

Unlocking Value from Startups' Ties to Established Firms: The Role of the Entrepreneurs' Background

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Evidence on whether startups benefit from corporate venture capital investment is equivocal. Research suggests that the principal impediment to value creation in these relationships for startups is the complexity of the larger organization – the varying incentive structures, layers of bureaucracy and convoluted decision-making processes that limit their access to valuable resources. I examine whether the backgrounds of the entrepreneurs may influence the ability of the startups to navigate this complexity and unlock value from these relationships. I focus in particular on experience working in an established firm in the same industry, and find that startups whose entrepreneurs have more of this type of experience are more likely to translate their CVC relationships into alliances with the established firm aimed at development or commercialization of their technologies. This effect is heightened if the established firms' employees managing these relationships have a background in R&D, thus enabling them to connect the entrepreneurs to the critical decision makers with respect to alliance formation. However, I also find that more experience working at established firms among entrepreneurs is associated with a narrowing of the technological distance between the startup and the established firm post-investment, i.e. the startup becomes technologically more like the established firm. This effect is also heightened by the presence of investment managers from R&D backgrounds, but is alleviated if the entrepreneurs themselves have more prior founding experience. Through these findings, the study contributes to research on entrepreneurship, innovation and corporate venture capital.

Unlocking Value from Startups' Ties to Established Firms: The Role of the Entrepreneurs' Background

Does it matter where entrepreneurs come from? The evidence in answer to this question has increasingly pointed to the affirmative, especially as it pertains to the issue of the careers led by these individuals prior to launching their ventures. In particular, research suggests that startups founded by individuals with prior experience working in established firms are more likely to be successful (Agarwal, Echambadi, Franco, & Sarkar, 2004; Chatterji, 2009). The argument here is that experience working in these firms can be the source of tacit contextual knowledge that is crucial to the success of entrepreneurial ventures. Yet, we also know that startups often succeed precisely by virtue of their ability to break free of the norms and mindsets that tend to constrain the innovative abilities of established firms (Christensen & Bower, 1996; Henderson & Clark, 1990). Given that individuals are imprinted by the norms of the firms they work in (Beckman, 2006), it is conceivable that entrepreneurs who previously worked at established firms may therefore also be limited in some ways by their experiences. Research has thus far not juxtaposed these contrasting ways in which entrepreneurs' work experience may influence the way they manage their startups.

I examine the implications of this hitherto unexplored tension in the context of entrepreneurial firms' relationships with established firms that arise from corporate venture capital investments. Specifically, I look at how prior experience of working in established firms can influence entrepreneurs' ability to manage their relationships with their corporate investors. Established firms have become an increasingly significant source of venture capital for startups over the past decade. These relationships with established firms are

thought to be of value to startups as a channel for access to valuable resources such as knowledge and complementary assets (Dushnitsky, 2012). Research has however documented substantial heterogeneity in whether these benefits are realized in practice, with recent work suggesting that navigating the complexity of these large organizations is the most significant impediment to startups unlocking the potential benefits from these relationships (Alvarez-Garrido & Dushnitsky, 2016; Pahnke, Katila, & Eisenhardt, 2015). Yet, we have thus far had no research looking specifically at how the backgrounds of the entrepreneurs may influence their ability to manage these relationships, and consequently the value that their startups may be able to derive from them.

I study this question in the context of startups in the life sciences receiving investment from established pharmaceutical companies, and find that startups whose entrepreneurs have greater prior experience working in established pharmaceutical companies are more likely to form a downstream innovation alliance with their corporate investor. The downstream capabilities of established firms in relation to drug development and commercialization are the most significant form of complementary asset in this industry, and as such, this type of alliance is the clearest pathway for startups to access these resources (Rothaermel & Deeds, 2004). I also find that the background of the established firms' employees who are responsible for managing these relationships plays an important role in this context. The benefits associated with entrepreneurs having pharmaceutical experience are accentuated if these individuals have a background in Research and Development, i.e. if they worked in R&D prior to taking up their roles in the corporate venturing divisions of the established firms. The reason for this lies in the ability of these managers to facilitate engagement

between the startup and the established firm's internal R&D departments, whose buy-in is crucial to an alliance being formed between the two firms.

However, I also find greater experience working at established firms among entrepreneurs is associated with a narrowing of the technological distance between the startup and the established firm post-investment. In other words, after the relationship is formed the startup becomes technologically more similar to its corporate investor, the more the entrepreneurs have prior experience working for established firms. This is likely to relate to the fact that, given the imprinting they have received in their prior careers in working in large pharmaceutical companies, they are more prone to conform to the value perceptions prevalent among the employees of the corporate investor. Interestingly, I find that this propensity to conform associated with Pharma experience declines to the extent that the entrepreneurs also have prior experience founding startups, i.e. prior founding experience dampens the relationship between prior Pharma experience and technological conformity with the established firm post-investment. I also find that the established firm employees managing these relationships play a significant role in this respect as well, with the presence of managers with an R&D background amplifying the relationship between the extent of the entrepreneurs' pharma experience and the decline in the technological distance between the two firms.

In sum, the findings offer important support to the idea that a relationship between the same pair of firms can lead to potentially quite different exchanges and outcomes depending on the people managing it on either side, i.e. the individuals at the interface. Research on interfirm relationships has generally abstracted away from these considerations. This is a particularly significant issue in the context of the relationships arising from corporate

venture capital investments, given these relationships are relatively open-ended, i.e. what will be exchanged between the firms is not well specified ex-ante. Consequently, the way they are managed plays a significant role in determining what the firms get from these relationships.

More generally, research in this domain has primarily focused on at the average effect of having corporate VC as a form of investment, typically compared to other forms of investment, say independent VC or government funding (e.g. Pahnke et al., 2015).

However, an important implication of these findings is that there can be a substantial degree of heterogeneity in these relationships, i.e. not all CVC is the same. Examining these relationships at the dyadic level rather than in aggregate allows us to more closely examine the antecedents of this heterogeneity, in this case that relating to the prior experience of the entrepreneur. The results show that prior experience of working in established firms can be valuable to entrepreneurs in enabling them to more effectively manage their relationships with their corporate investors in certain specific ways. However, I also highlight the fact that these experiences can also be the source of some important limitations, in that it can lead entrepreneurs to conform more closely to the value perceptions that prevail within established firms.

