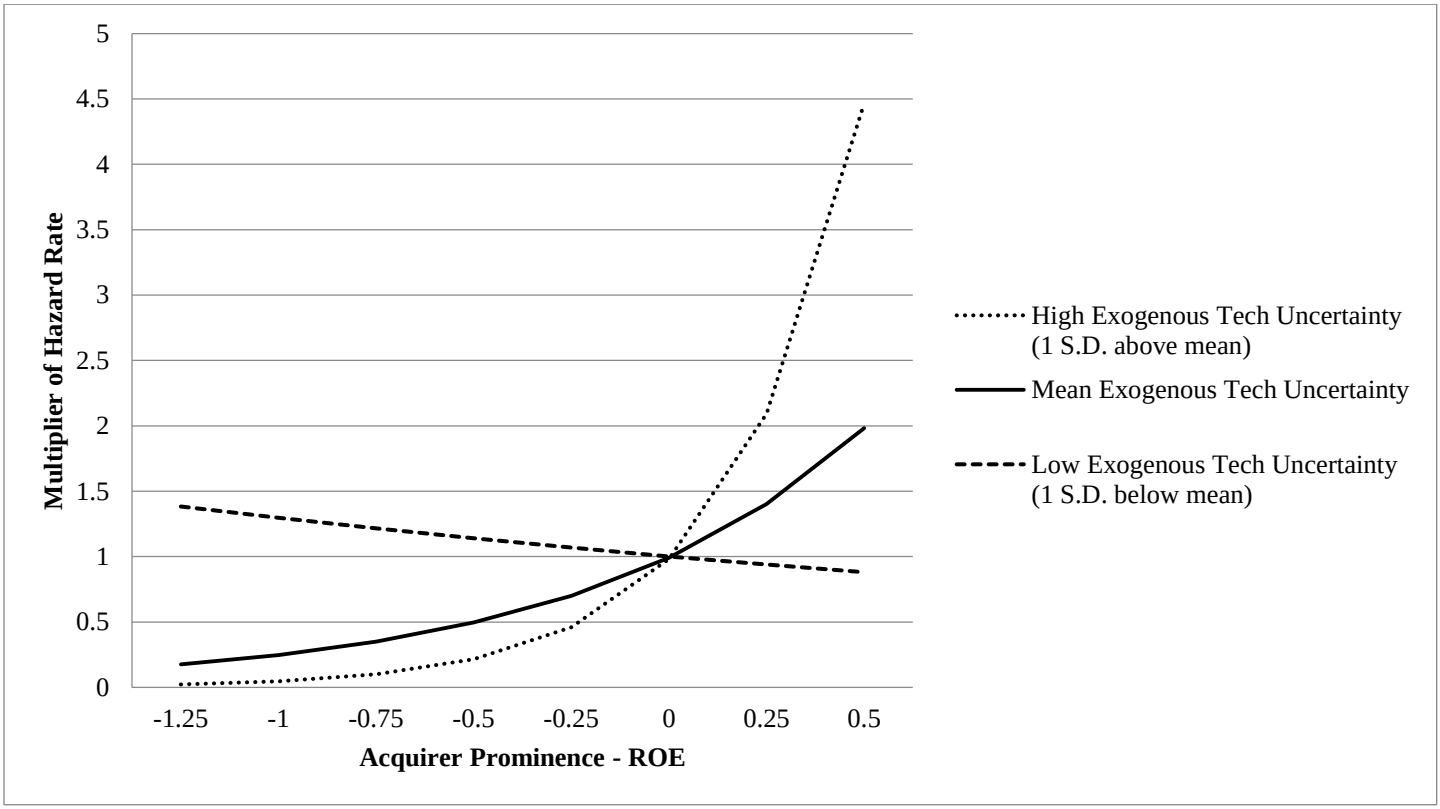


Figure 2. Acquirer Prominence–ROE and Technological Uncertainty



Online Appendix 1-Panel A. Explanation of additional variables used in robustness tests at the acquirer-venture (target)-year level data.

Methodology. *F*or each year between 1982 and 2005, we have formed all possible pairs between biotech ventures (targets) and the firms that have acquired in the biotech industry during the past five years. We conducted robust logit regressions using acquirer-venture-year level data. We have clustered error terms at the potential acquirer and venture level. All the right hand side variables are lagged one year.
Dependent variable. Equal to one if a potential acquirer *i* acquirers a venture *j* at time *t*, and zero otherwise.
Independent variables: The independent variables are; the number of prior acquisitions in the focal venture's subfield (for H1); the prominence of prior acquirers in the focal venture's subfield (for H2). The moderators are the exogenous tech uncertainty within the focal venture's subfield (for H3 and H4); and the technological distance between the focal venture and its potential acquirer's underlying resources and knowledge base (Makri et al., 2010) (for H5 and H6). (All the independent variables vary through time and are lagged one year). Below, we discuss the extensive list of the *additional* control variables we have generated for the acquirer-venture-year level data to better address alternative explanations. The control variables that we use for our main analyses reported in the tables are all kept in the acquirer-venture-year level analyses as well.

