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BEING FIRST OR MAKING A DIFFERENCE? A STUDY OF U.S. VENTURE CAPITAL INVESTMENTS INTO THE "CLEAN" ENERGY SECTOR



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ABSTRACT

This study highlights how firm reputation both enables and constrains engagement in novel actions that fall outside established business practices. In a study of venture capital (VC) investment in the emerging clean energy sector, we find that VC firms with medium reputation are more likely to engage in novel action and tend to do so earlier than either their high or low reputation peers. However, VCs with either low or high reputation exhibit greater commitment to the novel actions. Together, these findings suggest that firms with medium level of reputation devise an "early entry-low level of commitment" strategy, whereas the most reputable firms and those still in process of developing their reputation tend to engage in later but more significant commitment to novel action.

INTRODUCTION

Stakeholders of knowledge-intensive industries that provide highly specialized professional services often find it extremely difficult to compare the tacit knowledge, skills, and competences of competing firms. In such industries, firm reputation is found to guide stakeholders in their comparison, decision and actions with regards to competing firms (Darby & Karni, 1973; Rindova, Williamson, Petkova, & Sever, 2005). Examples of such industries include venture capital (VC) management (Diamond, 1989; Gompers, 1996), business education (Martins, 2005; Rindova et al., 2005), accounting services (Greenwood, Li, Prakash, & Deephouse, 2005), and legal/investment advice (Philips & Zucherman, 2001). Reputation reduces stakeholders' uncertainty by providing summary information about the firms belonging to a relevant peer-group (Fombrun, 1996; Rindova et al., 2005) and indicating which firms are "positively distinctive" among their peers (King & Whetten, 2008: 192). Past research suggests that high reputation contributes to long-term financial benefits such as premium prices (Rindova et al., 2005), and a "reservoir of goodwill" with stakeholders (Pfarrer et al., 2008; Pfarrer, Pollock & Rindova, 2010). Overall, the reputation literature emphasizes the importance of consistent high performance and predictable firm actions for the purpose of developing and maintaining a strong reputation (Dierickx & Cool, 1989; Forbrun & Shanley, 1990).

Whereas the benefits of building reputation and the consequences of maintaining it are well-understood, relatively little research attention has been devoted to examining its effects on firm decisions to engage in novel actions that fall outside of established business practices and that may require new skills and business models. The limited empirical evidence related to this issue leads

to contradictory conclusions. For example, in a recent study Pfarrer and colleagues (Pfarrer et al., 2010) suggest that reputational concerns constrain deviations from standard industry practices. In contrast, other research emphasizes the benefits of having an established reputation, one of which is the ability of such actors to deviate from established norms of behavior with minor penalties for engaging in such non-conforming behaviors (Rindova et al, 2006; Pfarrer et al., 2010). These seemingly contradictory findings suggest that the relationship between actors' reputation and their engagement in novel action may be more complex than presented to date and call for more careful examination of these effects.

In this study, we take a step towards unpacking this relationship by examining the enabling and constraining impacts of firm reputation. Specifically, we propose that firms with varying levels of reputation face unique constraints and enablers, which lead them to utilize different strategies vis-à-vis engaging in novel actions. Highly reputable organizations typically possess both the resources to engage in a novel action (Garud, Jain, & Kumaraswamy, 2002) and the legitimacy to justify the rationale for doing so (Sherer & Lee, 2002). However, it is exactly those same firms that benefit most from the established business models and practices (Greenwood & Suddaby, 2006), and have the least incentives to deviate from them (Rindova et al., 2006). The less reputable firms, on the other hand, are more likely to search for new opportunities, because they are not successful enough with the existing business model. But their lower reputation may prevent them from obtaining the resources needed to depart from the existing practices and to develop new skills and business models. In this study, we test empirically the relative importance of these opposing forces across various dimensions of engaging in a novel action.

The context we selected for our investigation is the initial investment decisions of U.S. venture capital firms into the emerging clean energy sector.¹ The growing number and variety of clean energy technologies – such as solar and wind power – has attracted significant research attention over the past few years. Scholars have established the importance of various institutional factors, such as social movements (Lounsbury, Ventresca & Hirsch, 2003; Pacheco, 2009; Sine & Lee, 2009), certification from legal authorities (Sine, David & Mitsuhashi, 2007), and the development of political and legal infrastructure (Sine et al., 2005) that are key to encouraging entrepreneurial activity in this nascent sector. Little research attention, however, has been devoted to the involvement of the VC community in the emergence of this sector. Because the clean energy sector differs substantively from other high-technology sectors with which most VCs are familiar, in terms of capital intensity, time-horizon, exit potential, and skills needed to select, mentor, and develop the startups, VC investment decisions regarding the emerging clean energy sector provide an ideal opportunity for examining the effects of actor reputation on the manner in which they engage in novel actions.

