# THE EFFECTS OF PRIOR CO-INVESTMENTS ON THE PERFORMANCE OF VC SYNDICATES: A RELATIONAL AGENCY PERSPECTIVE

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# THE EFFECTS OF PRIOR CO-INVESTMENTS ON THE PERFORMANCE OF VC SYNDICATES: A RELATIONAL AGENCY PERSPECTIVE


## ABSTRACT

This study provides a reconciliation of previous findings regarding the effects of prior co-investments among venture capitalists (VCs) and the performance of VC syndicates. We propose a relational agency framework outlining cost-benefit trade-offs associated with prior co-investments between VCs. A longitudinal study of 4,550 U.S. ventures receiving syndicated investments from 1980 to 2017 shows that there exists an inverted U-shaped relationship between the number of prior co-investments and a venture's likelihood of a successful exit through initial public offering or merger and acquisition. We further find that the relationship between prior co-investments and syndicate performance is moderated by venture-specific and partner-specific risks.



## MANAGERIAL SUMMARY

We study the effects of prior co-investments among venture capital (VC) firms on the performance of VC syndicates. We propose a framework outlining cost-benefit trade-offs associated with prior co-investments between VCs. A study of 4,550 U.S. ventures receiving syndicated investments shows that there exists an inverted U-shaped relationship between the number of prior co-investments and a venture's likelihood of a successful exit through initial public offering or merger and acquisition. Our findings hold implications for managers considering whom to partner with for future co-investments and the conditions under which prior co-investments are more or less likely to be beneficial.



**Keywords:** *Entrepreneurial finance; venture capital; syndication; prior co-investments; performance.*

**Running head:** The Effects of Prior Co-Investments on the Performance of VC Syndicates

# 1 INTRODUCTION

Venture capital (VC) firms frequently partner together by investing in the same entrepreneurial ventures. Syndication of VC investments, where two or more investors co-invest in a venture and share any resulting proceeds, offers distinct advantages over solo investments, including greater access to resources, sharing of risks and better informed decisions regarding which projects to invest in (Brander, Amit, & Antweiler, 2002; Lerner, 1994; Lockett & Wright, 2001). Given the risks associated with VC investments in general, and the selection of partners for syndicated investments specifically, investors often rely on their pre-existing networks and syndicate with the same partners over time (Bygrave, 1988; Li & Rowley, 2002; Wright & Lockett, 2003; Sorenson & Stuart, 2001; 2008). While the effects of prior co-investments on the performance of VC syndicates have received some attention, conclusions have been mixed, with some authors arguing for positive effects of prior co-investments (Hochberg, Ljungqvist & Lu, 2010), some arguing for diminishing returns (De Clercq & Dimov, 2008), while others finding negative effects arising from repeated co-investments between VCs (Guler, 2007). There thus exists theoretical and empirical ambiguity regarding the impact of prior co-investments on syndicate performance. This raises the following questions: *How do prior co-investments affect the performance of VC syndicates?* And: *Which contingency factors affect this relationship?*

Past research has explored various theoretical mechanisms linking prior collaborations with a focal partnership's performance. Studies in the entrepreneurial finance, networks, and strategic alliance literatures have argued that prior collaborations between partners improve current partnership performance by fostering relationship continuity, mutual learning, facilitating trust, and triggering the development of collaborative capabilities, norms and routines (Coleman, 1988; Gulati, 1995a; Lioukas & Reuer, 2015). Other studies, however, have suggested that there are

limits to the benefits conferred by prior collaborations, which can lead to increasing resource redundancy, overconfidence, and inertia (Li & Rowley, 2002; Uzzi, 1997). These negative aspects of repeated collaborations have been found to diminish and even negatively affect various performance-related outcomes of repeated partnerships, such as knowledge creation (McFadyen & Cannella, 2004; Molina-Morales, Martínez-Fernández, & Torlo, 2011) and various financial outcomes (Goerzen, 2007; Holloway & Parmigiani, 2016).

This paper builds on Uzzi's (1997) arguments that recognize potential tensions associated with repeated collaborations. Our aim is to provide additional evidence on the benefits and costs of prior co-investments and to identify important partner and venture-specific risks that moderate the relationship between prior co-investments and performance in the context of VC syndicates. To this end, we propose a relational agency framework focusing on the cost-benefit trade-offs associated with prior co-investments in syndicated VC investments. The relational agency framework represents a theoretical extension of the classical principal-agency theory that is focused on information asymmetries and goal incongruence between the venture and its investors by recognizing potential agency conflicts among multiple investors themselves. Prior VC research has already identified a scope for potential "principal-principal" conflicts within VC syndicates (e.g., Bruton, Filatotchev, Chahine, & Wright, 2010; Chahine, Arthurs, Filatotchev, & Hoskisson, 2012). The relational agency framework integrates both venture- and partner-specific agency problems and associated risks, and explores how these conflicts emerge and evolve as an outcome of continuous relationships among VCs based on repeated co-investments.

More specifically, our theoretical framework suggests that prior co-investments can reduce some of the *partner-specific* risks associated with syndicated VC investments, including free-riding, relational conflict, and self-serving behavior (Coleman, 1988; De Clercq & Dimov, 2008;

Heidl, Steensma, & Phelps, 2014; Uzzi, 1997; Zhelyazkov & Gulati, 2016). At a very high number of prior co-investments, however, *venture-specific risks* increase by way of shifting VCs' focus from monitoring each other towards overreliance on trust, resulting in inertia with respect to the venture selection process as well as rendering co-investors' resources increasingly redundant (Goerzen, 2007; Li & Rowley, 2002). This suggests that the benefits of reducing *partner-specific risks* may outweigh the costs associated with an increase in *venture-specific risks*, but only up to a certain number of prior co-investments. Once this point is surpassed, the costs of prior co-investments will override the benefits at which point prior co-investments start to have a negative impact on the performance of the syndicate. This suggests that the effect of prior co-investments on the syndicate's performance follows an inverted U-shaped pattern.

We test these arguments in the context of syndicated VC investments using a longitudinal sample of 28,863 observations from 4,550 ventures across four industries in the U.S. from 1980 to 2017. Following previous research in entrepreneurial finance, we equate the syndicate's performance with the likelihood of a venture's successful exit through an initial public offering (IPO) or merger and acquisition (M&A). We note that the phenomenon of syndicated VC investments is widespread within our data, as 63% of the VC backed ventures received capital investments from two or more investors, and VCs often formed syndicates with the same partners. Our analyses generate three main findings. First, we find support for our main hypothesis as the number of prior co-investments has an inverted U-shaped relationship with the venture's likelihood of a successful exit. Moreover, we find that the shape of this relationship is moderated by two contingency factors. Specifically, the age of the venture moderates the effect of prior co-investments on performance such that both the positive and the negative aspects of prior co-investments are amplified (attenuated) for younger (older) ventures. Similarly, we find that

geographical concentration of syndicate members partially moderates the effect of prior co-investments on performance such that both the positive and the negative aspects of prior co-investments are attenuated (amplified) for geographically concentrated (dispersed) syndicates.

This study aims to make two contributions. First, by combining agency theory with a relational governance perspective we offer a novel theoretical framework that clarifies the complex relationship between prior co-investments and the performance of VC syndicates. We advance previous work by identifying cost-benefit trade-offs associated with partner and venture-specific risks and how these risks are related with the extent of prior co-investments among syndicated VCs. Prior research grounded in the agency perspective has emphasized the governance costs associated with the venture-VC dichotomy (e.g., Chahine et al., 2012; Dushnitsky & Shapira, 2010; Kaplan & Strömberg, 2003; Wright & Lockett, 2003). As our analysis is centered on the dynamics surrounding prior co-investments, which lead to relational capital between VCs, rather than the relationship between a VC and the portfolio company, the mainstream principal-agency theory has certain limitations. Similarly, other important theoretical contributions have been made by scholars applying a networks perspective on syndicated investments (e.g., Bygrave, 1988; Li & Rowley, 2002; Sorenson & Stuart, 2001; 2008). This perspective, however, has predominantly focused on the positive externalities arising from syndication and tends to ignore the negative aspects of embeddedness (for notable exceptions, see Goerzen, 2007; Guler, 2007; Zhelyazkov & Gulati, 2016). The relational agency framework put forward in this study considers both the positive and the negative aspects of prior co-investments.

Second, we propose that the relationship between prior co-investments and syndicate performance is moderated by risks associated with the current investment, that are otherwise independent from the relational mechanisms embedded in prior co-investments. First, younger

(rather than older) ventures are characterized by higher information asymmetries and overall greater venture-specific uncertainty (Manigart et al., 2006). As such, they demand closer monitoring to avoid failure arising from agency conflicts, and they require more diverse resources to grow. These aspects render the effects of prior co-investments particularly salient as they increase both the benefits and the costs of prior co-investments at their lower and higher levels, respectively. Second, geographical dispersion (rather than geographical concentration) of syndicate members provides limited opportunities for investors to meet face-to-face, and also makes it costlier to coordinate and monitor the portfolio company. The features of geographically dispersed syndicates also render the effects of prior co-investments more prominent. These contingency factors moderate the cost-benefit trade-offs associated with prior co-investments, and they provide richer theoretical insights into the outcomes of VC syndicates.

## 2 THEORY AND HYPOTHESES

The benefits of syndicated VC investments have been well-documented and include a reduction of venture-specific risks through enhanced deal flow, improved selection, and broader access to resources to sustain ventures' growth and increase their prospects of success (Brander et al., 2002; Lerner, 1994; Lockett & Wright, 2001). These benefits notwithstanding, syndicated VC investments are also prone to risks which are typically not encountered in solo investments, including conflicts between co-investors, free-riding, and self-serving behavior (De Clercq & Dimov, 2008; Zhelyazkov & Gulati, 2016). Similar trade-offs have been identified in contexts other than syndicated VC investments, by scholars studying strategic alliances and networks (e.g., Burt, 1992; Coleman, 1988; Goerzen, 2007; Granovetter, 1985; Holloway & Parmigiani, 2016; Uzzi, 1997). Despite these well-documented costs and benefits of syndication (and inter-firm

collaborations more broadly), we still know relatively little about the factors driving heterogeneity in performance among VC syndicates (Jääskeläinen, 2012; Manigart & Wright, 2014). Addressing this gap, below we develop and test a theoretical framework that is grounded in a relational agency perspective, and predicts how prior co-investments affect the performance of VC syndicates. Additionally, we further unpack this relationship by identifying two contingency factors that moderate the prior co-investments-performance relationship.

### 2.1 Prior co-investments and the performance of VC syndicates

Prior co-investments affect partner- and venture-specific risks existing within a focal syndicate. Prior co-investments reduce *partner-specific* risks and improve a syndicate's overall chances of successful performance (Hochberg et al., 2010). Investors with a history of prior co-investments are familiar with each other and they will have developed emotional attachment and a deeper professional understanding towards each other.[2] Prior co-investments also reinforce interorganizational routines and norms, trigger best practices, guide interactions and create a shared understanding that facilitates the exchange of resources and information between VCs (McFadyen & Cannella, 2004). Trust and routines developed through prior co-investments also help to reduce conflicts and increase the speed of decision making. Uzzi (1997, p. 47), for example, found that familiar firms could work out problems "on the fly" by better identifying and executing coordinated solutions. VC investors with a history of prior co-investments know each other's strengths and weaknesses and they can rely on past experiences to guide their current interactions. Since there are significant uncertainties and coordination costs involved with syndication, working

[2] We define *partner-specific risks* as the risks of making an investment that does not result in a positive return, in part or fully driven by factors stemming from interorganizational dynamics between co-investors in a syndicate. Similarly, we define *venture- specific risks* as the risks of making an investment that does not result in a positive return, in part or fully driven by factors related to the investor's (or syndicate's) venture selection and/or venture governance processes. Partner and venture-specific risks can embody different aspects of a VC investment.

with familiar investors is an important mechanism to mitigate partner-specific risks (Goerzen, 2007; Gulati, 1995a, 1995b, 1999). In sum, VCs with a history of prior co-investments are less likely to suffer from opportunism and conflicts.

That being said, while some prior co-investments improve the syndicate's performance by reducing partner-specific risks, there exist diminishing benefits to additional co-investments (De Clercq & Dimov, 2008; McFadyen & Cannella, 2004). Beyond a certain number of prior co-investments, partnering VCs will sufficiently trust each other and grant each other access to the resources and knowledge they possess. After this, each co-investment only has a marginal impact on the additional trust VCs bestow upon each other. Once this point is reached, not only is the improvement in terms of added trust and understanding minimal (partner-specific risks reduction), investors will also start experiencing redundant resources and the potential for each VC to add value will decrease, which translates into growing venture-specific risks.

Indeed, while the added benefits of increasing the number of prior co-investments will level off as they pertain to the relational dynamics among partnering VCs, many prior co-investments can have unintended negative consequences associated with an increase in *venture-specific risks*. When investors repeatedly co-invest, their deal flow becomes smaller (i.e., they pick from a contracted pool of potential ventures), their selection processes become inefficient (i.e., they fail to choose the best ventures within the smaller pool), and they have access to an increasingly overlapping set of resources to sustain the venture's growth and increase its prospects for success. In other words, a very high number of prior co-investments leads to ex-ante inefficient selection processes and impaired ex-post monitoring activities, which both have a negative impact on the syndicate. We discuss both effects in more detail below.