THEORY

Though popular notions of entrepreneurship conceive of founders as college dropouts working out of a garage, in reality most entrepreneurs have prior employment experience, and this experience significantly shapes their approach toward entrepreneurship (Bhide, 1994; Cooper, 1985; Robinson & Sexton, 1994). There is some evidence to suggest that the most common path to entrepreneurship in high technology industries involves prior

employment at an established firm (Freeman, 1986; Gompers, Lerner, & Scharfstein, 2005; Klepper, 2001). This is sometimes referred to as 'spawning' which Chatterji (2009: 186) defines as "the process by which employees of incumbent firms found entrepreneurial ventures in the same industry". Bhide (1994) found that nearly three quarters of the entrepreneurs in his study were using ideas they came across while working for their previous employer.

Gompers et al., (2005) outline two processes of entrepreneurial spawning from incumbent firms. In the first of these, employees of incumbent firms in an industry gain a range of skills and knowledge through their work that they can fruitfully employ in dealing with the challenges of entrepreneurship. They also gain access to networks that include suppliers of labor, goods and capital as well as potential customers. These resources facilitate the launch and growth of their ventures. In the alternative process, employees of incumbent firms become entrepreneurs because the large bureaucratic organizations fail to facilitate the development of their entrepreneurial ideas internally. Gompers et al., (2005) test these two processes and find broad support for the first explanation, suggesting in addition that this learning process that supports later entrepreneurship among employees may be particularly pronounced among firms that were once venture backed themselves.

A range of studies have also suggested that the performance of firms founded by former employees of incumbent firms will be superior to that of other types of entrepreneurial firms (e.g. Agarwal et al., 2004; Klepper & Sleeper, 2005). They suggest that this superior performance is explained by inherited capabilities in relation to technology, market and managerial processes. In an influential paper, Chatterji (2009) found that 'spawns' are likely to raise funding more quickly and that they receive higher valuations in their last rounds of

funding than firms founded by individuals with no prior work experience at established firms. However, he finds no evidence that the advantages enjoyed by spawns are the result of technical knowledge inherited from incumbent firms. Instead, he suggests that these benefits arise because of more tacit non-technical knowledge such as an understanding of regulatory and marketing processes in the industry.

The idea that the principal benefits of experience working at an incumbent firm for entrepreneurship arise from tacit non-technical knowledge also raises some interesting questions. The success of entrepreneurial firms frequently lies in their ability to pursue technologies and ideas that more established firms are unable or unwilling to pursue (Henderson, 1993). Established firms are often encumbered by the weight of the structures, systems, processes, and mindsets they have developed to suit the prevailing technological and environmental paradigms of the time (Christensen & Bower, 1996; Henderson & Clark, 1990). This is also reflected in the cognitive frameworks used by its managers to make sense of the world. These representations are typically a product of historical experience, and are subject to the institutionalizing forces prevailing within the firm. They can include beliefs about what business models or technologies are likely to be successful, who the firm's competitors are etc. (Porac, Thomas, Wilson, Paton, & Kanfer, 1995). These frameworks often become deeply entrenched within firms and can be immensely difficult to alter. A range of studies have demonstrated how a firm can become locked into specific strategic and technological directions due to the mental models that prevail among its managers (e.g. Tripsas & Gavetti, 2000).

We know that individuals who are employees of these organizations are likely to be imprinted by the beliefs and mindsets that prevail within them. Just as employees of

established firms can absorb valuable tacit knowledge during their work experience that can then help their subsequent entrepreneurial ventures, this knowledge is likely to be part of a package of broader cognitive frameworks they take from their experiences. Prior work has touched on this issue, for instance Beckman (2006) argues that prior company affiliations of entrepreneurs are likely to be important because "... the past companies in which managers have worked offer employees models for what an organization should look like and how it should act." (Beckman, 2006: 742). The idea here is that entrepreneurs are imprinted by the norms, beliefs and routines of the organizations in which they have been embedded, and that this in turn is likely to shape their decision making within their new ventures (Marquis & Tilcsik, 2013). Some of this imprinting includes a tacit understanding of processes and norms that can be hugely beneficial to the new venture (Chatterji, 2009). However, given we know that the mental models that prevail among managers of established firms can also be a constraint in some important ways especially in relation to technology, it is plausible that these constraints could also carry over to the new ventures started by former employees of these firms. Research has thus far not examined whether these constraints do indeed exist, or how they may manifest themselves in terms of the strategies and outcomes of the entrepreneurial firms founded by former employees of established firms. I will examine this broad issue in the specific context of the relationships between established firms and startups that arise from corporate venture capital investments.

Corporate Venture Capital and Complementary Assets

Corporate Venture Capital refers to minority equity investments in startups by established firms, and it is now among the fastest growing modes of interfirm partnership globally (Wu, 2016). From the established firm's perspective, these relationships are thought to provide a

window through which emerging technologies can be observed, understood, and possibly internalized. For the startups these relationships are purported to be a channel for access to valuable resources, in particular to complementary assets that would be difficult for the startups to obtain through other channels (Dushnitsky, 2012). Whether in practice they do indeed attain access to these resources via these relationships remains an open question, with research documenting equivocal findings on the benefits of these relationships for startups (Kim & Park, 2017). The most recent research on this topic indicates that the impediments to startups' access to complementary assets within the established firm arise primarily from the difficulties associated with navigating the organizational complexity of the larger firms, i.e. their bureaucracy, internally inconsistent incentive structures and resultant convoluted decision-making processes. As Pahnke et al., (2015: 9) surmise, "Helpful resources exist within corporations, but dispersed authority, complex and slow organizational processes, and internal conflicts... complicate ventures' access to these resources."

A question that follows naturally from this is whether some startups are better equipped to overcome these impediments than others, and what characteristics of startups may be associated with an enhanced ability to do so. To the best of my knowledge there has thus far been no research into this question, which is an increasingly important one given the rate at which these types of relationships are growing. I will attempt to address this gap by specifically considering the role of the people at the interface of these relationships – i.e. the individuals who are managing the relationship on the part of both the startup and the established firm. I will examine how the backgrounds of these individuals may influence

how effectively the startup is able to navigate the complexity of the established firm and obtain access to valuable complementary assets.

I will study this question in the context of the life sciences. Specialized complementary assets play an indispensable role in this industry, particularly in the latter stages technological development, but also in marketing and distribution of drugs (Gans & Stern, 2003). The latter stages of development consist of clinical trials involving large scale testing on human patients often simultaneously across multiple countries which can cost hundreds of millions of dollars as well as requiring huge staffs of specialized personnel (Sammut & Burns, 2005). These resources are typically controlled by large, established Pharmaceutical companies, and are of a scale that makes it difficult for startups to do this on their own. Consequently, startups have to form partnerships with established firms to be able to carry out these activities and advance their innovation process (Rothaermel & Deeds, 2004). Obtaining a downstream partnership with an established firm is therefore a major milestone for life science startups.