THEORY DEVELOPMENT AND HYPOTHESES

Reputation in the Venture Capital Industry. There are two main stakeholder groups that rely heavily on the reputation of VC firms for decision making: (a) investors (e.g., pension funds, university endowments, etc.) that entrust their capital to VC firms and (b) startups that seek VC firms' funding.

Given that investors entrust their money with a chosen VC firm for ten to twelve years (the usual life-cycle of a fund), it is important – albeit difficult – for them to evaluate the ability of the VC firm to deliver high returns on their capital (Diamond, 1989; Gompers, 1996). Investors consider the reputation that a VC firm has accumulated as a result of past performance to compare

it to its competitors. Research suggests that without a strong reputation, VC firms will find it very challenging to raise their next fund with investors (Gompers, 1996). Most VC firms are aware of the close connection between past performance and reputation and spend significant amount of effort building and maintaining a good reputation by carefully selecting, monitoring, and exiting from the startups in which they invest (Gompers, Kovner, Lerner, & Scharfstein, 2006). Indeed, empirical evidence shows that VC firms with a proven performance track-record are more likely to raise follow-on funds and that returns on investment persist strongly among subsequent funds (Kaplan & Schoar, 2005).

Startups seeking financial backing are also concerned with the reputation of prospective VC investors (Baum & Silverman, 2004; Sapienza, 1992). The most reputable VC firms provide non-monetary benefits such as the highest quality guidance, mentoring, and advice to their portfolio companies. They also endorse the selected startups and improve their access to resources from other stakeholders (Pollock & Gulati, 2007; Pollock et al., 2010), thus further improving their growth prospects. These are all incentives for startups to seek the backing of the more reputable VCs even if this entails less favorable terms of the deal (Hsu, 2004).

VC Investment in the Clean Energy Sector as a Novel Action. The major sectors in which VCs have invested so far include communications, media, computers, electronics, biotechnology, medical and pharmaceuticals (Dimov & de Holan, 2010), all of which offer opportunities for rapid growth and scalability of the technologies developed by entrepreneurial startups. Most VCs would consider an exit to be successful if it returns at least ten times their investment (Ghosh & Nanda, 2010). Overall, the prevalent wisdom among the VC community and entrepreneurship scholars alike is that VCs “only invest when they believe that the firm has the potential to grow, and thereby rapidly increase the value of their equity investment” (von Burg & Kenney, 2000: 1138).

VC investment in clean energy represents a novel action given that this sector differs from other technology-based domains in several important ways: First, clean energy startups often require much larger amounts of capital than the other sectors VCs have invested in (whether alone or in syndication), with the needs of a single firm often exceeding the size of a typical VC fund (Ghosh & Nanda, 2010). Second, most VCs lack the managerial competence needed for mentoring and advising clean energy startups, and for connecting them to suitable partners and technical talent. Third, and probably the biggest problem so far, is the lack of a feasible exit mechanism, such as IPO and acquisition. So far, clean energy IPOs have been extremely rare. Fourth, the typical time that VCs have to budget for before they can hope to exit their clean energy investments is likely to be much longer than the typical investment cycle of about five years (Ghosh & Nanda, 2010; Wustenhagen & Teppo, 2006).

Lastly, unlike the majority of high-technology startups that offer new special features and have the potential to generate high profit margins, clean energy startups develop proprietary technologies to generate, store, manage, and improve efficiency in use of energy. In the mature U.S. market, energy is a cheap commodity product the demand for which is driven primarily by price and public policy (Ghosh & Nanda, 2010; Lassiter, Sahlman & Wagonfeld, 2010). Therefore, energy cannot be sold at high profit margins and typically requires a significantly large production scale just to break even. This makes the conventional VC standards for a successful return on investment inadequate or unreachable. Taken together, these considerations suggest that VC investments in the emerging clean energy sector represent a novel action on their part.

Role of Reputation in the Engagement of Novel Action. In order to explicate the role of reputation as an enabler and constraint of novel action, we categorize VC's into three reputation levels: (a) highly-reputable VCs, who have consistently demonstrated their competence and ability to bring high returns on investment; (b) moderately-reputable VCs, who have a reasonable performance track record but not as impressive as the most reputable peers; and (c) VCs with no/low level of reputation who are yet to prove their abilities and accumulate reputation.²

In addition, we suggest that investment in an emerging sector is a complex decision and involves at least three distinct aspects: first, the VC has to decide whether to invest or not (entry decision); second, those that do enter have the option of doing so earlier or later (timing of entry); and finally, when a VC firm invests, it has to decide on the degree to which it will commit resources, time and effort to the novel action, i.e., the relative importance that the emerging sector has for a focal VC firm in its entire investment portfolio (level of commitment). Prior research has focused primarily on the decision to engage in novel (or deviant) action (Pfarrer et al., 2010; Philips & Zuckerman, 2001), while the timing and level of commitment has received less research attention. However, given our goal to provide a richer and more nuanced picture of the role that firm reputation plays in their engaging in novel action, we develop hypotheses for each of these three aspects of the investment decision.