Measures of similarity between focal venture's acquirer and prior acquirers in the venture's subfield.

i. ***Product market similarity between venture's potential acquirer and prior acquirers in the venture's subfield.*** If the potential acquirer *i* of a venture *j* at time *t* and the prior acquirers within the focal venture *j*'s subfield operate in similar product markets, the potential acquirer *i* and prior acquirers might simply face similar investment opportunities and hence acquire similar targets. In that case, we might observe a positive association between the prior acquisition activity within the focal venture *j*'s subfield targeting the venture's rivals and the venture *j*'s likelihood to be acquired by potential acquirer *i*, which is generated by the similarity between the firms rather than social influence. For this purpose, for each dyad of potential acquirer *i* and focal venture *j* in each year *t*, we calculated the total number of overlaps between the four digit SIC codes of the focal acquirer *i* and the prior acquirers within the focal venture *j*'s subfield (Ahuja et al., 2009).

ii. ***-Lack of- Similarity in technology domain between focal venture's potential acquirer and prior acquirers in the venture's subfield.*** To the extent that firms operate in similar technological areas tend to face similar investment opportunities, as the tech similarity between a potential acquirer and prior acquirers increase, potential acquirer might act in similar ways to the prior acquirers in the venture's subfield even without any social influence. To incorporate the (lack of) similarity, at first, for each year *t*, acquirer *i* and venture *j*, we calculated the tech distance between the focal potential acquirer *i* and each of the prior acquirers in the venture's *j*'s subfield (Ahuja, 2000; Rosenkopf and Almeida, 2003). Then, we take the average of these tech distances.

iii. ***–Lack of- similarity in size and/or profitability between focal venture's potential acquirer and prior acquirers in the venture's subfield***. Similarity in size and profitability enables us to partially control for homophily because firm size and profitability are among the important dimensions of social stratification among firms (Podolny, 1993; Ahuja et al., 2009; Lieberman and Asaba, 2006). According to homophily mechanism, firms that are similar tend to engage in similar activities and investments, which as a result might have similar sizes, or similar levels of profitability. Relatedly, firms that have similar size and profitability might face similar opportunity sets for investment. Hence, by controlling for the similarity, or the lack of similarity (in size and profitability) between potential acquirer *i* of a venture *j* and prior acquirers in the venture *j*'s subfield, we partially address homophily mechanism. This, as a result enables us to better control for the association between changes in the prior number of acquisitions (changes in prior acquirers' prominence) targeting the venture's rivals in the subfield and the venture's likelihood to

be acquired without any social influence. In our analyses, we control for the -lack of- similarity between potential acquirer and prior acquirers in a venture's subfield through:

- *the difference between the total assets of the potential acquirer of the venture and the average total assets of prior acquirers in the venture's subfield.*
- *the difference between the ROE of the potential acquirer of the venture and the average ROE of prior acquirers in the venture's subfield.*

iv. ***Prior alliances between the potential acquirer of the venture and the prior acquirers in the venture's subfield.*** Homophily principle, even though it is primarily about the behaviors of individuals, might suggest that firms that are similar are more likely to form affiliations in the first place (Kossinets and Wattz, 2009; McPherson, et al., 2001; Ruef et al., 2003). To the extent that homophily requires similar firms to be more likely to form ties with each other, the existence of prior ties among firms can be an indicator of the underlying similarity in their various characteristics (Ahuja et al., 2009; Kossinets and Wattz, 2009; Ruef et al., 2003). Furthermore, according to homophily, firms with prior ties might face similar opportunity sets, and hence might act similarly without social influence (McPherson, et al., 2001). This suggests that firms that have prior ties might tend to behave similarly simply because the opportunity sets/investment sets available to them are similar. Hence, controlling for previous alliances between the venture *j's* potential acquirer *i* and prior acquirers within the venture *j*'s subfield, helps us to control for the extent of homophily and related similarity between the venture's potential acquirer and previous acquirers in the venture's subfield and consequently the resulting similarity in their acquisition activities (Ahuja et al., 2009) without social influence.

Macro level/External conditions as a source of similarity in the behavior of focal venture's potential acquirer and prior acquirers in the venture's subfield

As an alternative mechanism, to the extent that prior acquirers in a venture's subfield and potential acquirers of the focal venture are subject to similar changes/shocks in macroeconomic conditions, they might act in similar ways without any social influence, or imitation. Hence, we control for:

- ***Macroeconomic conditions/shocks*** using the *Median absolute change in ROA; Median absolute change in asset turnover and Median absolute change in employment growth in biotech industry along with year fixed* effects (Harford, 2005; Haunschild, 2003; Ahuja et al., 2009).
- *We also control the* ***number of ventures available to be acquirer in a subfield.***

Potential acquirer-year level controls

- ***Potential acquirer's financial slack and performance.*** Previous studies suggest that a firm's (potential acquirer's) financial slack can be highly influential in affecting a firm's actions in general and acquisition decisions in particular (e.g., Haleblian, McNamara, Kolev, and Dykes, 2012; Smith et al., 2001). Hence, we have controlled various measures of the potential acquirer's financial slack and its prior performance using the firm's ***debt-to equity ratio; firm's revenue growth, growth in the number of firm's employees and firm's Tobin's q*** because firms with higher valuations might be more prone to conduct acquisitions.
- ***Potential acquirer's prior performance.*** We also controlled for ***potential acquirer's ROE*** as an indicator of the firm's performance.
- ***Potential acquirer's patent count.***

Potential acquirer-venture-year level control variables.