A large number of pharmaceutical companies are also active corporate venture capital investors. The purpose of these investments for these firms is to obtain a window on emerging technologies, so they can make better informed decisions about how to engage with them as they develop over time. Making a commitment to a particular technology by investing directly in its development (typically via an alliance) can be extremely costly, hence the step of making early equity investments can be a valuable source of enhanced information which can enable more effective decision making with respect to downstream alliances.

Organizationally, the locus of decision making within pharmaceutical firms on venture capital investments and on alliances are separate. Corporate venture capital activities are typically carried out by a division of the company that exists specifically for this purpose, which is run by managers who may be externally recruited for these roles, or who have moved into these roles internally from other parts of the organization. These individuals are then the primary decision makers regarding which startups receive venture capital investment from the firm (Dushnitsky, 2012). On the other hand, the decision rights on which technologies to commit to by forming an external partnership typically reside within the R&D divisions of these firms. Hence, for a startup that receives CVC investment from a firm to be able to translate that into a downstream alliance, the principal challenge is to obtain the buy-in of the firm's R&D managers. This is an important distinction in this context, as illustrated in figure 1. The point to note here is that classical conception of the two firms as monoliths abstracts away from this entirely. However, to understand how one can lead to the other, it is critical that we take these organizational differences in the locus of decision rights into account.

INSERT FIGURE 1 HERE

The ability of a startup to do translate a CVC investment into a downstream alliance can depend on a range of factors, but among the most important is likely to be an understanding of both the value perceptions of the managers within established firms, as well as of the processes of influence and decision making within these firms. Key to this is overcoming the 'Not Invented Here' syndrome that can cause R&D managers to take a negative view the idea of investing in a technology that was developed externally (Kapoor & Klueter, 2015).

Entrepreneurs in the life sciences can come from a wide range of backgrounds – academics, former VCs, medical doctors, and former employees of pharmaceutical firms to name a few. I argue that the last of these is likely to have an important advantage with respect to navigating these organizational challenges and achieving the buy-in of the internal R&D managers. Given their experience, these individuals are likely to have a better grasp of the social and political processes that characterize large pharmaceutical companies than entrepreneurs from other types of backgrounds. They are also more likely to have an accurate understanding of whose opinions are most likely to be critical in determining the decision of alliance formation, and the incentives that those individuals are responding to. Entrepreneurs from other backgrounds, for instance academics, are unlikely to have the same nuanced understanding of the decision processes that operate within these firms. As a consequence, all else being equal, entrepreneurs with experience working at established firms are likely to be navigate these relationships more effectively in terms of achieving the buy-in needed to form a downstream alliance with the established firm.

Hypothesis 1: Startups whose entrepreneurs have more pharmaceutical experience are more likely to translate a CVC investment into a downstream alliance with the corporate investor

However, the extent to which entrepreneurs are able to employ this type of knowledge also depends on the access they get to the R&D organization of the established firm, and how these investments are portrayed internally. The investment managers, i.e. the employees of the established firm who are in charge of making and managing these investments are likely to play a key role in this respect. As previously mentioned, these individuals play the role of interface between the established firm and the startup. In this respect, they are the startup's

primary point of access to the established firm, as well as their main cheerleaders within the larger firm (Dushnitsky & Shapira, 2010; Lerner, 2013).

However, the investment managers are likely to differ in their ability to make these connections for the entrepreneurs they invest in. While the entrepreneurs' own experiences may be helpful with pitching their startup as a potential alliance partner, they are likely to need the right type of access to managers within the internal R&D organization to be able to effectively deploy that experience. I argue that the backgrounds of the investment managers is likely to be a major driver of how effectively they are able to make these connections for the entrepreneurs. Investment managers can move into these roles from different parts of the established firm, or they may be recruited externally (from venture capital for instance) (Dushnitsky & Shapira, 2010). Individuals who transition into these roles with a background in R&D, i.e. those who have themselves worked in the R&D divisions of pharmaceutical companies prior to taking up these roles are likely to be advantageously positioned in this respect. These individuals are likely to have a better understanding of who the key decision makers are with respect to the formation of a downstream partnership. Furthermore, they are also more likely to have to social capital to effectively make connections with these people for the entrepreneurs they invest in. Consequently, I argue that the previously hypothesized positive effect should be positively moderated by the presence of investment managers with R&D experience.

Hypothesis 1a: The positive relationship between the entrepreneurs' pharmaceutical experience and the likelihood of alliance formation will be positively moderated by the extent of R&D experience of the established firm's investment managers.

The preceding hypotheses are based on the argument that experience in a similar institutional environment can help entrepreneurs draw out some of the potential benefits associated with their corporate VC relationships with established firms. However, the same mechanisms that are the source of these benefits, i.e. the entrepreneurs' superior institutional knowledge based on their experience, can also accentuate the constraining influence that these relationships can have on the technological trajectories of the startup. Broadly, we know that as startups engage with established firms, they are likely to start to conform to the value perceptions prevalent among the managers of those firms (DiMaggio & Powell, 1983). Given the asymmetry in power in these relationships – established firms are larger, more powerful firms, and they have some degree of ownership over the startup – coercive and normative pressure are likely to be a driver of technological isomorphism, i.e. the startup is likely align its technological trajectory to be more in line with that of the established firm (Guler, Guillén, & Macpherson, 2002; Haunschild, 1993). Recent research shows some evidence of the existence of this type of decline in technological distance in these relationships (Polidoro & Yang, 2017).

I argue that entrepreneurs whose prior careers were spent in pharmaceutical firms are likely to be particularly susceptible to these effects, leading their startups to conform more closely with their corporate investors than startups whose entrepreneurs come from other backgrounds. There are two reasons for this. First, given their backgrounds, these individuals are likely to be able to generate richer flows of information between the two firms. Consequently, the startup is likely to receive stronger cues on the perspectives that prevail within the established firm on what technological directions are worth pursuing. Second, given these individuals are also more likely to have been imprinted with the types of

norms that prevail within these firms, their propensity to internalize and act on the information they receive from their corporate investors is also likely to be higher (Marquis & Tilcsik, 2013). In other words, they are likely to be more amenable to seeing the logic driving the thinking of the employees of the established firm, given their own prior institutionalization in similar environments. Note that the argument here relates to the change in the technological distance between the firms after investment, compared to what it was before the investment occurred. Hence, I am not arguing merely that startups founded by former employees of established firms are on average likely to be more technologically similar to established firms. The argument is that the degree of technological conformity between the firms post investment vs pre investment will be more pronounced when the entrepreneurs have pharmaceutical experience.