Highly-reputable VCs. The top of the hierarchy consists of the most reputable VC firms (e.g., Kleiner Perkins Caufield & Byers, Sequoia Capital, Draper Fisher Jurvetson, Benchmark Capital) that have been around for a while and are well known even beyond the VC community. These firms have built their reputations through decades of discovering promising startups, turning them into fully functional businesses, and providing handsome returns to investors after successful IPOs and acquisitions. Their established reputation enables these firms to raise larger funds (Dimov, Shepherd, & Sutcliffe, 2007; Dimov & Milanov, 2010) and to select among the most promising investment opportunities (Hsu, 2004). The disproportionate availability of resources relative to less reputable peers gives these VCs greater flexibility in terms of the types of investments they make and the amount of risk they take (Dimov & de Holan, 2010).

Further, highly reputable firms enjoy greater credibility and influence when trying to convince others of the rationale behind their decisions and actions. Research demonstrates that such firms can legitimize new activities as acceptable, appropriate, and even desirable (Haunschild & Miner, 1997; Rindova & Kotha, 2001; Rindova et al., 2007) as well as solicit the support of state, government and other institutions (Lounsbury et al., 2003). Examples of reputable firms engaging in novel action include the adoption of new personnel practices by prestigious law firms (Sherer & Lee, 2002) and the championing of "nouvelle cuisine" by prominent French chefs (Rao, Monin, & Durand, 2003). This phenomenon, called "elite institutional entrepreneurship" (Greenwood & Suddaby, 2006) highlights that the most reputable organizations in a field have superior access to information as well as the financial resources, social skills and political influence required to successfully envision and initiate novel practices (Garud, et al., 2002; Jain & George, 2007).

Finally, reputation enables novel action by endowing firms with "idiosyncrasy credit" (Hollander, 1958), which refers to the greater tolerance and forgiveness on part of stakeholders towards these organizations due to the goodwill they have accumulated over time. Recent research demonstrates that when reputable firms engage in an idiosyncratic action (such as restatement of financial results) that contradicts the expectations of their stakeholders, they are more likely to

be forgiven (Pfarrer et al., 2010). Overall, it appears that the most reputable firms in an industry possess the material and social resources needed to take novel action.

On the flip side, the most reputable firms have the least incentives to deviate from the existing business models and practices they have mastered to perfection (Rindova et al., 2006). Maintaining an already established reputation calls for consistency, reliability, and predictability – a continuity in actions and performance – and prevents the most reputable firms from engaging in behaviors that depart from industry norms and standard practice (Fombrun, 1986; Clark & Montgomery, 1998; Weigelt & Camerer, 1988). Therefore, other things being equal, concerns with preserving reputation tend to constrain novel action by high reputation firms.

Applied to the VC context, we can assume that the most reputable firms are also the ones that have benefited most from the established business models and investment practices, largely because they played a big role in developing and perfecting these investment models and practices (Gompers & Lerner, 1999). In order to preserve their reputation, these firms tend to persist with their strategies and invest in areas where they have accumulated competence and experience, or diversify in closely related sectors (Dimov et al., 2007; Dimov & de Holan, 2010). Investing in an emerging sector that requires different skill-sets and business models is likely to contradict the interests of reputable VC's and their stakeholders, given the high uncertainty regarding the potential returns on such investments. Although they possess the material and social resources to engage in novel action, these firms are unlikely to do so because they are concerned about the potential for reputation damage. Overall, we expect that as far as likelihood of novel action is concerned, the role of reputation as a constraint will prevail over its enabling aspects for highly reputable VC firms. Thus, a highly reputable VC will be less likely to invest in an emerging sector.

Given the considerations with preserving their already established reputation, we expect that the few reputable VCs that decide to engage in novel action would do so relatively late. Waiting until some uncertainties are resolved and/or the emerging sector gains legitimacy makes an investment more attractive, especially for VCs who are looking for new sectors to diversify their investment portfolio. For example, the Internet bubble burst of 2000 triggered heated debates and criticism of the VC industry, which arguably provoked consideration of new investment opportunities by reputable VC's. The external pressures, in conjunction with the growing public attention towards clean energy, made the latter a potential candidate for investment. Overall, we expect reputable VC's to invest relatively late in the emerging sector, when the sector gains some legitimacy and/or external events motivate search for new opportunities.