Many prior co-investments can reduce the depth and breadth of VCs' deal flow, which is especially relevant when selecting portfolio companies to invest in. By repeatedly co-investing, VCs' industry expertise and contacts become progressively similar. When two VCs have co-invested 10 times in the past, they will know the same 10 entrepreneurs, investment bankers and consultants. Moreover, the more VCs co-invest, the more they are expected to reciprocate (Hochberg et al., 2010). Therefore, not only do they receive the same deals through an overlapping network, they will also feel obliged to co-invest and invite each other for subsequent deals, leading to inertia and path dependent decision making (Li & Rowley, 2002). Both these factors limit VCs' willingness to explore new directions that may be promising, especially if such opportunities show little resemblance with previous investments or involve radically new ideas (Dushnitsky & Lavie, 2010). Uzzi (1997) has explored how over-embeddedness, or the extent to which firms have overlapping networks, limits the flow of new or novel information that can potentially generate innovative ideas. Furthermore, VCs with many prior co-investments will experience lowered incentives to engage in a thorough due diligence process as they develop positive emotions towards each other that can bias their judgment and critical evaluation of any opportunities (Li & Rowley, 2002). High levels of trust generated as a result of many prior co-investments can thus lead to a lack of objectivity, overconfidence, flawed evaluations and less stringent due diligence procedures (Zahra, Yavuz, & Ucbasaran, 2006).

In addition to these selection inefficiencies, prior co-investments can also lead to ex-post governance issues associated with ineffective monitoring and subpar resource allocation once the initial investment decision has been made. As previously mentioned, an increasing number of prior co-investments helps establishing trust between syndicate members. However, as partners trust each other more and more, they will gradually reduce their monitoring and control activities

(Molina-Morales et al., 2011; Wicks, Berman, & Jones, 1999). In the context of new ventures, Zahra and colleagues (2006) found that overreliance on trust, in the absence of sufficient controls, increases errors of judgment, obscures rational decision making and discourages entrepreneurial risk taking. Similarly, Guler (2007) found that, despite lower expected returns, VCs continue to invest in a venture because of social obligations and pressure to imitate. Considering the strong links between monitoring activities and the VC syndicate's performance (Manigart et al., 2006), we thus expect that reduced monitoring associated with increased trust through many prior co-investments will lead to a negative impact on the syndicate's performance.

To summarize, we propose that the benefits of reducing partner-specific risks will accumulate with the number of prior co-investments, up to a certain point when the marginal benefits will diminish. From this point on, the benefits associated with additional prior co-investments will be outweighed by increased venture-specific risks that come into play, with increasing marginal costs, as the number of prior co-investments increases from a moderate to a high number, such that their combined effects will cause the relationship between prior co-investments and performance to invert and become negative.[3] The overall effect of prior co-investments on syndicate performance will thus be non-linear, such that:

*Hypothesis 1 (H1). The number of prior co-investments among investors in a VC syndicate will have an inverted U-shaped relationship with the syndicate's performance.*

[3] The exact number of prior co-investments at which the relationship with a syndicate's performance inverts is an empirical question and goes beyond the scope of our theory development. While we do identify this inflection point in our data at 67 prior co-investments (which includes 2.0% of all observations, or 4.5% of all ventures)—suggesting that the benefits of prior co-investments mostly outweigh the costs—we conjecture that this will vary across industries and geographical territories.

## 2.2 The moderating roles of venture age and VCs' geographical concentration

To further enhance our understanding of how of prior co-investments affect the syndicate's performance, we look at two types of risks associated with the investment that are otherwise independent from the relational mechanisms arising from prior co-investments. We argue that the effects of prior co-investments are moderated by the age of the venture and the geographical concentration of syndicate members. VCs often invest at different stages of the venture's lifecycle and therefore face different venture-specific risks. Similarly, VC syndicates encompass different degrees of geographical concentration, leading to differences in partner-specific risks. The specific risks that we draw from to formulate our arguments in support of Hypothesis 1 are directly and exclusively related to prior co-investments between the VCs that comprise a syndicate (e.g., increasing resource redundancy, overconfidence, ineffective venture selection), while the specific risks that we draw from to formulate our arguments in support of the proposed contingency factors in Hypothesis 2 and 3 are largely independent from the risks arising from prior co-investments and relate to the investment itself (e.g., younger ventures requiring greater monitoring and guidance, partner-related dynamics arising from co-investors being geographically dispersed). While we acknowledge that such risks may not always be fully independent, they independently moderate the relationship between prior co-investment and syndicate performance.

While venture-specific risks by definition vary from one venture to the next, investments in younger (rather than older) ventures are riskier, because these ventures are more uncertain, need enhanced monitoring, and require more diverse resources to grow, everything else being equal (De Clercq & Dimov, 2008; Manigart et al., 2006; Zahra et al., 2006). These risks associated with younger ventures amplify both the costs and the benefits associated with previous co-investments. Considering these uncertainties, co-investing with familiar partners helps VCs deal with potential

problems, while it simultaneously renders the syndicate's selection, monitoring and availability of diverse resources of utmost importance. We therefore argue that investing in younger ventures will increase the positive effects of prior co-investments along the upward sloping part of the inverted U-shaped relationship as outlined in H1, but it also intensifies the negative effects along the downward sloping part of the relationship.

When the number of prior co-investments between syndicated VCs increases from a low to a moderate level (i.e. the upward sloping part of the curve), interorganizational routines and trust become more beneficial when investing in younger ventures. Overall, the partner-specific risks of syndication become greater when VCs invest in younger ventures because of the potential conflicts arising from investing in highly uncertain ventures. Therefore, coordination mechanisms and trust developed through prior co-investments are more salient in terms of reducing the overall uncertainty, avoiding conflicts and partner opportunism associated with the information asymmetries typical of a younger venture (Dimov & De Clercq, 2006; Sorenson & Stuart, 2001). That said, when the number of prior co-investments continues to increase from a moderate to a high level (i.e. the downward sloping part of the curve), problems of adverse selection, resource redundancy and a lack of monitoring due to partners' overreliance on trust will become particularly cumbersome for syndicates investing in younger ventures. The riskier the venture, the more difficult it is for VCs to assess its growth potential, presenting significant scope for adverse selection and subpar due diligence processes. Furthermore, an early stage start-up is typically resource poor and requires many and diverse resources to prosper. Thus, if investors' resources have become redundant over many prior co-investments, the chances of success for the venture are reduced. Similar arguments have been put forward by Goerzen (2007) who argued that, in technologically uncertain environments, the negative effects of many repeated collaborations

between alliance partners become amplified. Finally, early stage start-ups require constant monitoring in order to avoid making costly mistakes. A syndicate composed of overly familiar investors is more prone to overconfidence, underestimated risks and relaxed monitoring activities, all of which increase the odds that the portfolio company will ultimately fail (Molina-Morales et al., 2011; Wicks et al., 1999; Zahra et al., 2006). Older ventures, on the other hand, are less uncertain, easier to monitor and have a more clearly defined growth path. Having established a clear growth trajectory and controlling their own resources, older ventures' need for hands-on coaching, technical expertise and monitoring is weakened (Hallen, 2008; Sorenson & Stuart, 2008). The number of prior co-investments thus has a less pronounced effect on the venture with regards to both the costs and benefits of VCs' prior co-investments.

Taken together, the cost-benefit trade-offs of prior co-investments among syndicated VCs are particularly pronounced for younger ventures rather than older ones. This suggests that the inverted U-shaped relationship between prior co-investments and syndicate performance will be steeper for younger ventures and flatter for older ones. Hence, we hypothesize that:

*Hypothesis 2 (H2). Venture age will moderate the inverted U-shaped relationship between the number of prior co-investments among investors in a VC syndicate and the syndicate's performance, such that the inverted U-shaped curve becomes steeper (flatter) for younger (older) ventures.*

The geographical clustering of VCs in regions such as Silicon Valley, New York or Boston is testimony to the importance of co-locating in the VC industry (Chen, Gompers, Kovner, & Lerner, 2010; Saxenian, 1994; Sorenson & Stuart, 2001). When knowledge is mainly tacit, as in

the case of VC investments, face-to-face communication and interactions are vital (Von Hippel, 1994). Geographical proximity to networking events, co-investors and portfolio companies is an important determinant of partner-specific risks (Thornton & Flynn, 2003). We thus expect that geographical concentration among the members of an investment syndicate will moderate the effects of prior co-investments on the venture's chances of making a successful exit.

Even though all syndicates are exposed to partner-specific risks, it is syndicates with geographically dispersed (rather than concentrated) co-investors that are particularly exposed to partner opportunism. In a geographically dispersed syndicate, partner-specific risks are higher because co-investors often have limited chances to meet face-to-face, for example in board meetings or during other venture-related activities. Geographical dispersion also decreases the chances to meet co-investors in social gatherings and industry events that are otherwise unrelated to the current investment (Sorenson & Stuart, 2001). These formal and informal meetings allow co-investors to meet in person and nurture their relationship, reducing partner-specific risks. Moreover, the fact that VCs are more likely to run into each other reduces the chances of opportunistic behavior due to the fear of meeting the same investors over and over again (Gulati, Nohria, & Zaheer, 2000; Porter, 2000). In geographically dispersed syndicates, partner-specific risks are at their peak and the routines and trust developed through prior co-investments can be particularly beneficial for these syndicates. The challenges brought upon by VCs' geographical dispersion will therefore increase the positive effects of prior co-investments along the upward sloping part of the inverted U-shaped relationship outlined in H1, making it steeper.

Moreover, VCs that are farther removed from their investees also face heightened venture-specific risks. First, *ex-ante*, it is more challenging for geographically dispersed VCs to invest and conduct due diligence in a potential portfolio company. This is due to coordination costs, time

consuming company visits and different regional networks that could facilitate information gathering and resolving uncertainties. Second, *ex-post*, the costs of monitoring the venture as well as fellow co-investors are likely to be correlated with geographical distance. In fact, VCs' ability to monitor the portfolio company, coach its management team and provide introductions may depend on the opportunity to interact frequently with the company (Sapienza, Manigart, & Vermeir, 1996). For example, Lerner (1995) found that VCs are more likely to serve on the boards of portfolio companies which are geographically proximate (rather than distant). We therefore expect that the challenges faced by geographically dispersed syndicates will not only amplify the positive effects of prior co-investments, but also the negative effects associated with inefficient selection and lack of monitoring, all of which are prevalent along the downward sloping part of the inverted U-shaped relationship outlined in H1.

Taken together, these arguments suggest that the cost-benefit trade-offs of prior co-investments will be particularly pronounced in geographically dispersed syndicates, rather than geographically concentrated (i.e. co-located) syndicates. This suggests that the inverted U-shaped relationship between prior co-investments and syndicate performance will be flatter for geographically concentrated syndicates and steeper for geographically dispersed VC syndicates:

*Hypothesis 3 (H3). Syndicate's geographical concentration will moderate the inverted U-shaped relationship between the number of prior co-investments among investors in a VC syndicate and the syndicate's performance, such that the inverted U-shaped curve becomes flatter (steeper) for geographically concentrated (dispersed) syndicates.*

## 3 DATA AND VARIABLES

### 3.1 Data description and sample

We test our hypotheses using a comprehensive sample of VC investments in the U.S. from 1980 to 2017. We source investment data from the Thomson One Banker database which reports VC investments worldwide. The dataset reports numerous variables at the venture as well as at the VC syndicate-level, including whether the venture has been exited through an IPO or M&A. Considering that we can only study the phenomenon of prior co-investments within syndicated investment deals, we restrict our sample to ventures receiving syndicated VC investments. A VC syndicate is defined as "two or more venture capital firms taking an equity stake in an investment for a joint payoff, either in the same investment round or at different points in time" (Lockett, Ucbasaran, & Butler, 2006, p. 118). Therefore, we include in our sample all ventures receiving investments from two or more VCs, either simultaneously or in different rounds. In our data, 63% of all VC backed ventures received syndicated investments.

Following Hallen, Katila, and Rosenberger (2014) and Hochberg, Ljungqvist, and Lu (2007), we begin our sample in 1980 given that in 1979 the U.S. Department of Labor clarified its "prudent man rule" to allow pension funds to invest in VCs, changing the VC industry considerably. This act also redefined the role of VC fund managers and literally kick-started the industry. Before these reforms, VC investments were limited in terms of number and economic relevance and thus are of marginal relevance to our analyses. Further, we do not include first investments made after the year 2007 to allow a minimum period of 10 years for a syndicate to exit the venture. Yet, if the venture received its first investment before or in 2007, we keep tracking all subsequent investments made in the venture up to, and including, 2017.

Our sample consists of ventures with business operations in the four most prevalent industries in terms of VC investment activity: medical, health and life science, computer hardware, computer software, and semiconductors. Based on Thomson One Banker data, these industries comprise 57% of all ventures receiving VC investments, 64% of active VC firms, and 59% of all capital invested during our study time period. To avoid institutional or cultural biases, we include only investments in which both the VC and the venture are located in the U.S. Additionally, to avoid differences in investment objectives and practices we only include investments made by independent VCs, excluding other types of investors, such as corporate venture capitalists (Souitaris, Zerbinati, & Liu, 2012). We also remove ventures reported to receive investments before they were founded or investments from "undisclosed investors". We also drop ventures aged 20 years or more to avoid "living dead" situations (Ruhnka, Feldman, & Dean, 1992). Finally, we restrict our sample to ventures where at least one of the investors reported a minimum of two investments within our study time period. This procedure excludes incidental investors with limited coverage and results in a more reliable sample for hypothesis testing. Our final sample includes 28,863 venture-year observations related to 4,550 ventures.