Hypothesis 2: The extent of the entrepreneurs' prior pharmaceutical experience will be negatively related to the change in technological distance between the startup and the established firm post investment compared to the distance pre investment.

The extent of this conformity is also likely to be related to who in the established firm these entrepreneurs get access to. As I described previously, the investment managers are likely to play a key role in shaping this. Given their position as the principal point of contact with the established firm for the entrepreneur, their own standing and connections within the larger firm are likely to be critical in shaping who in this firm the entrepreneurs end up speaking to the most.

We are focusing here on an outcome that has fundamentally to do with technology, and the technological choices the startup makes after their relationship with the established firm is formed. The extent to which these effects occur is likely to relate to the extent of the input

the entrepreneurs receive on technology from people within the established firm. This in turn will depend on the extent of their access to the people in the established firm who are most focused on technology. In the context of pharmaceuticals (and in most high technology environments), this would be the people who work in R&D. Drawing on the logic described previously on the backgrounds of the investment managers, it is likely that the entrepreneurs access to the people in the R&D division will be enhanced if the investment managers themselves moved into these roles from prior careers in R&D. Consequently, I argue that the baseline effect of entrepreneurs' pharma experience is likely to be moderated by the extent of the investment managers' R&D experience. Hence,

Hypothesis 2a: The negative relationship between the entrepreneurs' pharmaceutical experience and the change in technological distance between the established firm and the startup post investment will be negatively moderated (i.e. amplified) by the extent of R&D experience of the established firm's investment managers.

Research has shown that entrepreneurs, like most other professionals, learn from practice, i.e. they learn to manage the process of starting and growing ventures more effectively as they do it multiple times (Gompers, Kovner, Lerner, & Scharfstein, 2006). With repeated attempts, entrepreneurs update their beliefs and adapt their approaches to managing their ventures in ways that they perceive to be more fitting with their objectives and their environments (Westhead & Wright, 1998). In the present context as well, it is likely that the entrepreneurs' prior founding experience will play a role.

While I expect entrepreneurs' pharma experience to facilitate greater information flows between the startup and the established firm, the extent to which these individuals internalize the cues they receive from their corporate investors may also be tempered by

their entrepreneurial experience. Key to this is the level of uncertainty these individuals are experiencing with regards to their decision making about the technological trajectory of their firms. In the absence of any prior founding experience, the uncertainty these individuals experience is likely to be at its highest, which in turn will make them most likely to conform to the isomorphic pressures they feel from the established firm, which as previously mentioned is likely to be seen as an authoritative source of guidance given its size and status in the industry (Podolny, 1994). However, as entrepreneurs become more experienced, they have a greater store of knowledge to call on with regards to managing the process of venture growth, and consequently the level of uncertainty they experience is likely to decline. As a consequence, their propensity to conform to these pressures coming from the established firm is also likely to decline. Consequently, I expect that the extent of the entrepreneurs' prior founding experience will dampen the aforementioned relationship between their pharma experience and the technological distance between the two firms.

Hypothesis 2b: The negative relationship between the entrepreneurs' pharmaceutical experience and the change in technological distance between the established firm and the startup post investment will be positively moderated (i.e. dampened) by the extent of the entrepreneurs' prior founding experience.

METHODS

Empirical research examining corporate venture capital based relationships between established firms and startups has almost exclusively adopted a binary characterization of the phenomenon, i.e. 'corporate VC' vs 'no corporate VC'. From the startup perspective this entails comparing on average the outcomes of startups that receive CVC investment vs ones that don't (e.g. Alvarez-Garrido & Dushnitsky, 2016), and from the established firm

perspective, it entails a comparison of those that make these investments vs ones that don't (e.g. Wadhwa & Kotha, 2006). This approach has been the source of great insight into average differences between different categories - for instance corporate vs independent VC for startups, or making VC investments vs not doing so for established firms. However, this binary characterization is essentially aggregating across a range of different types of corporate VC relationships between different types of firms and startups in which these relationships are managed in different ways by different kinds of people. The findings from recent research on the phenomenon further attest to the notion that there is a great deal of heterogeneity underlying this binary characterization (Kim & Park, 2017; Pahnke et al., 2015). The fundamental point here is that not all CVC relationships are the same, either from the established firm's perspective or the startup's. There are significant differences in terms of motivation, incentive structures, organization and in particular, the way these relationships are managed across different firms. Consequently, we may be able to learn more by examining these relationships at a dyadic level rather than as an aggregation across multiple relationships.

Relatedly, we have little research looking at outcomes at the level of the dyad, i.e. what exchanges occur between the two firms following investment. Most research in this domain has examined firm level outcomes such as profitability, patenting or exit and examined how these correspond to the aggregated binary characterization of 'CVC vs no CVC'. However, given that the value addition in these relationships ostensibly comes from exchanges of knowledge, capital or other resources, our understanding could be enhanced by specifically examining whether, when and to what degree these types of exchanges arise following a

CVC investment. The unit of analysis in this study will therefore be the ‘established firm – startup’ dyad.

My empirical context is the life sciences. I started by identifying every investment made by an established Pharmaceutical firm in a US based life sciences startup between 2002 and 2012 using *Venture Xpert* as my data source. Of these, I only retained first time investments - follow on investments, i.e. investments by an established firm in a startup in which it has previously invested are dropped (Dushnitsky & Lenox, 2005). Hence, each ‘established firm – startup’ dyad only appears once in the data, and I started with 330 dyads involving 249 startups and 30 established firms. Some startups receive investment from multiple established firms, I treated these as separate dyads but accounted for this in my analyses. I collected data on the downstream alliances of these firms from the *Informa Medtrack* database, and information on their patents from the USPTO’s *Patentsview* database.