However, we expect that once reputable VC firms decide to invest in an emerging sector they would commit substantively to their selected course of action. First, reputable VCs are likely to be more confident in their decisions regarding the emerging sector and to trust their own ability to acquire the new skills and practices required to succeed in the new sector. Research has established that experienced decision makers are more comfortable making decisions under uncertainty as compared to less experienced peers (Fox & Tversky, 1995; Heath & Tversky, 1991). Further, experienced decision makers feel confident in their intuition and prefer to bet on their vague beliefs as opposed to known probabilities (Heath & Tversky, 1991). Consistent with these ideas, Dimov and colleagues find that reputable VCs have lower propensity to syndicate when investing in sectors new to them (Dimov & Milanov, 2010) and a greater propensity to invest in early-stage startups, which are considered riskier than later-stage ones (Dimov et al, 2007). Therefore, reputable VCs are likely to feel confident that they can not only contrive the right business model,

engage in adequate due diligence, develop the necessary evaluation criteria, but also select the most promising startups and mentor them effectively.

Second, highly-reputable VCs have a greater capacity to obtain the necessary resources for taking novel action, not only through creating targeted funds, but also through mobilizing social and political support (Garud et al., 2002; Jain & George, 2007). This is due to the validity and legitimacy that come with the reputation, which allow them to justify the rationale for novel action better than less reputable peers (Sherer & Lee, 2002).

Finally, the most reputable firms can afford to deviate most from the established industry practices before being questioned (or punished, in the event of failure), due to the “reservoir of goodwill” (Pfarrer et al., 2010) or “idiosyncrasy credit” (Hollander, 1958) bestowed by their reputation. High reputation mitigates the potential negative consequences of engaging in deviant behaviors by making stakeholders less critical about the actions of reputable firms (Pfarrer et al., 2010; Rindova et al., 2006). Following this logic, highly reputable VCs can afford to become elite institutional entrepreneurs without significantly damaging their reputation. Overall, if and when reputable VCs decide to invest in the emerging sector such as clean energy, we expect them to make substantive commitments, because of their confidence in making decisions under uncertainty, their ability to mobilize resources, and the goodwill that they possess.

Moderately-reputable VCs. The moderately reputable VCs (e.g., Rockport Capital Partners, Nth Power, FreshTracks Capital) have demonstrated reasonable performance but have been less successful in accumulating reputation than their most reputable peers. As a result, they typically have less access to resources and opportunities in current investment sectors. This arguably creates incentives for these firms to search for new opportunities and to engage in novel action. Moreover, their extant reputation enables them to access some of the resources that they require for such actions. Overall, the highly competitive nature of the field can serve as motivation for these VCs to explore new investment opportunities, especially if they expect that early entry into an emerging sector can give them the lead time required to figure out how to succeed in this nascent domain.

On the flip side, the risk of losing their already established reputation serves as a constraint to novel action by these firms. Although they may not have benefited from the existing business models and practices to the same degree as their most reputable peers, moderately reputable VC’s may still find reasons to stick to these practices in order to move up the rankings. Phillips & Zuckerman (2001) refer to this phenomenon as “middle-status conformity,” one in which the firms in the middle of the pack (in terms of reputation) experience pressure to conform to the “ideal” practices and behaviors of a field. In addition, moderately reputable VCs may be subject to closer monitoring by institutional investors and may have less discretion in terms of where to invest their funds, as compared to the most reputable peers.

However, given the competitive nature of the VC industry and the high stakes involved, we expect the competitive pressure experienced by the VCs with medium reputation to outweigh their desire to conform, and to make them more amenable to engage in novel action in search for superior opportunities. In other words, for the middle-reputation VCs, the emerging sector may appear more attractive than for their more reputable peers, because their inferior performance in the established investment sectors creates (possibly unreasonable) expectations for greater success in the new sector. The desire to enhance their reputation, then, makes it more likely for these firms to “go for the fences” and undertake novel action.

Our expectation that moderately reputable VC's would enter earlier than their high or low-reputation peers implies that they will invest in the emerging sector under greater uncertainty. Although the search for better investment opportunities and potential competitive advantage in the new sector may motivate those VCs to invest early on, they are likely to find it more difficult than their more reputable peers to raise capital for such novel investments. Possessing inadequate resources or being limited to using a fraction of funds raised for investment in other sectors constrains the scale of commitment that these firms can make in the emerging sector. Also, early entry in the emerging sector entails high chances of failure, given the limited opportunities to learn from the mistakes of the others. The highly uncertain outcomes of such "experiments" could potentially be very damaging to VC reputation. Exploring new opportunities while minimizing potential reputation damage calls for an "options" approach to entering the emerging sector by relying largely on small-scale investment experiments. Thus, we expect that moderately reputable VCs would try to limit the potential downsides of their investments in the emerging sector by committing only a small proportion of their portfolio to it.