### 3.2 Measures and variables

*Dependent variable.* VCs invest with the goal of exiting a venture at a later stage. Successful VC investments are typically exited through IPO or M&A (Hochberg et al., 2007). Alternative indicators of success such as accounting measures or return on investment are seldom available given that both VCs and their portfolio companies tend to be private entities that typically do not disclose their financial results (Bellavitis, Filatotchev, & Kamuriwo, 2014; Bellavitis, Filatotchev, & Souitaris, 2017). Therefore, our dependent variable takes the value of 1 if, in a given year, the venture exits through IPO or M&A, 0 otherwise. Ventures are dropped from our sample the year

after they go through a successful IPO or M&A event, or if they do not receive any further investment rounds. In subsequent analyses reported as robustness tests, we separate the two exit events to assess if our results are driven by either of these *successful exit* events.

*Independent variables*. The variable *prior co-investments* counts the number of prior co-investments between the VCs in a syndicate. In line with previous studies (De Clerq & Dimov, 2008), we count the number of prior co-investments between pairs of VCs that are actively investing in the most recent investment round, and then collapse this information at the syndicate level to measure the total number of prior co-investments. This measure is dynamic and changes when new investors join a syndicate, or when VCs invest in ventures outside of a syndicate. Consider, for example, a syndicate that in the year 2000 was composed of three VCs: Alpha, Beta, and Gamma. If in 1999 Alpha and Beta invested together in two start-ups, but none of them invested with Gamma, the number of prior co-investments in 2000 will be two. Similarly, if in 2001 Alpha and Beta invested together in another start-up, in 2002 the number of prior co-investments will be three. Further, this number can change if in 2003 a new investment round is conducted and the syndicate changes composition. Our measure thus takes into account all prior co-investments up to date between all VCs in the most recent investment round. We only include VCs active in the most recent round because if investors choose not to re-invest in subsequent rounds, they might have become disengaged from either the venture, the syndicate, or from both. Investment term sheets may include dilution provisions to ensure that VCs who stop contributing lose their board seats and get diluted in subsequent rounds. Further, investors who are not following up on earlier investment(s) might struggle to influence the venture's strategic direction and operations, either directly or indirectly (Guler, 2007; Townsend, 2015; Zhelyazkov & Gulati, 2016). To test H1, we include both the linear and quadratic terms of *prior co-investments* in our

empirical models. For H1 to be supported, the linear term is expected to have a positive sign, while the quadratic measure is expected to have a negative coefficient. Our reported results are robust to a number of alternative variable operationalizations, which we discuss in more detail after our main results and fully report in an Online Appendix.

To test for the effects proposed in H2 and H3, we include two variables that are then interacted with the main effect of *prior co-investments*. First, *venture age* measures the age of the venture (in years) and captures the extent of venture-specific risks. For H2 to be supported, the interaction between *venture age* and the linear term of *prior co-investments* is expected to have a negative coefficient, while the interaction with the quadratic term is expected to have a positive coefficient. Second, *geographical concentration* captures the degree of partner-specific risks and allows us to test H3. We measure *geographical concentration* by counting the number of VC pairs that are located in the same metropolitan region (e.g., Boston) as the venture. Specifically, we count the number of pairs of co-located VCs, and we only consider those VCs that are investing in the most recent round. This measure changes dynamically when new VCs join or leave a syndicate. For example, if in 2000 VCs Alpha and Beta invested in a venture and they are co-located with the venture, the syndicate's geographical concentration will be 1. However, if in 2003 there is a new investment round conducted by VCs Alpha, Beta and Gamma, which are also located in the same metropolitan region, in that year the measure would equal 3 (pairs). For H3 to be supported, the interaction between *geographical concentration* and the linear term of *prior co-investments* is expected to have a negative significant coefficient, while the interaction with the quadratic term is expected to have a positive coefficient.

*Controls.* Several factors may affect the likelihood of a venture's successful exit, which we include as controls. We identify controls at the syndicate, venture and macro-levels. In terms of

syndicate-level controls, we control for the number of *potential dyads in syndicate*, which measures the number of potential pairs of VCs in a syndicate. This measure is calculated as $\frac{n(n-1)}{2}$ where $n$ is the number of VCs in a syndicate. This measure accounts for the fact that larger syndicates allow for an exponentially higher number of prior co-investments than smaller syndicates. A syndicate with two investors has one potential pair (AB), syndicates with three investors have three potential pairs (AB, AC, BC), syndicates with four investors have six potential pairs (AB, AC, AD, BC, BD, CD), and so on. Controlling for *potential dyads in syndicate* allows us to disentangle the effect of syndicate size from that of prior co-investments. Additionally, we control for differences in terms of VCs' past experiences. More experienced VCs might be able to better support a venture and they might also be better equipped to deal with their co-investors. That said, experienced VCs may also be more path dependent and myopic in terms of their investment strategies. Path dependency dynamics are similar to those developed in syndicates with many prior co-investments and, therefore, it is imperative that we control for experience. *Syndicate experience* takes the sum of prior VC investments by all VCs in the most recent round of the syndicate, up to the current year. At the venture-level, we include the number of *investment rounds* received, which likely improves a venture's chances of making a successful exit. We also control for the cumulative amount of *equity invested* in a venture up to date (in millions of current USD). Finally, at the macro-level, we control for *market hotness,* which counts the number of IPOs and M&As in a given year in the industry of a venture. This measure considers both the competitiveness and the attractiveness of a given sector-year, thus controlling for time varying industry-level variation that may affect the likelihood of a venture's successful exit. We further add venture location, venture industry, and year fixed effects. *Venture location* includes 25 dummy variables indicating the metropolitan area of the venture (e.g., Boston). *Venture industry* includes

four dummy variables indicating the industry a venture operates in. Lastly, we include 36 year dummies to control for macro-trends via *year fixed effects*.

## 4 METHODS

We estimate a panel logit regression with random effects and robust standard errors. The logit model fits a binary response with a maximum likelihood of a positive outcome given a set of regressors. A panel logit regression is appropriate given that our dependent variable is binary and varies with time: the venture's likelihood of a successful exit in a given year.[4] To further interpret our findings, we follow procedures for interpreting results in models with limited dependent variables (Hoetker, 2007). Testing hypotheses about the nature of the relationship between an explanatory variable and the dependent variable in non-linear models requires supplementary analysis examining the value and significance of the explanatory variable's marginal effect at theoretically and empirically meaningful values of said variable. With respect to interaction terms, Wiersema and Bowen (2009) propose conducting a graphical analysis as the most complete assessment of an interaction effect. Therefore, in addition to the marginal effects analyses, we graphically depict results for our hypotheses. We follow convention by using as high and low values of our moderators one standard deviation below and above their sample means. Lastly, to test for the inverted U-shaped effect of *prior co-investments*, we follow several of the procedures laid out in Haans, Pieters and Zi-Lin (2016). Specifically, we include both the linear and quadratic terms of *prior co-investments*, we estimate the turning point at which the relationship between *prior co-investments* and *successful exit* inverts and we assess if the turning point is within our sample range by conducting a U-test (also see Lind & Mehlum, 2010).

[4] We additionally estimate our results using various alternative modelling techniques including a Cox hazard model, a multinomial logit and a Heckman selection model (see Robustness tests section).

## 5 MAIN RESULTS

### 5.1 Descriptive statistics

Table 1 reports descriptive statistics and pairwise correlations for our estimation sample. We note that 10.4% of all venture-year observations represent a successful exit event.[5] On average, ventures in our sample are 5.24 years old, received 4 rounds of investments from VC syndicates with 4.63 potential dyads. The average syndicate has 8.25 prior co-investments and a total experience of 162 investments (excluding the focal investment). Approximately two thirds of all syndicates have at least one pair of co-located VCs based in the same region as the venture. The average variance inflation factor (VIF) for our models is 3.44, implying that multicollinearity is not an issue of concern when interpreting our findings (Kutner et al., 2004).

---INSERT TABLE 1 ABOUT HERE---

### 5.2 Main analyses

Table 2 reports our main results. In Model 1 we include control variables and fixed effects, in Model 2 we add both the linear and quadratic terms of *prior co-investments* testing H1, and in models 3 and 4 we include the interactions between *prior co-investments* and *venture age* and *prior co-investments* and *geographical concentration* testing H2 and H3, respectively. We report the likelihood ratio chi-square statistic to test and indicate the models' overall significance. For reference, in Model 5 we report and include all covariates combined into a single model.

---INSERT TABLE 2 ABOUT HERE---

[5] On average, successful ventures exit 5.5 years after entering our sample, at 7.3 years of age.

In line with H1, in Model 2 we observe that the linear term for *prior co-investments* is positive and significant ($p < 0.01$), while the quadratic term is negative and significant ($p < 0.01$). To further assess the existence of a curvilinear effect we conduct a U-test (Sasabuchi, 1980). The U-test supports with high confidence the existence of an inverted U-shaped relationship between *prior co-investments* and the likelihood of a successful exit ($t$-stat = 2.51; $p < 0.01$). The test indicates that the inflection point is at 67 prior co-investments, which is well within our data range. To further interpret these results, we estimate marginal effects at meaningful values of *prior co-investments,* while keeping all other variables constant at their means. We estimate marginal effects at increments of 10 prior co-investments, up to 150 (99.7% of our observations). Figure 1 shows that the predicted probability of a successful exit increases from 8.4% at 0 prior co-investments to 11.3% at 70 co-investments, after which it declines to 8.0% at 150 prior co-investments. Hence, when the number of prior co-investments increases from a low to a moderate level, chances of a successful exit increase by 34%. However, when prior co-investments continue to increase from a moderate to a high level, the likelihood of a successful exit falls by 30%. Taken together, these findings lend strong support to H1.

---INSERT FIGURE 1 ABOUT HERE---

Model 3 tests H2 by adding the interactions between *prior co-investments* and *venture age*. The variable *venture age* has a positive and significant coefficient ($p < 0.01$): the older the venture, the more likely it is to successfully exit through IPO or M&A. Consistent with H2, we find that the age of the venture indeed has a moderating effect on the curvilinear relationship between *prior co-investments* and a venture's *successful exit*. The linear term of the interaction is negative and significant ($p < 0.01$), while the quadratic term is positive and significant ($p < 0.05$). To further assess support for H2, we estimate the marginal effects of *prior co-investments* at different values

of *venture age*. As depicted in Figure 2, for younger ventures (-1 s.d.), the predicted probability of a successful exit ranges from 5.6% at 0 prior co-investments, to 11.3% at 90 (the inflection point), and 7.9% at 150 prior co-investments. For older ventures (+1 s.d.), however, the predicted probability of a successful exit is less volatile (meaning that the curve is flatter), ranging from 12% at 0 prior co-investments, to 12.9% at 50, and 9.4% at 150 of prior co-investments. Combining these results, we note support for H2: both the positive and the negative effects of prior co-investments are stronger for younger ventures as compared to older ventures.

---INSERT FIGURE 2 ABOUT HERE---

In model 4 we test H3 by adding interaction terms between *prior co-investments* and *geographical concentration*. The variable *geographical concentration* has a positive and significant coefficient ($p < 0.05$): the more geographically concentrated the syndicate members, the more likely the venture is to make a successful exit. Consistent with H3, we find that *geographical concentration* moderates the effect of the relationship between prior co-investments and performance. The linear interaction is negative and significant ($p < 0.01$), while the quadratic interaction is positive and significant ($p < 0.01$). We also compute the marginal effects for *prior co-investments* at different values of *geographical concentration*. As depicted in Figure 3, for geographically dispersed syndicates (i.e., 0 co-located dyads[6]), the predicted probability of a successful exit ranges from 8.2% at 0 prior co-investments, to 12.5% at 80, and 9.0% at a 150 prior co-investments. For geographically concentrated syndicates (+1 s.d.), the predicted probability of a successful exit ranges from 9.0% at 0 prior co-investments, to 11.8% at 70, and 8.3% at 150 prior co-investments. We thus note limited support for H3: Figure 3 shows similar curves at different values of *geographical concentration*, with the notable exception that for geographically

[6] The mean of *geographical concentration* is 0.677 with a standard deviation of 1.963. Since we cannot have a negative value for this measure, we use 0 as a lower bound, while the upper bound is 2.64 (+ 1 s.d.).

concentrated syndicates the curve shifts to the left. The probability of a successful exit for geographically dispersed syndicates peaks at 80 prior co-investments, while for geographically concentrated syndicates it peaks at 70 prior co-investments. Additionally, for geographically concentrated syndicates, the positive effects of prior co-investments are slightly weaker, while the negative effects are stronger, potentially suggesting a substitution effect.

---INSERT FIGURE 3 ABOUT HERE---

We turn to Model 2 for the interpretation of our controls. Perhaps not surprisingly, in markets with many IPO's and M&A's (i.e., *market hotness*) syndicates are more likely to successfully exit their ventures ($p < 0.01$). The number of *investment rounds* and *venture age* also have positive effects on the likelihood of success ($p < 0.01$), implying that older ventures that receive more investment rounds are associated with higher chances of successfully exiting through IPO or M&A. We further find that experienced syndicates have greater chances of successfully exiting their investments ($p < 0.01$). Surprisingly, we find that more capital, everything else being equal, is not associated with higher chances of a successful exit.

### 5.3 Robustness tests and sensitivity analyses

We run several robustness checks and alternative specifications to assess the sensitivity of our findings and rule out alternative explanations. Below we summarize the motivations underlying and the conclusions derived from these tests, which can be broadly categorized into three classes of concerns: (a) concerns related to our choice of estimation technique and sample structure, (b) concerns related to the operationalization and choice of our dependent and independent variables, and (c) concerns related to endogeneity resulting from sample selection bias in our sample of

syndicated VC investments. Table 3 summarizes the main results from these robustness tests, while fully tabulated results are reported in the Online Appendix.