I then collected individual level data on both the startup and the established firm. For the startup, I aimed to identify the members of its senior management in the period after it received investment. To do so I identified the individuals who occupied the following positions or their equivalents – President, Chief Executive Officer, Founder, Chief Operating Officer, Chief Business Officer, Chief Scientific Officer, Chief Medical Officer and Chief Technical Officer. The logic behind this choice is that I am seeking to identify the individuals most directly involved in interactions with the established firm, and in the key strategic and technological decisions of the startup. Lower level employees are less likely to have the requisite level of influence. Similarly, non-executive board members are unlikely to be involved in the day-to-day work of the firm; hence, I only include executive employees. I start with the full list of executives associated with each of the startups in my sample. I then

drop those individuals who do not satisfy the criteria described above to arrive at a list of 554 names.

For each of these names, I then seek to collect data on their career history. I do so via a manual search process. My primary source of data for this is *LinkedIn*, supplemented by other web sources such as *Bloomberg* and *Crunchbase*. I also drop the individuals in those cases where they have left the startup's employment prior to it receiving investment from the established firm. For each of these individuals I collect information on the companies at which they previously worked (if any), and their educational qualifications. There are about 75 firms for which *Venture Xpert* did not provide any information on the executives of the required level of seniority. For these, I carry out a manual search process to first identify the names of the executives in the positions of interest, and then collect information on their backgrounds as done previously. This resulted in an additional 189 names to add to the previous 554. To identify the names of these individuals, the primary source of data was the internet archive (*archive.org*), supplemented by data from the SEC's *Edgar* database. By this process, I was able to collect personnel data for all by 249 of the startups in my sample.

Similarly, I hand collected information on the investment managers of each established firm from a range of sources. I identified the names of the individuals in charge of investments for each company using the *Greyhouse venture capital directories*, the *Galante venture capital and private equity directories*, archived versions of company webpages on the internet archive (*archive.org*), the SEC's *Edgar* database and historic company press releases. Subsequently, I collected information on the career histories of each of these individuals through manual searches on *LinkedIn*, supplemented by information from *Bloomberg* and the internet archive (*archive.org*).

Dependent Variables

Downstream Alliance: This is a binary variable indicating whether or not the startup and the established firm (i.e. its corporate investor) form a downstream alliance aimed at development or commercialization in the period following the investment.

Technological Distance Difference: This is the difference of the technological distance between the established firm and the startup in the five years after investment and the technological distance between the firms in the five years leading up to investment. In other words, it is the difference between the post-investment technological distance and the pre-investment technological distance. I measure technological distance as the Euclidean distance between the vectors indicating the proportion of each of the two firms' patents in each technological class, for the patents filed in the relevant periods (Vasudeva, Zaheer, & Hernandez, 2013). Hence a negative value of this variable indicates that the two firms move closer together technologically after investment, and a positive value means they move apart.

Independent Variables and Controls

The primary independent variable is a measure of whether the entrepreneurs associated with a startup have previously worked in an established firm. To measure this, for each individual associated with the startups in the sample, I identify whether they have any prior full-time work experience at an established firm in the same industry, which I define it as any publicly traded company in the pharmaceutical industry that has over one thousand employees. I then define the variable *Entrepreneur Pharma* as the proportion of the entrepreneurs associated with that startup who have previously worked for established pharmaceutical firms.

I also develop measures to characterize other common types of entrepreneurial backgrounds in this industry. *Entrepreneur Academic* is the proportion of the entrepreneurs who joined the startup from academia. *Entrepreneur Medical* is the proportion of the entrepreneurs who are medical doctors (i.e. they have an MD). *Entrepreneur Non-healthcare* is the proportion of these individuals who were previously employed by firms that operate outside the healthcare industry, and *Entrepreneur Venture Capital* is the proportion of these individuals who were previously employed by venture capital firms. I also create a measure of the prior entrepreneurial experience of these individuals. For each startup, I define the variable *Entrepreneur Founding Experience* as the proportion of the entrepreneurs associated with that startup who have been founders of companies in the past.

The key independent variable with respect to the investment managers is the extent to which they have experience in Research and Development. In a similar manner as with the entrepreneurs, I first identify for each of the investment managers whether they worked in R&D prior to taking up their roles as investment managers, and define the variable *Investment Manager R&D* as the proportion of the firm's investment managers who have experience working in R&D. Similarly, I define *Investment Manager Business Development* as the proportion of these individuals who worked in the business development functions of the established firms, and *Investment Manager Venture Capital* as the proportion who worked in independent or conventional venture capital prior to taking up these roles.

I also include a range of other variables that could be related to both the IVs and the outcomes of interest. I include the average tenure of the investment managers in the established firm prior to taking up their roles related to venture capital. This could be related to the degree and strength of their networks within the firm which would enable them to

make connections for the entrepreneurs. I also include the number of investment managers that the established firm has, which may be related to how involved and influential each manager is, and the likelihood of there being managers of different types of backgrounds. I include the age of the startup as of the time of investment. Older startups may have more refined technologies which may be more appealing candidates for an alliance, and the fundraising behavior of the entrepreneurs may also be related to their backgrounds which could result in a startup receiving corporate investment at systematically later or earlier periods of their existence. I also include the total number of patents filed by the startup as of the year of investment. This is a characterization of their level of technological development which could be related to both the entrepreneurs' backgrounds and also the likelihood of a subsequent alliance.

Estimation

Each row in the data represents an 'established firm – startup' dyad. The principal threat of bias in our estimates arise from unobserved heterogeneity, i.e. unobservable factors that relate to both the entrepreneurs' characteristics and the outcomes of interest, i.e. alliance formation and change in technological distance. I include established firm fixed effects in all my models to restrict comparisons to within the portfolio of investments made by each established firm. This step greatly reduces the threat of unobserved heterogeneity since different firms may be making investments with different (unobservable) objectives, which could be correlated to the outcomes of interest. However, the scope for variance in objectives within the investments made by a single firm are substantially lower (though not absent, as I will discuss later). I also include year fixed effects in all the models to account

for any aggregate time-varying factors that influence the variables of interest. I use OLS estimation in all models unless otherwise noted.