Low-reputation VCs. The VC firms that fall at the bottom of the reputational rankings in a given year are not necessarily the worst performers. Unlike in other industries, where firms with poor reputation can survive for many years, a lack of reputation in the VC industry would lead to the inability of a firm to raise follow-on funds and its subsequent liquidation (Diamond, 1989; Gompers, 1996). This implies that VC's with a low reputation are more likely to be new (or relatively young) ones. Given that a typical VC fund takes about ten years to liquidate, and that the first startup exits are most likely to occur after about five years of investment, a newly-created VC firm would lack reputation for a while before it can publicly demonstrate its competence. Thus, newly created VC firms have to undergo a slow process of developing their initial reputation.

At one level, the lack of reputation can be liberating: VCs that fall into this category have no reputation at stake (i.e., "nothing to lose") which enables them to consider wider range of actions. Further, and more important, these VCs have neither mastered, nor benefitted from, existing business models and practices. Unlike their more reputable peers, they are not embedded in existing industry practices and have no particular reason to conform to them. For example, Lounsbury et al. (2003) observed that NGOs – who, at the time, were peripheral organizations in their organizational field – played a significant role in the institutionalization of recycling practices. This observation is also a central theme within the literature on technological change, which has highlighted the role of newcomers as pioneers of innovation and the inability of embedded incumbents to respond to such shifts (Henderson & Clark, 1990; Christensen, 1997; Schumpeter, 1950). Overall, the lack of reputation enables these VCs to consider a wider range of investment opportunities and business models, which makes them more likely to engage in novel action.

However, the low reputation can also constrain the ability of these firms to engage in novel action. The less reputable VCs arguably have the hardest time raising money, because in the eyes of investors they lack the track record of their competitors. As a result, these VCs would normally start with small funds. Second, VC firms with low reputation may have less choice in terms of startups to invest in, because these startups would prefer to be associated with reputable VCs (Hsu, 2004; Gompers et al., 2006; 2008). These limitations are particularly pronounced in established investment sectors where the definition of what constitutes a promising investment opportunity is well-understood and shared among VC firms and aspiring startups.

Building on the above arguments, we hypothesize that low-reputation VC's are more likely to enter emerging sectors than their more reputable peers. Many of these firms have been founded precisely to explore the viability of the emerging sector and often reflect the passion and experience of their founders (Chen, Yao, & Kotha, 2009; Cardon, Wincent, Singh, & Drnovsek, 2009). As indicated above, prior research suggests that low-reputation firms can afford to engage in novel actions because they have relatively little to lose in case of failure (Philips & Zuckerman, 2001) and they are minimally embedded by the past (Garud & Jain, 1996).

While these VCs are highly motivated to craft emerging sectors, it is also the case that they typically lack the resources needed for making such change (Maguire, 2007), because they cannot draw on their performance track record when trying to convince prospective investors to provide capital for investments in an emerging sector. In other words, although VCs that lack reputation may be willing to invest in the emerging sector early on, their low credibility is likely to limit their ability to raise the necessary capital and mobilize resources until the sector gains sufficient legitimacy as a potential source of business opportunities. Thus, we expect that the constraints imposed by their lack of reputation would delay investment entry by such VCs.

However, once they manage to obtain the necessary resources, these VCs are likely to commit substantively to the emerging sector, for at least two reasons: First, the limited capital and other resources available to these VCs make investment feasible in only one or two sectors at a time. Moreover, their possible lack of experience implies that they would have to learn multiple skills and investment practices simultaneously – a fairly challenging task for any VC firm. As a result, the constraints imposed by the lack of reputation call for focus rather than spreading the limited resources and competences thin. Second, new VC firms like Sail Venture Partners and Braemar Energy Ventures were specifically created to invest primarily in the emerging clean technology sector. This firms' stated mission provides strong incentives to stay focused. In sum, low/no reputation VCs are likely to commit substantively to the emerging sector, in part due to limited resources and learning capacity, and in part due to their underlying mission and investment focus.