--- INSERT TABLE 3 ABOUT HERE ---

### 5.4 Alternative estimation techniques

We assess the robustness of our findings to a number of alternative estimation techniques. First, we estimate a multinomial logit model which allows us to separately test for the likelihood of a venture exiting through an IPO or M&A event (Table 3, R1). The multinomial logit allows us to examine whether our results are driven by either of our outcome variables. Results are directionally consistent and indicate that our hypotheses are mostly supported for both types of exit events. That said, we do not find statistically significant results for the quadratic interaction between *prior co-investments* and *venture age* (in relation to both exit events) and the linear interaction between *prior co-investments* and *geographical concentration* (in relation to IPO exits).

Second, we run a Cox proportional hazard model that estimates the hazard rate of ventures "at risk" of experiencing an IPO or M&A (Table 3, R2). Despite having its own set of limitations, the hazard model's main advantage over logistical regression is that it takes into account the censored nature of our data (i.e., not all ventures exit our sample through an IPO or M&A event). We estimate ventures' hazard rates from the year of first investment received (Giot & Schwienbacher, 2007). Our findings are fully consistent when using this alternative estimation technique. Third, our main models take into account all investors participating in the most recent investment round of a syndicate. It could be argued, however, that VCs act opportunistically by only investing in those ventures that are highly likely to be successful. It could further be argued that when a venture is likely to be successful, current VCs invite familiar co-investors to "join the

party". Hence, one could argue that familiar investors are invited to join a syndicate only once the venture's chances of success have been revealed. To address this concern, we run two separate robustness tests. To start, we estimate results on a cross-sectional sample of observations at the time of first investment (Table 3, R3). This allows us to isolate the pre-investment dynamics of prior co-investments from any confounding effects occurring after the syndicate is formed. The outcome variable is a venture's eventual exit within 5 years. In addition, we re-calculate our *prior co-investments* measure based on first round investors only (Table 3, R4). This model is longitudinal. Results for both tests are either directionally consistent or fully supported. However, model R3 shows limited statistical significance.

### 5.5 Alternative variable operationalizations

We next assess the sensitivity of our results to various alternative variable operationalizations and model specifications. First, our main models include only investors actively participating in the most recent investment round, but ignore any investors from previous rounds who are not active in the most recent round. It could be argued, however, that VCs do not re-invest for reasons unrelated to the venture. For example, VCs focusing on early stage ventures may not follow up in later rounds because the venture has grown and is considered out of scope for the investor. Despite not re-investing, the VC might still play an active role in the syndicate and, therefore, have an impact on the syndicate's dynamics. To address this concern we re-run our analyses using a measure of prior co-investments that considers all investors up to date, even if they did not invest in the latest round (Table 3, R5). Our results are fully consistent.

Second, another argument could be put forward about the role of the lead investor (Ferrary, 2010). Lead VCs can exert greater control over the venture as well as over other co-investors in a

syndicate. Therefore, we re-operationalize our measure of prior co-investments by only taking into consideration prior co-investments between the lead VC and other VCs in a syndicate. In other words, we ignore prior co-investments between non-lead VCs. We identify the lead investor as the investor that has invested the highest amount of funding up to and including the investment-year. Results are consistent, suggesting that the prior co-investments involving the lead VC are no different from the other co-investors (Table 3, R6).

Third, to assess if there exists relevant heterogeneity across syndicates in terms of syndicate size, we re-run our models on clusters of syndicates based on various sizes. We estimate our results based on subsamples of syndicates sized between two and five VCs (small syndicates) and between six and 10 VCs (large syndicates). Results are consistent suggesting that syndicate size does not meaningfully affect our main results (Table 3, R7a/b).

Fourth, to assess the extent that our main results are driven by older prior co-investments, which may be outdated and therefore irrelevant to a syndicate's current dynamics, we run two related robustness tests. To start, we consider different thresholds for both the syndicate composition as well as the length of time we take prior co-investments into account. We re-run our models by restricting prior co-investments based on rolling windows of three, five, and 10 years. For example, with the five-year window, we discard any prior co-investments prior to five years before the current year (Table 3, R8a/b/c). In addition, we re-estimate our results by considering when prior co-investments happened. This measure divides each co-investment by the number of years since time *t*. Recent co-investments thus are assigned greater weights than older ones. For example, a 10-year-old co-investment counts as 1/10, a five-year-old counts as 1/5, and so on (Table 3, R9). Results are consistent across these models suggesting that the recentness of

co-investments does not affect our findings. However, the interaction between *prior co-investments* and *venture age*, however, is not statistically significant in model R8a.

Fifth, we currently take into account all prior co-investments regardless of whether these were successful or not. It could be argued, however, that some of the mechanisms in our theory development (e.g., overconfidence, relaxed monitoring) will only manifest when prior co-investments between VCs were successful. As such, we only regard prior co-investments that have been successful, namely investments that have been exited through IPO or M&A. Results are consistent suggesting that the outcome of prior co-investments does not alter the effect on current successes (see Table 3, R10). We do not use this measure in our main analyses because we believe that co-investors learn about their peers in bad times as much as in successful ones.

Sixth, we replace the moderator variable *geographical concentration* with an alternative proxy for partner specific-risks, namely how long co-investors have been investing in the focal venture. As the syndicate becomes more established with time, partner-specific risks will decrease and the dynamics of the syndicate can substitute for prior co-investments. Investors participating in long established syndicates are more familiar with each other as well as with the venture itself. We operationalize this measure in two related ways. The first measure (*syndicate duration*) counts the number of years investors have been investing in the venture. The second measure (*investment rounds*) counts the number of investment rounds investors have conducted. We find that these alternative measures yield fully consistent results (Table 3, R11a/b).

### 5.6 Accounting for endogeneity

Lastly, we account for a potential source of endogeneity. Since we only study ventures that received syndicated investments, our results may suffer from selection bias arising from VCs

disproportionally selecting only the best ventures for syndicated investment deals (Zhang, Gupta, & Hallen, 2017). To account for this potential selection bias, we run a Heckman selection correction model (*heckprobit*) where we estimate the likelihood of a venture's successful exit contingent on the likelihood of receiving syndicated investment. We use the number of VC investment rounds at the industry-year level as an excluded variable in the outcome equation. We conjecture that additional investments in current ventures reduce a focal venture's likelihood of receiving syndicated VC investment, but that it won't have an effect on the venture's chances of success (conditional on receiving syndicated VC investments). We include all control variables, all fixed effects, the two moderators and the variable counting the number of VC investment rounds in the selection equation (Table 3, R12). There is a strong correlation between both models' error terms, and the selection correction is statistically significant ($p < 0.01$), suggesting that the decision to syndicate is indeed endogenous. Our main results remain fully supported for H1 and H2, and although directionally consistent for H3, they are not statistically significant.

An additional source of endogeneity might stem from the fact that "better" syndicates select better ventures. This line of reasoning, however, is part of our argument leading up to H1. Syndicates with a history of prior co-investments are associated with better selection and governance of portfolio companies. Given this, controlling for endogenous matching would suppress our main effect by controlling for its underlying mechanism. Having said this, if "more history" (i.e., prior co-investments) is correlated with better venture selection, then our estimates would be biased in a way that goes against our predictions, given that we expect to observe a negative effect of prior co-investments (on venture selection, among others)—at least at very high levels of prior co-investments. Our estimates could thus be considered as conservative under this conjecture.

## 6 DISCUSSION AND CONCLUSION

We studied how prior co-investments between VCs affect the likelihood of a venture's successful exit through IPO or M&A. Reconciling conflicting findings from past studies, we proposed a relational agency framework and argued that there exist cost-benefit trade-offs associated with prior co-investments. Some prior co-investments generate trust, establish routines and identify best practices that lead to shared understanding among investors. A very high number of prior co-investments, however, can lead to path dependencies, inertia, resource redundancy and overconfidence, resulting in suboptimal venture selection processes as well as inefficient monitoring efforts. Longitudinal analysis of 4,550 entrepreneurial ventures receiving syndicated investments between 1980 and 2017 shows that there exists an inverted U-shaped relationship between prior co-investments and the venture's likelihood of a successful exit. Furthermore, our results indicate that the relationship between prior co-investments and performance is moderated by two types of risks. First, the age of the venture moderates the effects of prior co-investments such that both the positive and the negative aspects of prior co-investments are amplified for younger ventures. Interestingly, we found that older ventures reap limited benefits from prior co-investments, and mostly incur the costs along the downward sloping part of the curve. Second, geographical dispersion of syndicate members also moderates the effects of prior co-investments. Contrary to our expectations of a flatter curve, however, we found similar shapes. Yet, the curve of prior co-investments for geographically concentrated syndicates peaked earlier than for geographically dispersed syndicates.

Scholars in entrepreneurial finance have called for more research on the performance implications of syndication, as well as for a better understanding of the drivers of performance

heterogeneity among the population of syndicates (Bellavitis, Filatotchev, Kamuriwo, & Vanacker, 2017; Manigart & Wright, 2014; Jääskeläinen, 2012). Prior research hinted at positive effects of syndication by emphasizing resource pooling benefits, which lower venture-specific risks (Bygrave, 1988; Brander et al., 2002; Hochberg et al., 2007). Other research stressed the negative effects of syndication, pointing to agency risks and coordination costs, which increase partner-specific risks (Filatotchev, Wright, & Arberk, 2006; Wright & Lockett, 2003). By developing a relational agency framework that takes into account both venture-specific and partner-specific risks, we have argued that prior co-investments are a double-edged sword: on the one hand, relationships nurtured through prior co-investments are positively associated with increased performance through reduced partner-specific risks relating to opportunism and development of trust (De Clercq & Dimov, 2008; De Clercq & Sapienza, 2006). On the other hand, the positive effect on performance is capped at a certain number of prior co-investments, after which the effect inverts due to increasing venture-specific risks associated with suboptimal venture selection and reduced monitoring (Guler, 2007; Molina-Morales et al., 2011). Despite the fact that investors prefer to co-invest with the same partners over time, this strategy may not always be optimal. Our results indicate that the probability of a successful exit ranges from 11.3% at a moderate number of prior co-investments to 8.0% at a very high number. This means that, by configuring a syndicate with the right mix of familiar and unfamiliar co-investors, VCs can increase their chances of a successful exit by 42%.

Our study further contributes by identifying two risk-related factors that moderate the effects of prior co-investments. First, we argued that both the positive and the negative effects of prior co-investments are moderated by venture-specific risks, which we measured by the venture's age. While it is well known that syndicated VC investments result in overall better venture

selection than solo investments (Brander et al., 2002), there still remains a sizable amount of risk in any syndicated investment (Manigart et al., 2006). Our findings suggest that the effects of prior co-investments are more prominent for younger ventures than for older ones. Our results also suggest that for later stage ventures, the negative effects of prior co-investments are particularly prominent, while the positive effects are more salient for younger ventures.

Second, we argued that both the positive and negative effects of prior co-investments are moderated by partner-specific risks, as measured by the geographical concentration of both the venture and VCs in a syndicate. VCs in geographically dispersed syndicates have limited opportunities to meet face-to-face, both among themselves as well as with the portfolio company. This increases information asymmetries and potential conflicts, therefore rendering the benefits of prior co-investments more salient. On the other hand, co-located VCs may also be faced with reduced monitoring and value adding opportunities. We, therefore, argued that in geographically dispersed syndicates both the costs and benefits of prior co-investments would be amplified. Our results, however, show that the relationship between prior co-investments and syndicate performance peaks sooner and declines faster for geographically concentrated syndicates. We conjecture that geographical concentration partially substitutes for the costs and benefits conferred by prior co-investments, and we invite future research to further disentangle the complex relationship between geographical concentration and syndicate performance.

Our study has several limitations that may be addressed by future research. First, our analytical framework rests on the assumption that prior co-investments are equally distributed among the VCs in a syndicate. Indeed, we currently do not discriminate between syndicates with prior co-investments distributed equally among all VCs, and syndicates with prior co-investments that are heavily concentrated within a small subgroup of VCs. Although we believe our framework

will hold at various levels of skewness—and our subsample analyses based on syndicate size show that our findings are consistent for smaller syndicates in which there is less opportunity for skewed distributions—there is an emergent literature on multi-partner collaborations showing that differences between subgroups of partners can affect the outcomes of these partnerships (e.g., Davis, 2016; Heidl et al., 2014). It will be interesting to see whether a skewed distribution of prior co-investments has a moderating effect on the impact of prior co-investments on performance. A skewed distribution of prior co-investments implies that there may be less overlap in resources and adequate levels of trust within the subgroup of VCs with fewer co-investments, while it can also increase opportunistic behavior and distrust between subgroups, which would mitigate some of the benefits of prior co-investments.

A second limitation relates to the different roles of VCs within a syndicate and the extent of their experience. It is well known that beyond financial investments, there are different ways in which investors can add value to their portfolio companies (e.g., through board participation or other types of strategic mentoring) (Ferrary, 2010). It is plausible that greater diversity in experience as pertains to a VC's prior roles and syndicate positions may reduce some of the negative effects of prior co-investments (e.g., resource redundancy, reduced monitoring) and result in a more rounded investor profile. Additionally, it may also be that diversity in terms of experience profiles can affect the management of a syndicate, such that greater diversity leads to more effective monitoring and mentoring of the portfolio company. This suggests that the effect of prior co-investments on syndicate performance may be contingent on VCs' prior roles and experience, both individually and at the syndicate level (see Hoang & Rothaermel, 2005, and Stuart, 2000, for examples from the alliance literature). Although we controlled for syndicate experience in terms

of the number of past investments, future studies might further unpack the relationship between prior co-investments and experience diversity of the VCs involved.