RESULTS

Table 1 shows the summary statistics for the variables of interest as well as their correlations. A downstream alliance is formed in about 6% of the dyads in the sample; this is the proportion of corporate VC investments where the investor subsequently forms a downstream alliance with the startup. Note also that the mean technological distance difference is small and positive, i.e. on average startups tend to move technologically apart slightly from their corporate investor after investment. Looking at the backgrounds of the entrepreneurs, the data shows that on average 46% of the entrepreneurs associated with a startup have prior experience working for an established firm. This is the most common type of background for entrepreneurs in this domain, and this is in line with prior findings in other high technology fields as well (Gompers et al., 2005). Somewhat unique to the life sciences is however the fact that 19% of the entrepreneurs on average have medical degrees. About 15% of the entrepreneurs also have prior founding experience. With respect to the investment managers, we see that on average there are 5 managers per firm, which is not surprising given the corporate investors in this industry are typically large firms and make a lot of investments (e.g. Novartis, Pfizer, GSK). The composition of these managers within a firm is on average split evenly between people from R&D and business development backgrounds (about 30% each). A further 6% of them are brought in from independent (i.e. non-corporate) venture capital firms.

INSERT TABLE 1 HERE

Table 2 shows the regression analyses using *downstream alliance* as the dependent variable. Model 1 shows the results when the outcome variable regressed against all the variables except those based on the entrepreneurs' backgrounds, with firm and year fixed effects. I do not find significant relationships between any of the characteristics of the investment managers and the likelihood of partnership formation. This is likely in large part owing to the nature of the data and the empirical design. The use of established firm fixed effects means that any effects based on variables pertaining to the corporate investor have to be based on within portfolio variations, i.e. variations across the different startup the established firm invests in. In the case of the investment manager characteristics, since we do not have a one to one mapping of individual investment manager to startup, the characteristics are those of the team of investment managers as a whole (the proportion of them with an R&D background etc.). Hence, within portfolio variations in this rely on the fact that different investments are made at different points in time, and that the composition of the investment managers within the firm also changes over time. However, within these large firms the turnover in investment managers is typically not very high. Hence, within the study period of ten years, the changes in these variables are relatively limited which in turn makes it harder to estimate the direct effect of these variables on the outcomes of interest in a fixed effects design. However, we can estimate interaction effects of these variables with others (such as the entrepreneurs' characteristics) that do vary substantially within the portfolio.

Model 2 of table 2 introduces the entrepreneurs' characteristics into the analysis. My expectation, outlined in hypothesis 1, was that on average startups with a greater proportion of their entrepreneurs with prior work experience in pharmaceutical firms would have a

greater propensity to form downstream alliances with their corporate investors. The results show that the coefficient associated with the *entrepreneur pharma* variable is positive and statistically significant. The economic significance of this coefficient is also substantial with the elasticity indicating that a 10% increase in the proportion of entrepreneurs with Pharma experience is associated with an approximately 7.5% increase in the likelihood that the startup will form a downstream alliance with the established firm. Hence, I find broad support for the first hypothesis.

Next, I want to examine how the characteristics of the investment manager may influence this main effect. My expectation was that having a greater proportion of these individuals from R&D backgrounds would enable the entrepreneurs to employ their pharma experience more effectively, and increase their chances of achieving the buy-in of the key decision makers on alliance formation within the established firm. To examine this, I introduce an interaction term between *investment manager R&D* and *entrepreneur pharma* into the model. This allows me to look at whether the previously observed positive relationship between the proportion of entrepreneurs with a pharma background and the likelihood of alliance formation is altered based on the number of established firm employees with an R&D background in charge of the investments. Model 3 of table 2 shows the results of this analysis. I find a positive and statistically significant interaction effect between these variables, indicating that a 1% increase in the proportion of investment managers from an R&D background in the established firm boosts the baseline effect size of *entrepreneur pharma background* on *downstream alliance* by about 2.6%.

INSERT TABLE 2 HERE

I now turn to the analyses relating to the change in technological distance between the established firm and the startup. Model 3 of table 3 shows the effect of the control variables on the *technological distance difference*. Once again, we find that none of the characteristics of the investment managers show a direct relationship with the outcome variables. The next step is to introduce the characteristics of the entrepreneurs. My expectation in this case was that on average startups with a greater proportion of their entrepreneurs with prior work experience in pharmaceutical firms would be likely to move closer to the established firm technologically, in other words that this should be related to a decline in the technological distance between the firms. Since the outcome variable is operationalized as a difference between the post and pre technological distances, a negative value of this variable indicates a decrease in technological distance. Model 4 of table 3 shows that the coefficient associated with *entrepreneur pharma background* is in this case negative and statistically significant. The substantive interpretation of the coefficient is that a 10% increase in the proportion of entrepreneurs who are former pharma employees is associated with an approximately 8% decline in the technological distance between the startup and the established firm following investment. This finding offers support to hypothesis 2.

As in the previous case, we next examine the interaction effect of *entrepreneur pharma background* and *investment manager R&D*. Here, my expectation was that a higher proportion of investment managers from an R&D background would accentuate the baseline negative effect. In model 5 of table 3, I introduce this interaction term and find a negative and significant coefficient associated with it. The implication of this coefficient is that a 1% increase in the proportion of investment managers from an R&D background in the established firm elevates the baseline negative effect by nearly 4%. Next, I examine the final

hypothesis, which suggested that having a higher proportion of entrepreneurs with prior founding experience would be associated with a dampening of the baseline negative relationship. To test this I introduce the interaction term of *entrepreneur founding experience* and *entrepreneur pharma*. Model 6 of table 3 shows that the coefficient associated with this term is positive and significant, and the magnitude implies that a 1% increase in the proportion of entrepreneurs with prior founding experience dampens the negative effect of entrepreneur pharma on the technological distance difference by about 2.6%. Model 8 is the fully specified model that includes both the interaction terms discussed. I will discuss the implications of these findings in the next section.

INSERT TABLE 3 HERE

DISCUSSION

The findings of this study contribute to the growing body of evidence attesting to the significance of entrepreneurs' prior careers for the strategies and outcomes of their ventures. In particular, these findings represent a contribution to the research on entrepreneurs who were previously employees of incumbent firms. While research in this domain has demonstrated that startups founded by these types of individuals possess some important advantages (e.g. Chatterji, 2009), these findings have been accompanied by calls for more work examining the mechanisms underlying these advantages. Cooperative relationships with more established firms are a widespread complement to the startup growth process in most industries, and managing these relationships is therefore a critical skill for entrepreneurs (Diestre & Rajagopalan, 2012). My findings suggest that this is an area where entrepreneurs with prior experience working at established firms may be at a significant

advantage compared to other types of entrepreneurs, based on their superior understanding of the structures, processes and mindsets that operate within these firms.