Taken together, our arguments suggest that VC firms with low reputation would be more motivated to enter an emerging sector such as clean energy compared to their more reputable peers due to a lack of constraints that come with higher reputation. The low-reputation VCs thus are able to take a more opportunistic approach to investment opportunities and enter the sector that seems to hold the most promise for the future. However, the nimbleness a low-reputation VC firm enjoys does not mean that they would be ahead of their peers in exploring new opportunities. Middle-reputation VC firms, trying to survive amongst fierce competition with equal or higher-reputation firms, are more willing to try out a new sector so that they can obtain first-mover advantage. These firms are more resourceful than the low-reputation firms while less constrained by concerns to protect their reputation than the high-reputation firms. Once the entry to the new sector is made, though, middle-reputation VC firms may not be willing to risk as much as their low and high-reputation peers as they do face greater uncertainty as first-movers. VC firms with low reputation will be able to devote a greater portion of their portfolio to the new sector as mandated by their limited size, hence a necessity to focus. VC firms with high reputation, although later than the mid-reputation peers in entry, will be determined to make their choice work by orchestrating a sizable portion of their resources to investments in the emerging sector. Therefore, we hypothesize:

H1: A VC firm's reputation will have a negative effect on its likelihood to invest in the clean energy sector.

H2: A VC firm's reputation will have a curvilinear (inverted U-shape) relationship to the timing of VC investment entry into the clean energy sector.

H3: A VC firm's reputation will have a curvilinear (U-shape) relationship to VC commitment to clean energy investments.

METHODS

Research Setting. The clean energy sector consists of an eclectic set of technologies that “harness renewable materials and energy sources or reduce the use of natural resources by using them more effectively and productively, cut or eliminate pollution and toxic wastes” (Pernick & Wilder, 2008: 2). Although clean energy technologies have been around for decades (Sine & Lee, 2009) and their potential to address economic, social, and political problems has been well-recognized (Pernick & Wilder, 2008), only recently has this sector piqued significant interest on part of the VC community.

Clean technologies by and large do not fit the profile of a “high-potential” investment opportunity that would attract VC attention. There exist many uncertainties related to the clean energy sector's economic feasibility and scalability, its availability of the requisite infrastructures for large-scale implementation, and the relatively long-time horizon of investments (Ghosh & Nanda, 2010; Pernick & Wilder, 2008). Thus investing in clean energy represents a novel action (and rare event) for the VC firms, which is supported by the VC industry investment statistics: According to VentureXpert data base, as late as 2000, the clean energy sector accounted for less than one percent of the VC investments in the U.S. (Pernick & Wilder, 2008). For the entire period of this study (1990-2008), less than five percent of all U.S. VC firms invested in the clean energy sector.

Data and Variables: Assuming that any VC could potentially invest in the clean energy sector, we included in our study the entire population of 3574 U.S. based VC firms that made an investment from 1990 to 2008. A VC firm was included in the panel for each year starting from 1990 or the year of its founding (if founded after 1990) until (a) the VC firm made an investment in clean energy; or (b) the VC firm made no investments for five consecutive years, at which point we assumed it was discontinued; or (c) the end of our observation period (the year 2008) was reached. Our final sample consisted of 37,293 firm-year observations. Data were obtained from the VentureXpert database, the LexisNexis database, Earth Policy Institute website, the U.S. Department of Energy website, and the Database of State Incentives for Renewables and Efficiency. Table 1 contains the variables in this study and their descriptions.

Estimation Methods. Three different estimation methods were used to test our hypotheses. We used random effects logistic regression to test H1 where the dependent variable is the likelihood that any VC firm in our sample makes an initial investment in the clean energy sector. We used event history analysis (semi parametric Cox regression) to test H2, the extent to which reputation impacts the timing of a focal VC firm to enter the clean energy sector (i.e., to invest for the first time in a clean energy startup). Since our third dependent variable, *level of commitment to clean energy*, is a ratio, we used random effects Tobit regression for the analysis.

RESULTS

Table 2 presents the results for the effect of reputation on our three dependent variables. We find that reputation has a positive and significant impact on the likelihood that a VC firm enters the clean energy investment (Table 2, Panel A). Hence we do not find support for H1. Since we also make predictions about the effect of the nonlinear term of reputation on VC decisions in H2 and H3, we also checked whether VC reputation has a non-linear effect on the likelihood of entry in the clean energy sector (Table 2, Panel B). We find that VC reputation has an inverted-U shaped relationship with the likelihood of entry in the clean tech sector, suggesting that VCs with very low and very high reputation are less likely to enter than VCs with moderate levels of reputation.

Table 2 also presents the results for the Cox proportional hazards regression used to examine the time to invest in clean energy. We report hazard rates in Panel C for ease of interpretation. Consistent with H2, we find that the linear term of VC reputation has a positive and consistently significant effect and the squared term of VC reputation has a negative and significant effect on the hazard of investing in clean energy. This suggests that very low and very high reputation VCs will invest later in clean energy sector than VCs with reputations in the moderate range. Hence we find strong support for H2.

Panel D of Table 2 presents the results of the panel Tobit regression. We find that the linear term of VC reputation has a negative and significant effect while its squared term has a positive and significant effect on the level of commitment. This result suggests that firms with very high and very low levels of reputation will invest in a greater number of clean energy startups as a proportion of the number of their overall investments than VC firms with moderate reputation. Thus we find support for H3.