Third, future research may extend our analytical framework by looking at a different population of syndicates or by looking at different outcome measures. We deliberately limited our sample to VCs and ventures with operations based in the U.S. That said, it would need to be tested whether our findings apply to other major geographic territories such as Europe and Asia (e.g., Dai, Jo, & Kassicieh, 2012). Additionally, it will be interesting to explore how the existence of cultural or institutional biases either among VCs or between VCs and their ventures potentially moderate the effects of prior co-investments. We also welcome studies exploring the effects of prior co-investments on alternative outcome measures. Prior research on alliances has shown that repeated collaborations affect different aspects of a partnership, such as the mode of contractual agreement (Gulati, 1995b), knowledge creation (McFadyen & Cannella, 2004; Molina-Morales et al., 2011), and financial performance (Holloway & Parmigiani, 2016). Future work may want to explore the effects of prior co-investments on VCs' return on investment, the propensity to engage in future syndicated investments, the venture's long term survival, or its ability to remain innovative. This line of enquiry may also extend our understanding of differences between value capture and value creation. Recent work has looked at the impact of interorganizational embeddedness on value capture (Elfenbein & Zenger, 2017), whereas our work focussed on the impact on value creation. That said, prior co-investments might also have an effect on value capture dynamics, both between syndicated VCs and between the syndicate and the portfolio company. Future studies should investigate how prior co-investments not only create value for the syndicate, but how value is captured within syndicated VC investments. These limitations and shortcomings notwithstanding, our theoretical framework and findings may be of interest to

scholars working in related fields—those in which loosely coupled organizations repeatedly collaborate—such as in strategic alliances (e.g., Hoang & Rothaermel, 2005; Sampson, 2005; Zollo, Reuer, & Singh, 2002), joint ventures (e.g., Simonin, 1997), and project-based and temporary organizations (e.g., Bechky, 2006; Holloway & Parmigiani, 2016). Repeated collaborations help organizations reduce their exposure to risks as they relate to inter-firm partnerships, but at the expense of creating a new set of risks associated with partner opportunism and transactional complexities. By collaborating with the same partner(s) over and over again, organizations can reduce partner-specific risks, which explains why organizations repeatedly collaborate in various contexts. That being said, the associated increase in relational familiarity tips the costs-benefits balance of prior collaborations towards an increase in project or venture-specific risks that manifest itself in increased agency costs of adverse selection and inefficient monitoring, governance and resource sharing. We hope future studies will test and expand our framework in related contexts such as those mentioned above.

## REFERENCES


Bechky, B. A. (2006). Gaffers, gofers, and grips: Role-based coordination in temporary organizations. *Organization Science, 17*(1), 3–21.

Bellavitis, C., Filatotchev, I., & Kamuriwo, S. (2014). The effects of intra- and extra-industry networks on performance: A case of venture capital portfolio firms. *Managerial and Decision Economics, 35*(2), 129–144.

Bellavitis, C., Filatotchev, I., Kamuriwo, D. S., & Vanacker, T. (2017). Entrepreneurial finance: New frontiers of research and practice: Editorial for the special issue Embracing entrepreneurial funding innovations. *Venture Capital, 19*(1-2), 1–16.

Bellavitis, C., Filatotchev, I., & Souitaris, V. (2017). The impact of investment networks on venture capital firm performance: A contingency framework. *British Journal of Management, 28*(1), 102–119.

Brander, J.A., Amit, R., & Antweiler, W. (2002). Venture-capital syndication: Improved venture selection vs. the value-added hypothesis. *Journal of Economics and Management Strategy, 11*(3), 423–452.

Burt, R.S. (1992). *Structural Holes: The Social Structure of Competition*. Cambridge, MA: Harvard University Press:

Bruton, G., Filatotchev, I., Chahine, S., & Wright M. (2010). Governance, ownership structure and performance of IPO firms: The impact of different types of private equity investors and institutional environments, *Strategic Management Journal, 31*(5), 491–509.

Bygrave, W. D. (1988). The structure of the investment networks of venture capital firms. *Journal of Business Venturing, 3*, 137–157.

Chahine, S., Arthurs, J. D., Filatotchev, I., & Hoskisson, R. E. (2012). The effects of venture capital syndicate diversity on earnings management and performance of IPOs in the US and UK: An institutional perspective. *Journal of Corporate Finance, 18*(1), 179–192.

Chen, H., Gompers, P., Kovner, A., & Lerner, J. (2010). Buy local? The geography of venture capital. *Journal of Urban Economics, 67*(1), 90–102.

Coleman J. (1988). Social capital in the creation of human capital. *American Journal of Sociology, 94*(Supplement), 95–120.

Dai, N., Jo, H., & Kassicieh, S. (2012). Cross-border venture capital investments in Asia: Selection and exit performance. *Journal of Business Venturing, 27*(6), 666–684.

Davis, J. P. (2016). The group dynamics of interorganizational relationships: Collaborating with multiple partners in innovation ecosystems. *Administrative Science Quarterly, 61*(4), 621–661.

De Clercq, D., & Dimov, D. (2008). Internal knowledge development and external knowledge access in venture capital investment performance. *Journal of Management Studies, 45*(3), 585–612.

De Clercq, D., & Sapienza, H. J. (2006). Effects of relational capital and commitment on venture capitalists' perception of portfolio company performance. *Journal of Business Venturing, 21*(3), 326–347.

Dushnitsky, G. & Lavie, D. (2010). How alliance formation shapes corporate venture capital investment in the software industry: A resource-based perspective. *Strategic Entrepreneurship Journal, 4*(1), 22–48.

Dushnitsky, G., & Shapira, Z. (2010). Entrepreneurial finance meets organizational reality: Comparing investment practices and performance of corporate and independent venture capitalists. *Strategic Management Journal, 31*(9), 990–1017.

Dimov, D. P., & De Clercq, D. (2006). Venture capital investment strategy and portfolio failure rate: A longitudinal study. *Entrepreneurship Theory and Practice, 30*(2), 207–223.

Elfenbein, D. W., & Zenger, T. (2017). Creating and capturing value in repeated exchange relationships: The second paradox of embeddedness. *Organization Science, 28*(5), 894–914.

Ferrary, M. (2010). Syndication of venture capital investment: The art of resource pooling. *Entrepreneurship Theory and Practice, 34*(5), 885–908.

Filatotchev, I., Wright, M., & Arberk, M. (2006). Venture capitalists, syndication and governance in initial public offerings. *Small Business Economics, 26*(4), 337–350.

Giot, P., & Schwienbacher, A. (2007). IPOs, trade sales and liquidations: Modelling venture capital exits using survival analysis. *Journal of Banking and Finance, 31*(3), 679–702.

Goerzen, A. (2007). Alliance networks and firm performance: The impact of repeated partnerships. *Strategic Management Journal, 28*(5), 487–509.

Granovetter, M.S. (1985). Economic action and social structure: A theory of embeddedness. *American Journal of Sociology, 91*, 481–510.

Gulati, R. (1995a). Does familiarity breed trust? The implications of repeated ties for contractual choice in alliances. *Academy of Management Journal, 38*(1), 85–112.

Gulati, R. (1995b). Social structure and alliance formation patterns: A longitudinal analysis. *Administrative Science Quarterly, 40*(4), 619–652.
Gulati, R. (1999). Network location and learning: The influence of network resources and firm capabilities on alliance formation. *Strategic Management Journal, 20*, 397–420.
Gulati, R., Nohria, N., & Zaheer, A. (2000). Strategic networks. *Strategic Management Journal, 21*(3), 203–215.
Guler, I. (2007). Throwing good money after bad? Political and institutional influences on sequential decision making in the venture capital industry. *Administrative Science Quarterly, 52*(2), 248–285.
Haans, R.F.J., Pieters, & C., Zi-Lin, H., (2016). Thinking about U: Theorizing and testing U- and inverted U-shaped relationships in strategy research. *Strategic Management Journal, 37*(7), 1177–1195.
Hallen, B. L. (2008). The causes and consequences of the initial network positions of new organizations: From whom do entrepreneurs receive investments? *Administrative Science Quarterly, 53*(4), 685–718.
Hallen, B. L., Katila, R., & Rosenberger, J. D. (2014). How do social defenses work? A resource-dependence lens on technology ventures, venture capital investors, and corporate relationships. *Academy of Management Journal, 57*(4), 1078–1101.
Heidl, R. A., Steensma, H. K., & Phelps, C. (2014). Divisive faultlines and the unplanned dissolutions of multipartner alliances. *Organization Science, 25*(5), 1351–1371.
Hoang, H., & Rothaermel, F. T. (2005). The effect of general and partner-specific alliance experience on joint R&D project performance. *Academy of Management Journal, 48*(2), 332–345.
Hoetker, G. (2007). The use of logit and probit models in strategic management research: Critical issues. *Strategic Management Journal, 28*(4), 331–343.
Hochberg, Y. V., Ljungqvist, A., & Lu, Y. (2007). Whom you know matters: Venture capital networks and investment performance. *Journal of Finance, 62*(1), 251–301.
Hochberg, Y. V., Ljungqvist, A., & Lu, Y. (2010). Networking as a barrier to entry and the competitive supply of venture capital. *Journal of Finance, 65*(3), 829–859.
Holloway, S. & Parmigiani, A., (2016). Friends and profits don't mix: The performance implications of repeated partnerships. *Academy of Management Journal, 59*(2), 460–478.
Jääskeläinen, M. (2012). Venture capital syndication: Synthesis and future directions. *International Journal of Management Reviews, 14*(4), 444–463.
Kaplan, S. N., & Strömberg, P. (2003). Financial contracting theory meets the real world: An empirical analysis of venture capital contracts. *The Review of Economic Studies, 70*(2), 281–315.
Kutner, M. H., Neter, J, Nachtsheim, C.J., & Wasserman, W. (2004). *Applied Linear Statistical Models* (4th ed.). London, US: McGraw-Hill.
Lerner, J. (1994). The syndication of venture capital investments. *Financial Management, 23*(3), 16–27.
Li, S., & Rowley, T. (2002). Inertia and evaluation mechanisms in interorganizations partner selection: Syndicate formation among U.S. investment banks. *Academy of Management Journal, 45*(6), 1104–1119.
Lind, J. T., & Mehlum, H. (2010). With or without U? The appropriate test for a U shaped relationship. *Oxford Bulletin of Economics and Statistics, 72*(1), 109–118.

Lioukas, C. S., & Reuer, J. J. (2015). Isolating trust outcomes from exchange relationships: Social exchange and learning benefits of prior ties in alliances. *Academy of Management Journal, 58*(6), 1826–1847.

Lockett, A., Ucbasaran, D., & Butler, J. (2006). Opening up the investor-investee dyad: Syndicates, teams and networks. *Entrepreneurship Theory and Practice, 30*(2), 117–130.

Lockett, A., & Wright, M. (2001). The syndication of venture capital investments. *Omega, 29*(5), 375–390.

Manigart, S. & Wright, M. (2014). Venture capital investors and portfolio firms. *Foundations and Trends in Entrepreneurship, 9*(4-5), 365–570.

Manigart, S., Lockett, A., Meuleman, M., Wright, M., Landström, H., Bruining, H., Desbrieres, P., & Hommel, U. (2006). Venture capitalists' decision to syndicate. *Entrepreneurship Theory and Practice, 30*(2), 131–153.

McFadyen, M. A., & Cannella, A. A., Jr. (2004). Social capital and knowledge creation: Diminishing returns of the number and strength of exchange relationships. *Academy of Management Journal, 47*(5), 735–746.

Molina-Morales, X. F., Martínez-Fernández, M. T., & Torlò, V. J. (2011). The dark side of trust: The benefits, costs and optimal levels of trust for innovation performance. *Long Range Planning, 44*(2), 118–133.

Porter, M. E. (2000). Location, competition, and economic development: Local clusters in a global economy. *Economic Development Quarterly, 14*(1), 15–34.

Ruhnka, J. C., Feldman, H. D., & Dean, T. J. (1992). The "living dead" phenomenon in venture capital investments. *Journal of Business Venturing, 7*(2), 137–155.

Sampson, R. C. (2005). Experience effects and collaborative returns in R&D alliances. *Strategic Management Journal, 26*(11), 1009–1031.

Sapienza, H. J., Manigart, S., & Vermeir, W. (1996). Venture capitalist governance and value added in four countries. *Journal of Business Venturing, 11*(6), 439–469.

Sasabuchi, S. (1980). A test of a multivariate normal mean with composite hypotheses determined by linear inequalities. *Biometrika, 67*, 429–439.

Saxenian, A. (1994). *Regional Advantage: Culture and Competition in Silicon Valley and Route 128.* Cambridge, MA: Harvard University Press.

Simonin, B. L. (1997). The importance of collaborative know-how: An empirical test of the learning organization. *Academy of Management Journal, 40*(5), 1150–1174.

Souitaris, V., Zerbinati, S., & Liu, G. (2012). Which iron cage? Endo-and exoisomorphism in corporate venture capital programs. *Academy of Management Journal, 55*(2), 477–505.

Sorenson, O., & Stuart, T. E. (2001). Syndication networks and the spatial distribution of venture capital investments. *American Journal of Sociology, 106*(6), 1546–1588.