- ***Prior alliances between the venture and its potential acquirer.***
- ***Potential acquirer's number of citations to the venture's patents.***
- ***Potential acquirer's number of prior acquisitions in venture's subfield*** to incorporate the acquirer's experience or inclination to engage in acquisitions in the venture's subfield.
- ***Tech distance between potential acquirer and the venture*** (this variable also enters as a moderator as the measure of transaction specific uncertainty).

Online Appendix 1-Panel B. The Acquirer-venture-year Level Analyses. (Dependent variable is equal to one if a potential acquirer *i* acquirers a venture *j* at time *t*. All the right hand side variables are lagged one year).

Variable	*Model I*	*Model II*
Subfield fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Number of prior acquisitions within the venture's subfield	0.047 (0.016) [0.004]	
Exogenous Technological Uncertainty * Number of prior acquisitions within the venture's subfield	0.230 (0.049) [0.000]	
Technological distance between venture and its potential acquirer * Number of prior acquisitions within the venture's subfield	0.031 (0.007) [0.007]	
Prior Acquirer prominence-ROE		0.484 (0.198) [0.015]
Exogenous Technological Uncertainty * Prior Acquirer prominence-ROE		0.950 (0.313) [0.002]
Technological distance between venture and potential acquirer * Prior Acquirer prominence-ROE		3.249 (0.890) [0.000]
Technological distance between the venture and potential acquirer	-20.274 (6.782) [0.003]	-44.149 (23.475) [0.060]
Exogenous Technological Uncertainty	-0.526 (0.139) [0.000]	-0.781 (0.151) [0.000]
Difference between the venture's potential acquirer and prior acquirers within the venture's subfield (with respect to ROE)	-0.317 (0.347) [0.360]	-0.504 (0.496) [0.309]
Difference between the venture's potential acquirer and prior acquirers within the venture's subfield (with respect to total assets)	-0.002 (0.001) [0.001]	-0.003 (0.001) [0.012]
Product market overlap between the venture's potential acquirer and prior acquirers within the venture's subfield	-0.066 [0.028] [0.028]	-0.113 (0.033) [0.001]
Total Number of prior alliances between the venture's potential acquirer and the prior acquirers within the venture's subfield	-0.562 (0.204) [0.006]	-0.563 (0.183) [0.002]
Tech distance between the venture's potential acquirer and the prior acquirers within the venture's subfield	-25.015 (6.134) [0.000]	-29.747 (6.583) [0.000]
Number of ventures in the focal venture's subfield	0.025 (0.013) [0.063]	0.028 (0.011) [0.012]
Number of potential acquirer's prior acquisitions in the venture's subfield	-0.628 (0.657) [0.339]	-0.035 (0.563) [0.950]
Potential acquirer and venture has prior alliance (dummy variable)	20.770 (2.338) [0.000]	24.609 (2.962) [0.000]
Number of cross citations from the potential acquirer to the venture	0.026 (0.013) [0.037]	0.049 (0.014) [0.000]

Potential acquirer's total patents	0.000 (0.010) [0.977]	-0.010 (0.011) [0.383]
Potential acquirer-Tobin's q	-0.005 (0.006) [0.423]	-0.009 (0.007) [0.163]
Potential acquirer-ROA	2.046 (0.244) [0.121]	3.336 (1.650) [0.043]
Potential acquirer-leverage	7.048 (1.564) [0.000]	6.316 (2.385) [0.008]
Potential acquirer—revenue growth	0.115 (0.244) [0.637]	0.707 (0.302) [0.119]
Potential acquirer—Asset turnover	-0.446 (0.470) [0.343]	-0.221 (0.385) [0.565]
Potential acquirer-employee growth	0.707 (0.635) [0.265]	0.253 (0.584) [0.665]
Venture age	0.215 (0.047) [0.000]	0.200 (0.044) [0.000]
Venture-number patens	0.336 (0.383) [0.381]	0.313 (0.497) [0.529]
Venture-alliance prominence	14.033 (8.730) [0.108]	14.066 (9.719) [0.418]
Venture-early stage	-0.532 (0.743) [0.474]	-0.332 (0.772) [0.667]
VC prominence of the venture's investors	1.787 (0.987) [0.070]	1.152 (1.204) [0.339]
Median absolute change in ROA in the industry	1.005 (0.277) [0.000]	1.549 (0.303) [0.000]
Median absolute change in Asset turnover in the industry	1.545 (0.403) [0.000]	2.699 (0.493) [0.000]
Median absolute change in Employment growth in the industry	-0.729 (0.184) [0.000]	-1.198 (0.234) [0.000]
Log likelihood, $L(\boldsymbol{\beta})$	-186.6	-161