Robustness Tests. We conducted the following additional analyses and found that the results remained the same in each case: 1) we used the original reputation measure validated by Lee et al. (2007) that included VC firm age as a part of the reputation composite; 2) we excluded the amount of funds raised by VC firms from the reputation composite and used it as a control instead; 3) we reran all the analyses by restricting the sample to different time periods (1990-1997 and 1998-2008); 4) we created a categorical variable of reputation by defining the high-reputation VCs as the top 30%, the mid-reputation VCs as the next 40%, and the low-reputation VCs as the bottom 30% based on the reputation scores.

DISCUSSION

This study draws on theories of reputation and institutional entrepreneurship to develop a more fine-grained understanding of the effect of reputation on novel action. Contrary to our predictions, we find a positive effect of VC firm reputation on the likelihood to invest in the emerging sector, which diminishes only at very high level of reputation (inverted-U shape). Consistent with our expectations, reputation is positively associated with the time to investment entry but this effect diminishes at high levels of reputation, suggesting that the VC firms with medium reputation are the fastest to invest. Interestingly, although the VCs with either high or low reputation are less likely to invest and take longer time to their first investment, upon investment they tend to commit a greater proportion of their portfolio to the emerging sector. Together, these findings shed light on the distinct strategies that firms with different levels of reputation devise, as a result of the perceived benefits and constraints associated with their reputation.

Our study makes several important contributions to extant theories of reputation and institutional entrepreneurship, as well as to entrepreneurship research on emerging markets. First, our study contributes to reputation theory by providing a more nuanced understanding of the role of reputation in strategic decision making by highly specialized organizations such as VCs. Examining the role of reputation as both an enabler and a constraint of novel actions allows us to progress beyond the well-established positive-feedback-loop relationship between reputation and performance to understand the more complex and non-linear behavioral consequences of having achieved a certain level of reputation. Our study extends prior research on reputation by treating the whether, when, and how decisions to engage in a novel action as a result of multiple motives concerning reputation that pull and push the firm in opposite directions. Whereas prior research has emphasized primarily the constraining role of reputation with regards to novel or unconventional actions, our study shows that there might be a threshold level of reputation which enables and motivates novel action.

Our study also provides a potentially useful insight to the middle-status conformity discourse in sociology, which has gone back and forth regarding the benefit of sticking to the established industry norms and practices in order to move up the reputational rankings (Phillips & Zuckerman, 2001). Contrary to the middle status conformity hypothesis, we observe that medium-reputation VCs are more (not less) likely to invest and tend to enter earlier than either high or low reputation peers. Arguably, VC firms are qualitatively different from the law and financial advising firms that Phillips and Zuckerman (2001) study in that they are inherently more comfortable with risk-taking. The fact that the VCs with the highest reputation are less likely to invest in the emerging sector despite the availability of resources suggest that concerns with preserving the already established reputation may be particularly strong in the VC industry.

Second, our study provides new insights to institutional theory and especially to institutional entrepreneurship research. Whereas institutional research has established that under uncertainty firms are likely to follow the industry leaders (Deephouse, 1996; Greve, 2000; Haveman, 1993; Pfarrer et al., 2008), the decision of the industry leaders to engage in novel actions is less understood. Some scholars in this domain have demonstrated how established (and by extension, reputable) organizations are influential in shaping the emergence of new markets, technologies and business models (Lounsbury et al., 2003; Rao et al., 2003; Suddaby & Greenwood, 2006). Others have highlighted the role of newcomers in pioneering such practices (Maguire, Hardy & Lawrence, 2004). In each of these instances, these organizations serve as institutional entrepreneurs (Garud et al., 2002; Jain & George, 2007) that pioneer the movement towards new practices as well as the creation of new markets. These studies have offered important insights about the conditions and processes by which these actors address the "paradox of embedded agency" (Seo & Creed, 2002) and influence the emergence of new practices. We expand on this research by looking at the decision of different actors of the same ilk to engage with an emerging sector – a precursor of the subsequent influence that these organizations would have on the domain. In conducting a large sample study of institutional entrepreneurship, we demonstrate how the likelihood of high and low reputation VCs to engage in novel action is actually lower than that of medium reputation ones. Our findings suggest that different actors of the same generic type play diverse roles in shaping the emergence of a new sector.