Sorenson, O., & Stuart, T. (2008). Bringing the context back in: The search for syndicate partners in venture capital investment networks. *Administrative Science Quarterly, 53*(2), 266–294.

Stuart, T. E. (2000). Interorganizational alliances and the performance of firms: A study of growth and innovation rates in a high-technology industry. *Strategic Management Journal, 21*(8), 791–811.

Thornton, P. H., & Flynn, K. H. (2003). Entrepreneurship, networks, and geographies. In Z. J. Acs and D. B. Audretsch (Eds.), *Handbook of Entrepreneurship Research* (pp. 401–433). Boston, MA: Springer.

Townsend, R. (2015). Propagation of financial shocks: The case of venture capital. *Management Science, 61*(11), 2782–2802.
Uzzi, B. (1997). Social structure and competition in interfirm networks: The paradox of embeddedness. *Administrative Science Quarterly, 42*, 35–67.
Von Hippel E. (1994). Sticky information and the locus of problem solving. *Management Science. 40*(4), 429–39.
Wicks, A. C., Berman, S. L., & Jones, T. M. (1999). The structure of optimal trust: Moral and strategic implications. *Academy of Management Review, 24*(1), 99–116.
Wiersema, M.F. & Bowen, H.P. (2009). The use of limited dependent variable techniques in strategy research: Issues and methods. *Strategic Management Journal, 30*(6), 679–692.
Wright, M., & Lockett, A. (2003). The structure and management of alliances: Syndication in the venture capital industry. *Journal of Management Studies, 40*(8), 2073–2102.
Zahra, S. A, Yavuz, R. I., & Ucbasaran, D. (2006). How much do you trust me? The dark side of relational trust in new business creation in established companies. *Entrepreneurship Theory and Practice, 30*(4), 541–559.
Zhang, L., Gupta, A. K., & Hallen, B. L. (2017). The conditional importance of prior ties: A group-level analysis of venture capital syndication. *Academy of Management Journal, 60*(4), 1360–1386.
Zhelyazkov, P. I., & Gulati, R. (2016). After the break-up: The relational and reputational consequences of withdrawals from venture capital syndicates. *Academy of Management Journal, 59*(1), 277–301.
Zollo, M., Reuer, J., & Singh, H. (2002). Interorganizational routines and performance in strategic alliances. *Organization Science, 13*(6), 701–713.

## TABLES AND FIGURES

Table 1. Descriptive statistics and pairwise correlations

| **Main variables** | **Mean** | **S.D.** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *1. Successful exit* | 0.104 | 0.305 | | | | | | | | | | | | | |
| *2. Market hotness* | 79.826 | 63.692 | 0.038 | | | | | | | | | | | | |
| *3. Equity invested* | 66.980 | 121.813 | 0.108 | 0.012 | | | | | | | | | | | |
| *4. Investment rounds* | 4.029 | 2.781 | 0.171 | -0.007 | 0.539 | | | | | | | | | | |
| *5. Syndicate experience* | 162.886 | 163.234 | 0.076 | -0.004 | 0.406 | 0.174 | | | | | | | | | |
| *6. Potential dyads in syndicate* | 4.633 | 7.116 | 0.032 | -0.080 | 0.149 | 0.097 | 0.461 | | | | | | | | |
| *7. Venture age* | 5.242 | 3.884 | 0.180 | 0.051 | 0.325 | 0.543 | 0.070 | 0.002 | | | | | | | |
| *8. Geographical concentration* | 0.677 | 1.963 | 0.013 | 0.002 | 0.056 | 0.018 | 0.305 | 0.496 | -0.034 | | | | | | |
| *9. Prior co-investments* | 8.253 | 19.090 | 0.046 | -0.117 | 0.141 | 0.076 | 0.630 | 0.642 | 0.006 | 0.490 | | | | | |
| **Interaction effects** | | | | | | | | | | | | | | | |
| *10. Prior co-investments*$^2$ | 432.623 | 2876.709 | 0.017 | -0.066 | 0.052 | 0.040 | 0.352 | 0.467 | 0.012 | 0.441 | 0.824 | | | | |
| *11. Prior co-investments * Venture age* | 43.693 | 128.929 | 0.069 | -0.080 | 0.227 | 0.173 | 0.568 | 0.514 | 0.203 | 0.345 | 0.830 | 0.709 | | | |
| *12. Prior co-investments*$^2$ ** Venture age* | 2405.613 | 19406.970 | 0.024 | -0.052 | 0.084 | 0.074 | 0.328 | 0.390 | 0.078 | 0.331 | 0.707 | 0.869 | 0.834 | | |
| *13. Prior co-investments * Geo. concentration* | 23.964 | 228.856 | 0.003 | -0.043 | 0.016 | 0.015 | 0.226 | 0.413 | -0.009 | 0.701 | 0.592 | 0.756 | 0.447 | 0.601 | |
| *14. Prior co-investments*$^2$ ** Geo. Concentration* | 2786.554 | 49954.720 | -0.002 | -0.034 | 0.001 | 0.007 | 0.155 | 0.317 | -0.002 | 0.520 | 0.508 | 0.775 | 0.405 | 0.642 | 0.944 |

*Notes.* Correlations with absolute values equal to or greater than 0.012 are significant at $p < 0.05$. Descriptive statistics and pairwise correlations based on estimation sample of 28,863 venture-year observations (4,550 ventures). The sample's variance inflation factor (VIF) is 3.44 (based on main model estimates; Table 2, Model 2).

**Table 2. Panel logit regressions estimating the effects of prior co-investments on a venture's likelihood of successfully exiting through IPO or M&A**

| Variable | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| *Market hotness* | 0.003** (0.001) | 0.003** (0.001) | 0.003** (0.001) | 0.003** (0.001) | 0.003** (0.001) |
| *Equity invested* | -0.000 (0.000) | -0.000 (0.000) | -0.000 (0.000) | -0.000 (0.000) | -0.000 (0.000) |
| *Investment rounds* | 0.095** (0.009) | 0.095** (0.009) | 0.092** (0.009) | 0.095** (0.009) | 0.092** (0.009) |
| *Syndicate experience* | 0.001** (0.000) | 0.001** (0.000) | 0.001** (0.000) | 0.001** (0.000) | 0.001** (0.000) |
| *Potential dyads in syndicate* | 0.003 (0.004) | 0.002 (0.004) | 0.001 (0.004) | 0.001 (0.004) | 0.000 (0.004) |
| *Venture age* | 0.099** (0.008) | 0.099** (0.008) | 0.109** (0.008) | 0.099** (0.008) | 0.109** (0.008) |
| *Geographical concentration* | -0.004 (0.011) | 0.002 (0.012) | -0.002 (0.012) | 0.040* (0.018) | 0.041* (0.018) |
| *Prior co-investments* | | 0.009** (0.003) | 0.020** (0.004) | 0.012** (0.003) | 0.022** (0.004) |
| *Prior co-investments*$^2$ | | -0.0001** (0.0000) | -0.0001** (0.0000) | -0.0001** (0.0000) | -0.0001** (0.0000) |
| *Prior co-investments * Venture age* | | | -0.002** (0.000) | | -0.002** (0.000) |
| *Prior co-investments*$^2$ ** Venture age* | | | 0.00001* (0.00000) | | 0.00001* (0.00000) |
| *Prior co-investments * Geographical concentration* | | | | -0.001** (0.000) | -0.001** (0.000) |
| *Prior co-investments*$^2$ ** Geographical concentration* | | | | 0.00001** (0.00000) | 0.00001** (0.00000) |
| Venture location fixed effects (25) | Yes | Yes | Yes | Yes | Yes |
| Venture industry fixed effects (4) | Yes | Yes | Yes | Yes | Yes |
| Year fixed effects (36) | Yes | Yes | Yes | Yes | Yes |
| Constant | -4.203** (0.739) | -4.193** (0.739) | -4.245**(0.740) | -4.211**(0.735) | -4.262**(0.736) |
| Venture-year observations | 28,863 | 28,863 | 28,863 | 28,863 | 28,863 |
| Ventures | 4,550 | 4,550 | 4,550 | 4,550 | 4,550 |
| Log-likelihood | -8,816.744 | -8,807.505 | -8,798.411 | -8,804.014 | -8,794.341 |
| Wald chi² | 802.68** | 823.29** | 862.57** | 835.49** | 877.51** |

*Notes.* ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$.

All models fit a panel logit regression with random effects. Robust standard errors reported within parentheses. The dependent variable is the venture's likelihood of exiting through IPO or M&A.

## Table 3. Overview of robustness tests

| | *Prior co-investments* | *Prior co-investments*$^2$ | *Prior co-investments * Venture age* | *Prior co-investments*$^2$ ** Venture age* | *Prior co-investments * Geographical concentration* | *Prior co-investments*$^2$ ** Geographical concentration* |
|---|---|---|---|---|---|---|
| **Alternative estimation techniques** | | | | | | |
| R1: Multinomial logit regression estimating the effect of P*rior co-investments* on venture's exit events separately | IPO: 0.009+ (0.005); M&A: 0.011* (0.005) | IPO: -0.000* (0.000); M&A: -0.000* (0.000) | IPO: -0.002** (0.001); M&A: -0.002** (0.001) | IPO: 0.000 (0.000); M&A: 0.000 (0.000) | IPO: 0.001 (0.001); M&A: -0.002** (0.000) | IPO: -0.000 (0.000); M&A: 0.000** (0.000) |
| R2: Cox proportional hazard model estimating the effects of *Prior co-investments* on a venture's hazard of exiting through IPO or M&A | 0.005* (0.002) | -0.000* (0.000) | -0.002** (0.000) | 0.000** (0.000) | -0.001* (0.000) | 0.000* (0.000) |
| R3: Considering all variables at the time of first investment round on the likelihood to exit 5 years later (cross sectional; OLS) | 0.003 (0.006) | -0.000* (0.000) | -0.001 (0.003) | 0.000 (0.000) | -0.001 (0.001) | 0.000* (0.000) |
| R4: Considering *Prior co-investments* between the first investment round investors only | 0.013** (0.004) | -0.000* (0.000) | -0.002** (0.001) | 0.000+ (0.000) | -0.001** (0.000) | 0.000** (0.000) |
| **Alternative variable operationalizations** | | | | | | |
| R5: Panel logit regressions testing the effects of VCs' prior co-investments among all syndicate members | 0.006* (0.003) | -0.000** (0.000) | -0.003** (0.000) | 0.000** (0.000) | -0.001** (0.000) | 0.000** (0.000) |
| R6: Considering *Prior co-investments* between the lead investor and other investors only | 0.025** (0.005) | -0.000** (0.000) | -0.007** (0.001) | 0.000** (0.000) | -0.005** (0.001) | 0.000** (0.000) |
| R7a: Including only syndicates with syndicate size between 2 and 5 | 0.018* (0.008) | -0.000* (0.000) | -0.008** (0.002) | 0.000* (0.000) | -0.001+ (0.001) | 0.000** (0.000) |
| R7b: Including only syndicates with syndicate size between 6 and 10 | 0.016** (0.006) | -0.000** (0.000) | -0.004** (0.001) | 0.000* (0.000) | -0.006** (0.002) | 0.000+ (0.000) |
| R8a: Considering *Prior co-investments* within the last 3 years between investors joining the syndicate within the last 3 years | 0.029** (0.005) | -0.000** (0.000) | -0.003* (0.001) | 0.000 (0.000) | -0.001* (0.001) | 0.000** (0.000) |
| R8b: Considering *Prior co-investments* within the last 5 years between investors joining the syndicate within the last 5 years | 0.022** (0.004) | -0.000** (0.000) | -0.003** (0.001) | 0.000+ (0.000) | -0.001* (0.000) | 0.000** (0.000) |
| R8c: Considering *Prior co-investments* within the last 10 years between investors joining the syndicate within the last 10 years | 0.013** (0.004) | -0.000* (0.000) | -0.004** (0.001) | 0.000** (0.000) | -0.001* (0.000) | 0.000* (0.000) |
| R9: Adjusting *Prior co-investments* for the recentness of prior collaborations | 0.015** (0.005) | -0.000** (0.000) | -0.005** (0.000) | 0.000+ (0.000) | -0.002* (0.001) | 0.000* (0.000) |
| R10: Replacing *Prior co-investments* with *Prior successful co-investments* (exited through IPO or M&A) | 0.015** (0.005) | -0.000** (0.000) | -0.002** (0.000) | 0.000** (0.000) | -0.002** (0.000) | 0.000** (0.000) |
| R11a: Replacing *Geographical concentration* with *Syndicate duration* to test H3 interactions | 0.008* (0.003) | -0.000** (0.000) | -0.003** (0.001) | 0.000** (0.000) | -0.001** (0.000) | 0.000** (0.000) |
| R11b: Replacing *Geographical concentration* with *Investment rounds* to test H3 interactions | 0.009** (0.003) | -0.000** (0.000) | -0.002** (0.000) | 0.000* (0.000) | -0.003** (0.001) | 0.000* (0.000) |
| **Accounting for endogeneity** | | | | | | |
| R12: Accounting for differences between syndicates vs solo investments (Heckman probit) | 0.004** (0.001) | -0.000** (0.000) | -0.001** (0.000) | 0.000** (0.000) | -0.000 (0.000) | 0.000 (0.000) |

*Notes.* ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$.

Unless specified, all models fit a panel logit regression with random effects and the dependent variable is the venture's likelihood of exiting through IPO or M&A. Model R12 fits a Heckman probit regression with selection correction for syndication. The second stage excludes the number of VC investment rounds in the focal venture's industry-year. In all models robust standard errors reported in parentheses. Fully tabulated results are reported in the Online Appendix.