However, my findings also suggest that entrepreneurs from these types of backgrounds may be constrained in other ways. In recent decades, entrepreneurial firms have had a significant impact on technological progress and a number of major industries have been upended by young firms. A great part of that success is rooted in their ability to pursue ideas and technologies that more established firms cannot as a consequence of not being encumbered by an adherence to the prevailing ways of doing things. However, if entrepreneurs have spent their formative years in established firms, it is plausible that they may have imbibed and internalized some of these impediments, which could then manifest themselves in the way they make decisions on behalf of their ventures. My findings on the increased technological conformity of startups that were founded by these types of employees is broadly consistent with this possibility. This is not an idea that existing research in this domain has grappled with, and the findings of this study would suggest that it is worth of further exploration.

An important counterpoint to this is the fact that the employees who leave their jobs in established firms to start companies are self-selected, i.e. these individuals are the ones that choose to leave, and they may have done so precisely because they are frustrated by the ways of thinking that prevail within the larger firms. However, research suggests that the ideas that individuals arrive at over the course of their work are the primary driver of entrepreneurship by former employee of established firms, rather than frustration at the internal processes of the established firm (Bhide, 1994; Gompers et al., 2005). Furthermore, the success of these ventures is often also based on tacit knowledge and connections gained

from the entrepreneurs' prior work experience (Chatterji, 2009). My arguments in this study are fundamentally based on the notion that the tacit knowledge that is the purported basis for these advantages is likely to be part of a larger package of cognitive frameworks that may also include some ways of thinking that are limiting. More research is needed to understand the ways in which these limitations can manifest themselves.

The findings in this study also attest to the idea that a relationship between a pair of firms could lead to substantially different kinds of exchanges and outcomes depending on the people managing them. Classic approaches to examining interfirm relationships adopt monolithic views of firms to examine how their aggregate characteristics such as their resources and capabilities affect the formation and performance of interfirm ties. However, in reality different parts of a firm may be central to different types of relationships. For instance, in the context of this study, identifying that the locus of decision rights over corporate venture capital investments and downstream alliances within established firms are different is fundamental to arriving at the insight that entrepreneurs' prior work experience can help them bridge that gap within the established firm. Scholars have stressed the need for more research on multiplexity in interfirm relations (Shipilov, Gulati, Kilduff, Li, & Tsai, 2014). The findings of this study demonstrate that greater cognizance to the internal factors around the management of these different relationships is also key to understanding the existence and implications of these types of structures.

The study also contributes to research on corporate venture capital. Research in this domain has found substantial heterogeneity in whether these relationships are beneficial to startups (e.g. Alvarez-Garrido & Dushnitsky, 2016; Kim & Park, 2017). The major impediment to these benefits arises from the organizational complexity of the established firms that the

startups need to navigate to be able to unlock value (Pahnke et al., 2015). This is the first study to take the next step of examining what factors may influence the ability of a startup to do so. Furthermore, to examine these issues at a fine-grained level it is critical to move beyond the approach of looking at the average effect of having CVC investment across a population of firms and adopt the ‘established firm – startup’ dyad as the unit of analysis. Future work will need to examine the range of other factors that may be relevant to the way startups are able to navigate these relationships.

This study has some important limitations. I focus on two very specific outcomes – downstream alliances and technological distance. These are very relevant in the context of the types of relationships that are the focus of this study, but they do raise the question of how the mechanisms and findings may generalize to broader characterizations of performance. The role of the entrepreneurs’ backgrounds may be also be less relevant or different in other settings. Empirically, while the design is aimed to limit the scope of these issues, unobserved heterogeneity between startups with different types of entrepreneurs remains a potential source of bias. The mechanism tests serve to rule out some important alternative explanations, but more research will be needed to establish whether the relationships observed here are causal.