Third, our study contributes to entrepreneurship research on VC entry into new investment markets by identifying additional institutional factors that may affect VC decisions to invest in an emerging sector. Only a handful of studies exist that examine VC firms' entry into new investment

markets. Past research has mainly focused on VC firms' industry and geographic diversification strategies (Gupta & Sapienza, 1992; Norton & Tenenbaum, 1993). Recent studies (Dimov & de Holan, 2010; Dimov & Milanov, 2010) have offered valuable insights into the effects of prior experience, in conjunction with status and reputation, on first-time VC investments into novel industries (i.e., VC has no or little investment experience). We contribute to this body of research by providing a systematic theoretical understanding of the reasons why VCs with different levels of reputation may be more or less inclined to invest in a highly uncertain sector that is quite distant from most of the industries VC firms traditionally invest in.

On a more practical note, our theory explains the relatively slow "emergence" of the clean energy sector in the U.S. If reputable VCs were to invest earlier into the emerging clean energy sector, they would have triggered faster legitimization of the sector. However, by investing later they ended up slowing down the process of legitimization of the emerging sector and diminishing the benefits for the startups in it. How this pattern of entry and commitment will ultimately impact the involvement of VC's and the development of the clean energy sector is difficult to say, given that we are still at the very early stages of this potential revolution. However our study has highlighted some of the key challenges that VCs are likely to encounter in creating this new domain. These challenges extend beyond the unique resource needs and revenue streams of start-ups in the clean energy space, to encompass the internal make-up of VC firms that drive their decisions to invest in this (and other) sectors. In this regard, our study represents a step towards gaining a more nuanced and fine-grained understanding of VC involvement with emerging sectors.

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NOTES

1. Clean technologies (or "cleantech") include technologies that aim at not only reducing environmental impact, improving productivity, but also providing superior returns to the investor and greater benefits to the customer. Energy-related clean technologies make up only part of the cleantech sectors. Other sectors include transportation, water, air, recycling, etc. Our focus is on energy-related cleantech, however, given that past research also covers sectors outside of clean energy (e.g., recycling), we use cleantech to refer loosely to energy-related clean technologies in this paper.
2. It should be noted that Phillips and Zuckerman (2001) consider the lowest-reputation firms outsiders that are prevented from upward mobility. We have no reasons to make such assumptions about the VC firms with no/low reputation, because it is unlikely for a VC firm to survive on the "periphery" of the industry. According to Diamond (1989), VC firms that fail to develop reputation would not be able to raise subsequent funds and would dissolve.

Full References Available from Corresponding Author

Table 1: Variables

<i>Dependent Variables</i>	
Likelihood of investment entry into clean energy	A dichotomous variable that takes a value = 1 if the focal VC firm invested in clean energy during 1990-2008, and 0 otherwise
Timing of investment entry in clean energy	The time taken by a focal VC firm to invest for the first time in a clean energy startup
Level of commitment to clean energy	# of clean energy startups funded by the VC firm in a given year as proportion of the total # of startups the VC firm funded in that year
<i>Independent Variables</i>	
VC firm reputation	Composite index of five measures of past VC performance: (a) # of portfolio companies invested in the past 5 years; (b) amount invested in the past 5 years; (c) total funds raised in the past 5 years; (d) # of funds raised in the past 5 years; (e) # of portfolio companies taken IPO during the past 5 years
<i>Control Variables</i>	
Cognitive legitimacy	# of media articles that contain one of the terms "clean energy," "green energy," "alternative energy," or a specific clean energy-generation technology (e.g., solar power, wind power) in the headline and lead paragraph
Sociopolitical legitimacy	# of federal financial incentives (e.g., tax breaks, loans, industry support and incentives) for renewable energy and energy efficiency in a given year
VC firm age	Age of the VC firm in years
VC firm industry focus	A dummy variable which takes the value 1 if the VC firm identifies its industry focus as being energy related
VC firm type	A dummy variable which equals 1 if the firm is a corporate VC, 0 otherwise.
VC State	A dummy variable that equals 1 if the focal VC is headquartered in California, 0 otherwise
Hotness of the VC market	# of startups funded by all VC firms in the focal investment year
Annual installed capacity	Annual US installed capacity for clean energy generation (MW)
Annual consumption	US clean energy consumption in quadrillion BTU

Table 2: Panel Regression Models

Variables	DV=Likelihood of investment entry		DV = Timing of commitment	DV = Level of commitment
	Panel A	Panel B	Panel C	Panel D
Reputation (t-1)	.127 (p<.001)	.243 (p<.001)	1.262 (p<.001)	-.017 (p<.01)
Reputation Squared		-.004 (p<.001)	.996 (p<.001)	.000 (p<.05)
Observations	37,293	37,293	37,293	709
Number of VC Firms	3574	3574	3574	172
Num. of Firms that invested			172	

Statistics presented here are 1) coefficients from random effects logistic regression (Panel A & B), 2) hazard rates from Cox proportional hazards regression (Panel C), and 3) coefficients from random effects Tobit regression (Panel D). Significance levels for all coefficients are reported in brackets.