**Figure 1. Marginal effects for H1 (main effect of *prior co-investments*)**

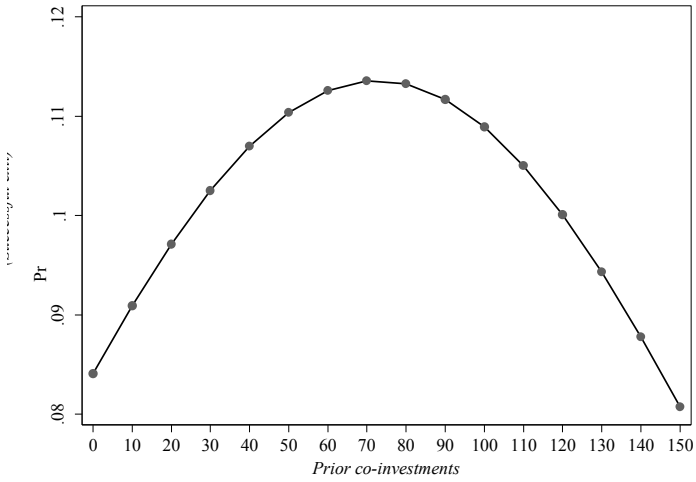



**Figure 2. Marginal effects for H2 (moderating effect of *venture age*)**

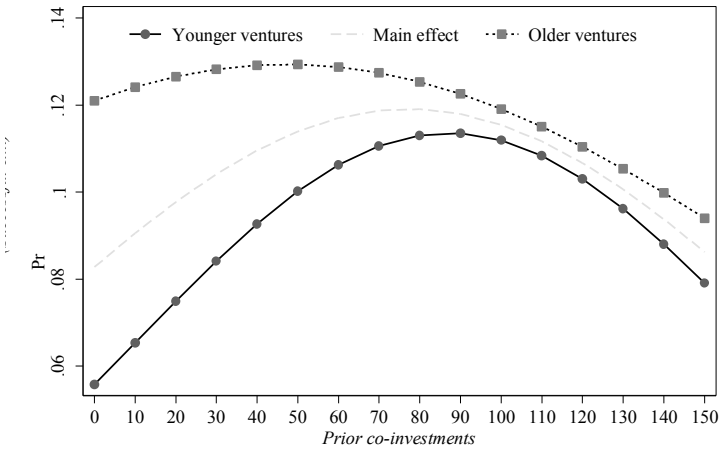
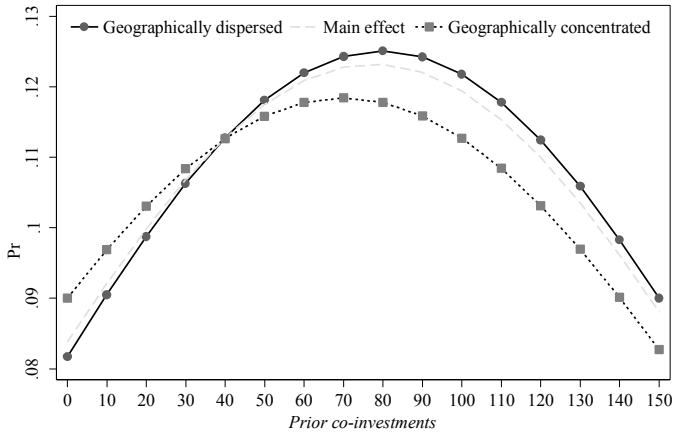



**Figure 3. Marginal effects for H3 (moderating effect of *geographical concentration*)**



# THE EFFECTS OF PRIOR CO-INVESTMENTS ON THE PERFORMANCE OF VC SYNDICATES: A RELATIONAL AGENCY PERSPECTIVE

## Online Appendix

Below we report all robustness tables referred to in Table 3 of the main document.

**Table R1. Multinomial logit regressions estimating the effects of prior co-investments on venture's exit events separately**

| Variable | 1a. (IPO) | 1b. (M&A) | 2a. (IPO) | 2b. (M&A) | 3a. (IPO) | 3b. (M&A) |
|---|---|---|---|---|---|---|
| *Market hotness (IPO)* | 0.057** (0.003) | 0.002 (0.003) | 0.057** (0.003) | 0.002 (0.003) | 0.057** (0.003) | 0.002 (0.003) |
| *Market hotness (M&A)* | 0.001 (0.002) | 0.004** (0.001) | 0.001 (0.002) | 0.004** (0.001) | 0.001 (0.002) | 0.004** (0.001) |
| *Equity invested* | 0.001** (0.000) | -0.001** (0.000) | 0.001** (0.000) | -0.001** (0.000) | 0.001** (0.000) | -0.001** (0.000) |
| *Investment rounds* | 0.031* (0.015) | 0.117** (0.010) | 0.029* (0.015) | 0.116** (0.010) | 0.031* (0.015) | 0.118** (0.010) |
| *Syndicate experience* | 0.001** (0.000) | 0.001** (0.000) | 0.001** (0.000) | 0.001** (0.000) | 0.001** (0.000) | 0.001* (0.000) |
| *Potential dyads in syndicate* | -0.002 (0.006) | 0.003 (0.004) | -0.003 (0.006) | 0.002 (0.004) | -0.001 (0.006) | 0.001 (0.004) |
| *Venture age* | 0.147** (0.010) | 0.084** (0.006) | 0.161** (0.010) | 0.095** (0.007) | 0.147** (0.010) | 0.084** (0.006) |
| *Geographical concentration* | 0.005 (0.024) | 0.002 (0.014) | -0.003 (0.024) | -0.002 (0.013) | -0.044 (0.048) | 0.059** (0.020) |
| *Prior co-investments* | 0.009+ (0.005) | 0.011* (0.005) | 0.019** (0.006) | 0.022** (0.005) | 0.010+ (0.005) | 0.014** (0.005) |
| *Prior co-investments*$^2$ | -0.000* (0.000) | -0.000* (0.000) | -0.000* (0.000) | -0.000** (0.000) | -0.000** (0.000) | -0.000* (0.000) |
| *Prior co-investments * Venture age* | | | -0.002** (0.001) | -0.002** (0.001) | | |
| *Prior co-investments*$^2$ ** Venture age* | | | 0.000 (0.000) | 0.000 (0.000) | | |
| *Prior co-investments * Geographical concentration* | | | | | 0.001 (0.001) | -0.002** (0.000) |
| *Prior co-investments*$^2$ ** Geographical concentration* | | | | | -0.000 (0.000) | 0.000** (0.000) |
| Venture location fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Venture industry fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Time period fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | -3.521** (0.337) | -4.591** (0.266) | -3.552** (0.333) | -4.438** (0.253) | -3.488**(0.334) | -4.431** (0.254) |
| Venture-year observations | 28,669 | | 28,669 | | 28,669 | |
| Ventures | 4,550 | | 4,550 | | 4,550 | |
| Log-likelihood | -10,149.955 | | -10,138.490 | | -10,142.862 | |

*Notes.* ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$.

All models fit a multinomial logit regression. Standard errors clustered around the venture reported within parentheses. Dependent variables reported in the first row. Yearly fixed effects are substituted with 5 year fixed effects due to convergence issues.

**Table R2. Cox proportional hazard model estimating the effects of prior co-investments on a venture's hazard rates of exiting through an IPO or M&A event**

| Variable | 1 | 2 | 3 |
|---|---|---|---|
| *Market hotness* | 0.002** (0.001) | 0.002** (0.001) | 0.002** (0.001) |
| *Equity invested* | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) |
| *Investment rounds* | -0.005 (0.008) | -0.008 (0.008) | -0.004 (0.008) |
| *Syndicate experience* | 0.000 (0.000) | 0.000+ (0.000) | 0.000 (0.000) |
| *Potential dyads in syndicate* | -0.003 (0.003) | -0.004 (0.003) | -0.004 (0.003) |
| *Venture age* | 0.038** (0.007) | 0.048** (0.007) | 0.038** (0.007) |
| *Geographical concentration* | 0.002 (0.010) | -0.001 (0.010) | 0.028+ (0.016) |
| *Prior co-investments* | 0.005* (0.002) | 0.017** (0.004) | 0.007* (0.003) |
| *Prior co-investments*$^2$ | -0.000* (0.000) | -0.000** (0.000) | -0.000* (0.000) |
| *Prior co-investments * Venture age* | | -0.002** (0.000) | |
| *Prior co-investments*$^2$ ** Venture age* | | 0.000** (0.000) | |
| *Prior co-investments * Geographical concentration* | | | -0.001* (0.000) |
| *Prior co-investments*$^2$ ** Geographical concentration* | | | 0.000* (0.000) |
| Venture location fixed effects | Yes | Yes | Yes |
| Venture industry fixed effects | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes |
| Venture-year observations | 24,114 | 24,114 | 24,114 |
| Ventures | 4,456 | 4,456 | 4,456 |
| Log-pseudolikelihood | -22,124.948 | -22,116.398 | -22,123.046 |
| Wald chi² | 890.23** | 948.61** | 884.76** |

**Table R3. Considering all variables at the time of first investment round on the likelihood to exit 5 years later (cross sectional)**

| Variable | 1 | 2 | 3 |
|---|---|---|---|
| *Market hotness* | -0.001 (0.001) | -0.001 (0.001) | -0.001 (0.001) |
| *Equity invested* | -0.013** (0.004) | -0.013** (0.004) | -0.013** (0.004) |
| *Investment rounds* | 0.186** (0.050) | 0.186** (0.050) | 0.185** (0.050) |
| *Syndicate experience* | 0.005** (0.001) | 0.005** (0.001) | 0.005** (0.001) |
| *Potential dyads in syndicate* | 0.053** (0.013) | 0.052** (0.013) | 0.048** (0.013) |
| *Venture age* | 0.055** (0.011) | 0.049** (0.013) | 0.047** (0.012) |
| *Geographical concentration* | -0.045+ (0.027) | -0.045+ (0.027) | -0.028 (0.040) |
| *Prior co-investments* | 0.003 (0.006) | 0.004 (0.007) | 0.014+ (0.008) |
| *Prior co-investments*$^2$ | -0.000* (0.000) | -0.000 (0.000) | -0.000* (0.000) |
| *Prior co-investments * Venture age* | | -0.001 (0.003) | |
| *Prior co-investments*$^2$ ** Venture age* | | 0.000 (0.000) | |
| *Prior co-investments * Geographical concentration* | | | -0.001 (0.001) |
| *Prior co-investments*$^2$ ** Geographical concentration* | | | 0.000* (0.000) |
| Venture location fixed effects | Yes | Yes | Yes |
| Venture industry fixed effects | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes |
| Constant | -0.235 (0.352) | -0.239 (0.352) | -0.232 (0.352) |
| Venture-year observations | 4,363 | 4,363 | 4,363 |
| Ventures | 4,363 | 4,363 | 4,363 |
| Log-likelihood | -2,761.441 | -2,761.384 | -2,759.457 |
| Wald chi² | 248.67** | 248.71** | 255.57** |

*Notes.* ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$.

All models fit a logit regression with random effects. Robust standard errors reported within parentheses. Models only include the initial investment round. The dependent variable is the venture's likelihood of exiting through IPO or M&A over the next five years.

**Table R4. Panel logit regressions testing the effects of VCs' prior co-investments among all syndicate members**

| Variable | 1 | 2 | 3 |
|---|---|---|---|
| *Market hotness* | 0.002** (0.001) | 0.002** (0.001) | 0.002** (0.001) |
| *Equity invested* | -0.000+ (0.000) | -0.000+ (0.000) | -0.000+ (0.000) |
| *Investment rounds* | 0.084** (0.011) | 0.084** (0.011) | 0.085** (0.011) |
| *Syndicate experience* | 0.002** (0.000) | 0.002** (0.000) | 0.002** (0.000) |
| *Potential dyads in syndicate* | 0.002 (0.003) | 0.002 (0.003) | 0.002 (0.003) |
| *Venture age* | 0.105** (0.008) | 0.112** (0.008) | 0.106** (0.008) |
| *Geographical concentration* | 0.006 (0.009) | 0.004 (0.009) | 0.016 (0.011) |
| *Prior co-investments* | 0.007* (0.003) | 0.018** (0.005) | 0.012** (0.003) |
| *Prior co-investments*$^2$ | -0.000+ (0.000) | -0.000+ (0.000) | -0.000** (0.000) |
| *Prior co-investments * Venture age* | | -0.002** (0.001) | |
| *Prior co-investments*$^2$ ** Venture age* | | 0.000 (0.000) | |
| *Prior co-investments * Geographical concentration* | | | -0.001** (0.000) |
| *Prior co-investments*$^2$ ** Geographical concentration* | | | 0.000** (0.000) |
| Venture location fixed effects | Yes | Yes | Yes |
| Venture industry fixed effects | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes |
| Constant | -4.127** (0.740) | -4.159** (0.740) | -4.146** (0.739) |
| Venture-year observations | 28,863 | 28,863 | 28,863 |
| Ventures | 4,550 | 4,550 | 4,550 |
| Log-likelihood | -8,798.709 | -8,792.165 | -8,794.013 |
| Wald chi² | 807.44** | 821.43** | 824.33** |

*Notes.* ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$.

All models fit a panel logit regression with random effects. Robust standard errors reported within parentheses. Prior co-investments are accounted taking into consideration the first round investors only. The dependent variable is the venture's likelihood of exiting through IPO or M&A.