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FIGURES AND TABLE

Figure 1: Locus of Decision Rights over CVC vs Downstream Alliances

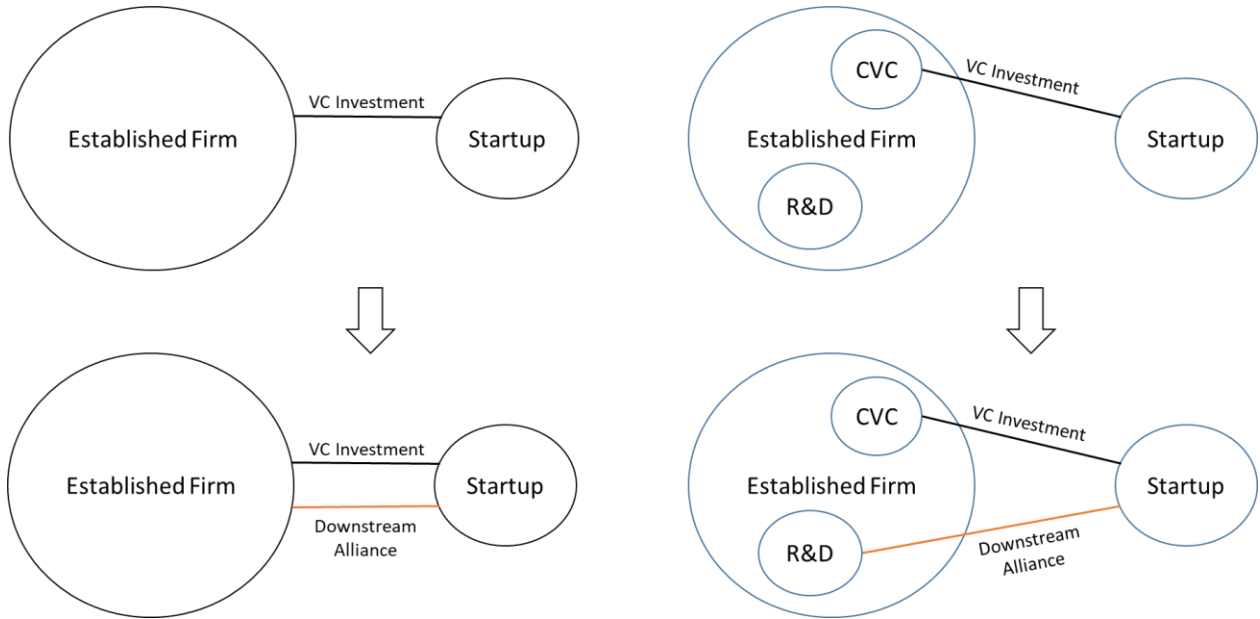


Table 1: Summary Statistics and Correlations

Sl	Variable	Mean	SD	min	max	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1	Downstream Alliance	0.06	0.23	0	1	1															
2	Technological Distance Difference	0.04	0.31	-0.81	1	-0.04	1														
3	Entrepreneur Pharma	0.47	0.43	0	1	0.13	-0.09	1													
4	Entrepreneur Academic	0.17	0.32	0	1	0.03	0.10	-0.29	1												
5	Entrepreneur Doctor	0.20	0.35	0	1	0.02	-0.09	-0.04	0.19	1											
6	Entrepreneur Venture Capital	0.07	0.22	0	1	0.00	0.05	-0.08	-0.13	0.10	1										
7	Entrepreneur Non-Healthcare	0.11	0.27	0	1	-0.05	-0.02	-0.33	-0.10	-0.13	-0.09	1									
8	Entrepreneur Founding Experience	0.15	0.31	0	1	-0.04	-0.07	-0.24	-0.09	-0.06	0.06	-0.01	1								
9	Investment Manager R&D	0.31	0.29	0	1	0.08	-0.04	0.05	-0.02	0.08	-0.03	-0.14	-0.02	1							
10	Investment Manager Business Development	0.30	0.30	0	1	-0.05	-0.07	0.02	-0.02	-0.02	0.02	0.07	0.02	-0.20	1						
11	Investment Manager Venture Capital	0.06	0.11	0	0.50	0.05	0.00	-0.01	0.00	0.02	0.00	0.03	-0.01	0.07	-0.15	1					
12	Investment Manager Avg Pre-CVC Tenure	3.19	3.13	0	11.75	-0.03	0.04	-0.03	0.05	-0.01	-0.09	0.01	-0.06	0.40	-0.08	0.06	1				
13	Number of Investors	4.92	2.65	1	10	0.05	-0.02	-0.06	0.00	0.02	0.12	-0.11	0.03	0.27	-0.22	0.31	0.39	1			
14	Company Age	4.79	3.81	1	21	0.12	-0.01	-0.09	0.09	0.08	-0.15	0.07	0.00	-0.01	-0.01	-0.03	-0.05	-0.04	1		
15	Total Patents	4.45	17.43	0	277	0.09	0.00	0.01	0.07	0.04	-0.05	0.05	-0.05	0.01	-0.05	-0.03	-0.04	-0.03	0.34	1.00	

Table 2: Translation of CVC into Downstream Alliance

DV: Downstream Alliance	Model 1	Model 2	Model 3
Entrepreneur Pharma		0.094*	0.018
		(0.036)	(0.044)
Entrepreneur Academic		0.037	0.036
		(0.058)	(0.057)
Entrepreneur Doctor		0.009	0.008
		(0.045)	(0.044)
Entrepreneur Venture Capital		0.052	0.061
		(0.062)	(0.057)
Entrepreneur Non-Healthcare		0.004	-0.002
		(0.045)	(0.045)
Entrepreneur Founding Experience		-0.002	0.001
		(0.024)	(0.023)
Entrepreneur Pharma X Investment Manager R&D			0.240*
			(0.087)
Investment Manager R&D	0.174	0.162	0.065
	(0.115)	(0.102)	(0.103)
Investment Manager Business Development	0.075	0.062	0.050
	(0.096)	(0.099)	(0.090)
Investment Manager Venture Capital	0.181	0.188	0.199
	(0.250)	(0.234)	(0.211)
Investment Manager Avg Pre-CVC Tenure	-0.007	-0.008	-0.009
	(0.006)	(0.006)	(0.006)
Number of Investors	0.008	0.004	0.003
	(0.011)	(0.011)	(0.011)
Company Age	0.005	0.006	0.007
	(0.004)	(0.004)	(0.004)
Total Patents	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)
Established Firm Fixed Effects	Y	Y	Y
Year Fixed Effects	Y	Y	Y
Number of Observations	330	330	330

*** p<0.001 ** p<0.01 * p<0.05 + p<0.1; Standard errors reported in parentheses are heteroscedasticity robust and clustered by investing firm. The Dependent Variable is binary and equals one if there is a development or commercialization focused alliance between the established firm and the startup in the period following CVC investment

Table 3: Change in Technological Distance

DV: Technological Distance Difference	Model 4	Model 5	Model 6	Model 7	Model 8
Entrepreneur Pharma		-0.071*	0.015	-0.101**	-0.016
		(0.028)	(0.051)	(0.032)	(0.052)
Entrepreneur Academic		0.088	0.090	0.082	0.084
		(0.072)	(0.075)	(0.074)	(0.077)
Entrepreneur Doctor		-0.121**	-0.119**	-0.119*	-0.118**
		(0.043)	(0.042)	(0.044)	(0.042)
Entrepreneur Venture Capital		0.064	0.055	0.066	0.056
		(0.130)	(0.125)	(0.130)	(0.126)
Entrepreneur Non-Healthcare		-0.133+	-0.126	-0.141+	-0.134+
		(0.074)	(0.075)	(0.073)	(0.074)
Entrepreneur Founding Experience		-0.091*	-0.095*	-0.149**	-0.150**
		(0.035)	(0.036)	(0.046)	(0.048)
Entrepreneur Pharma x Investment Manager R&D			-0.272*		-0.263*
			(0.125)		(0.122)
Entrepreneur Pharma x Entrepreneur Founding Experience				0.192*	0.180*
				(0.090)	(0.088)
Investment Manager R&D	-0.054	-0.052	0.057	-0.060	0.046
	(0.109)	(0.099)	(0.119)	(0.102)	(0.122)
Investment Manager Business Development	-0.072	-0.051	-0.037	-0.054	-0.041
	(0.158)	(0.155)	(0.147)	(0.157)	(0.149)
Investment Manager Venture Capital	-0.014	-0.018	-0.031	-0.021	-0.033
	(0.275)	(0.274)	(0.266)	(0.283)	(0.276)
Investment Manager Avg Pre-CVC Tenure	0.002	0.002	0.004	0.003	0.004
	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)
Number of Investors	-0.036**	-0.039***	-0.038***	-0.038**	-0.037**
	(0.012)	(0.010)	(0.010)	(0.011)	(0.010)
Company Age	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Total Patents	0.001	0.001+	0.001+	0.001+	0.001+
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Established Firm Fixed Effects	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y
Number of Observations	330	330	330	330	330

*** p<0.001 ** p<0.01 * p<0.05 + p<0.1; Standard errors reported in parentheses are heteroscedasticity robust and clustered by investing firm. The Dependent Variable is the difference in the technological distance between the established firm and the startup post and pre investment, i.e. technological distance post investment minus the technological distance pre investment.