**Table R5. Panel logit regressions testing the effects of VCs' prior co-investments among all syndicate members**

| Variable | 2 | 3 | 4 |
|---|---|---|---|
| *Market hotness* | 0.003** (0.001) | 0.003** (0.001) | 0.003** (0.001) |
| *Equity invested* | -0.001* (0.000) | -0.001* (0.000) | -0.001* (0.000) |
| *Investment rounds* | 0.081** (0.010) | 0.079** (0.009) | 0.078** (0.010) |
| *Syndicate experience* | 0.001** (0.000) | 0.001** (0.000) | 0.001** (0.000) |
| *Potential dyads in syndicate* | 0.001 (0.003) | 0.002 (0.003) | 0.001 (0.003) |
| *Venture age* | 0.103** (0.008) | 0.124** (0.008) | 0.103** (0.008) |
| *Geographical concentration* | 0.011 (0.008) | 0.002 (0.007) | 0.052** (0.014) |
| *Prior co-investments* | 0.006* (0.003) | 0.020** (0.003) | 0.007** (0.003) |
| *Prior co-investments*$^2$ | -0.000** (0.000) | -0.000** (0.000) | -0.000* (0.000) |
| *Prior co-investments * Venture age* | | -0.003** (0.000) | |
| *Prior co-investments*$^2$ ** Venture age* | | 0.000** (0.000) | |
| *Prior co-investments * Geographical concentration* | | | -0.001** (0.000) |
| *Prior co-investments*$^2$ ** Geographical concentration* | | | 0.000** (0.000) |
| Venture location fixed effects | Yes | Yes | Yes |
| Venture industry fixed effects | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes |
| Constant | -4.212** (0.742) | -4.299** (0.742) | -4.221** (0.739) |
| Venture-year observations | 28,863 | 28,863 | 28,863 |
| Ventures | 4,550 | 4,550 | 4,550 |
| Log-likelihood | -8,782.805 | -8,740.747 | -8,773.846 |
| Wald chi² | 840.98** | 909.46** | 874.57** |

*Notes.* ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$.

All models fit a panel logit regression with random effects. Robust standard errors reported within parentheses. Prior co-investments does not controls for potential VC withdrawals by basing measures exclusively on VCs active in the latest investment round, but rather includes all VCs that invested up to date. The dependent variable is the venture's likelihood of exiting through IPO or M&A.

**Table R6. Considering Prior co-investments between the lead investor and other investors only**

| Variable | 1 | 2 | 3 |
|---|---|---|---|
| *Market hotness* | 0.003** (0.001) | 0.003** (0.001) | 0.003** (0.001) |
| *Equity invested* | -0.001* (0.000) | -0.000+ (0.000) | -0.001* (0.000) |
| *Investment rounds* | 0.061** (0.010) | 0.059** (0.010) | 0.061** (0.010) |
| *Lead experience* | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) |
| *Potential dyads with lead* | 0.104** (0.013) | 0.098** (0.012) | 0.100** (0.013) |
| *Venture age* | 0.103** (0.008) | 0.123** (0.009) | 0.103** (0.008) |
| *Geographical concentration* | -0.020+ (0.010) | -0.028** (0.010) | 0.047** (0.017) |
| *Prior co-investments* | 0.029** (0.005) | 0.057** (0.007) | 0.034** (0.006) |
| *Prior co-investments*$^2$ | -0.000** (0.000) | -0.001** (0.000) | -0.000** (0.000) |
| *Prior co-investments * Venture age* | | -0.005** (0.000) | |
| *Prior co-investments*$^2$ ** Venture age* | | 0.000* (0.000) | |
| *Prior co-investments * Geographical concentration* | | | -0.005** (0.000) |
| *Prior co-investments*$^2$ ** Geographical concentration* | | | 0.000** (0.000) |
| Venture location fixed effects | Yes | Yes | Yes |
| Venture industry fixed effects | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes |
| Constant | -4.439** (0.742) | -4.516** (0.743) | -4.478** (0.736) |
| Venture-year observations | 28,863 | 28,863 | 28,863 |
| Ventures | 4,550 | 4,550 | 4,550 |
| Log-likelihood | -8,728.016 | -8,704.340 | -8,719.763 |
| Wald chi² | 997.50** | 1,057.90** | 1,023.37** |

*Notes.* ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$.

All models fit a panel logit regression with random effects. Robust standard errors reported within parentheses. Prior co-investments accounts for prior co-investments between the lead VC and all VCs that invested up to date. The dependent variable is the venture's likelihood of exiting through IPO or M&A.

**Table R7a. Including only syndicates with syndicate size between 2 and 5**

| Variable | 1 | 2 | 3 |
|---|---|---|---|
| *Market hotness* | 0.002 (0.001) | 0.002 (0.001) | 0.002 (0.001) |
| *Equity invested* | -0.000 (0.000) | -0.000 (0.000) | -0.000 (0.000) |
| *Investment rounds* | 0.071** (0.011) | 0.071** (0.011) | 0.071** (0.011) |
| *Syndicate experience* | 0.001** (0.000) | 0.001** (0.000) | 0.001** (0.000) |
| *Potential dyads in syndicate* | 0.129** (0.008) | 0.128** (0.008) | 0.126** (0.009) |
| *Venture age* | 0.089** (0.008) | 0.114** (0.010) | 0.089** (0.008) |
| *Geographical concentration* | 0.018 (0.018) | 0.011 (0.018) | 0.063* (0.027) |
| *Prior co-investments* | 0.016* (0.006) | 0.041** (0.009) | 0.024** (0.007) |
| *Prior co-investments*$^2$ | -0.000* (0.000) | -0.000** (0.000) | -0.000** (0.000) |
| *Prior co-investments * Venture age* | | -0.004** (0.001) | |
| *Prior co-investments*$^2$ ** Venture age* | | 0.000* (0.000) | |
| *Prior co-investments * Geographical concentration* | | | -0.005** (0.000) |
| *Prior co-investments*$^2$ ** Geographical concentration* | | | 0.000** (0.000) |
| Venture location fixed effects | Yes | Yes | Yes |
| Venture industry fixed effects | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes |
| Constant | -4.746** (0.948) | -4.885**(0.946) | -4.789**(0.926) |
| Venture-year observations | 18,538 | 18,538 | 18,538 |
| Ventures | 3,204 | 3,204 | 3,204 |
| Log-likelihood | -5,719.318 | -5,706.957 | -5,715.265 |
| Wald chi² | 1,140.60** | 1,143.25** | 1,155.05** |

*Notes.* ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$.

All models fit a panel logit regression with random effects. Robust standard errors reported within parentheses. Syndicate are restricted to sizes between two and five (small syndicates). The dependent variable is the venture's likelihood of exiting through IPO or M&A.

**Table R7b. Including only syndicates with syndicate size between 6 and 10**

| Variable | 1 | 2 | 3 |
|---|---|---|---|
| *Market hotness* | 0.005** (0.002) | 0.004** (0.002) | 0.005** (0.002) |
| *Equity invested* | -0.000 (0.000) | -0.000 (0.000) | -0.000 (0.000) |
| *Investment rounds* | 0.005 (0.020) | 0.006 (0.018) | 0.004 (0.020) |
| *Syndicate experience* | 0.000 (0.000) | 0.000 (0.000) | -0.000 (0.000) |
| *Potential dyads in syndicate* | 0.067** (0.005) | 0.063** (0.005) | 0.066** (0.005) |
| *Venture age* | 0.108** (0.016) | 0.153** (0.018) | 0.108** (0.016) |
| *Geographical concentration* | 0.011 (0.013) | 0.007 (0.012) | 0.051** (0.020) |
| *Prior co-investments* | 0.012** (0.004) | 0.028** (0.005) | 0.019** (0.005) |
| *Prior co-investments*$^2$ | -0.000** (0.000) | -0.000** (0.000) | -0.000** (0.000) |
| *Prior co-investments * Venture age* | | -0.003** (0.001) | |
| *Prior co-investments*$^2$ ** Venture age* | | 0.000** (0.000) | |
| *Prior co-investments * Geographical concentration* | | | -0.001** (0.000) |
| *Prior co-investments*$^2$ ** Geographical concentration* | | | 0.000** (0.000) |
| Venture location fixed effects | Yes | Yes | Yes |
| Venture industry fixed effects | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes |
| Constant | -4.105** (1.209) | -4.365** (1.222) | -4.100** (1.204) |
| Venture-year observations | 8,990 | 8,990 | 8,990 |
| Ventures | 1,216 | 1,216 | 1,216 |
| Log-likelihood | -2,377.636 | -2,364.849 | -2,373.052 |
| Wald chi² | 730.77** | 717.20** | 750.63** |

*Notes.* ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$.

All models fit a panel logit regression with random effects. Robust standard errors reported within parentheses. Syndicate are restricted to sizes between six and ten (large syndicates). The dependent variable is the venture's likelihood of exiting through IPO or M&A.

**Table R8a. Considering Prior co-investments within the last 3 years between investors joining the syndicate within the last 3 years**

| Variable | 2 | 3 | 4 |
|---|---|---|---|
| *Market hotness* | 0.003** (0.001) | 0.003** (0.001) | 0.003** (0.001) |
| *Equity invested* | -0.001* (0.000) | -0.001* (0.000) | -0.001* (0.000) |
| *Investment rounds* | 0.083** (0.010) | 0.082** (0.010) | 0.083** (0.010) |
| *Syndicate experience* | 0.001** (0.000) | 0.001** (0.000) | 0.001** (0.000) |
| *Potential dyads in syndicate* | -0.001 (0.003) | -0.000 (0.003) | -0.002 (0.003) |
| *Venture age* | 0.103** (0.008) | 0.113** (0.008) | 0.103** (0.008) |
| *Geographical concentration* | 0.004 (0.009) | 0.002 (0.008) | 0.023+ (0.013) |
| *Prior co-investments* | 0.018** (0.004) | 0.032** (0.005) | 0.022** (0.004) |
| *Prior co-investments*$^2$ | -0.000** (0.000) | -0.000** (0.000) | -0.000** (0.000) |
| *Prior co-investments * Venture age* | | -0.002* (0.001) | |
| *Prior co-investments*$^2$ ** Venture age* | | 0.000 (0.000) | |
| *Prior co-investments * Geographical concentration* | | | -0.001* (0.001) |
| *Prior co-investments*$^2$ ** Geographical concentration* | | | 0.000** (0.000) |
| Venture location fixed effects | Yes | Yes | Yes |
| Venture industry fixed effects | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes |
| Constant | -4.201** (0.742) | -4.266** (0.743) | -4.212** (0.740) |
| Venture-year observations | 28,863 | 28,863 | 28,863 |
| Ventures | 4,550 | 4,550 | 4,550 |
| Log-likelihood | -8,780.570 | -8,769.383 | -8,755.183 |
| Wald chi² | 847.54** | 907.05** | 858.96** |

*Notes.* ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$.

All models fit a panel logit regression with random effects. The measure prior co-investment only takes into account prior co-investments arising within the last three years and ignores older ones. Robust standard errors reported within parentheses. The dependent variable is the venture's likelihood of exiting through IPO or M&A.

**Table R8b. Considering Prior co-investments within the last 5 years between investors joining the syndicate within the last 5 years**

| Variable | 2 | 3 | 4 |
|---|---|---|---|
| *Market hotness* | 0.003** (0.001) | 0.003** (0.001) | 0.003** (0.001) |
| *Equity invested* | -0.001* (0.000) | -0.000* (0.000) | -0.001* (0.000) |
| *Investment rounds* | 0.082** (0.010) | 0.082** (0.010) | 0.082** (0.010) |
| *Syndicate experience* | 0.001** (0.000) | 0.001** (0.000) | 0.001** (0.000) |
| *Potential dyads in syndicate* | -0.002 (0.003) | -0.002 (0.003) | -0.003 (0.003) |
| *Venture age* | 0.104** (0.008) | 0.118** (0.009) | 0.104** (0.008) |
| *Geographical concentration* | 0.003 (0.008) | 0.000 (0.008) | 0.028* (0.013) |
| *Prior co-investments* | 0.014** (0.003) | 0.029** (0.004) | 0.018** (0.003) |
| *Prior co-investments*$^2$ | -0.000** (0.000) | -0.000** (0.000) | -0.000** (0.000) |
| *Prior co-investments * Venture age* | | -0.002* (0.001) | |
| *Prior co-investments*$^2$ ** Venture age* | | 0.000 (0.000) | |
| *Prior co-investments * Geographical concentration* | | | -0.001** (0.001) |
| *Prior co-investments*$^2$ ** Geographical concentration* | | | 0.000** (0.000) |
| Venture location fixed effects | Yes | Yes | Yes |
| Venture industry fixed effects | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes |
| Constant | -4.195** (0.742) | -4.285** (0.744) | -4.200** (0.740) |
| Venture-year observations | 28,863 | 28,863 | 28,863 |
| Ventures | 4,550 | 4,550 | 4,550 |
| Log-likelihood | -8,777.282 | -8,761.271 | -8,771.106 |
| Wald chi² | 831.09** | 903.87** | 850.68** |

*Notes.* ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$.

All models fit a panel logit regression with random effects. The measure prior co-investment only takes into account prior co-investments arising within the last five years and ignores older ones. Robust standard errors reported within parentheses. The dependent variable is the venture's likelihood of exiting through IPO or M&A.

**Table R8c. Considering Prior co-investments within the last 10 years between investors joining the syndicate within the last 10 years**

| Variable | 2 | 3 | 4 |
|---|---|---|---|
| *Market hotness* | 0.003** (0.001) | 0.003** (0.001) | 0.003** (0.001) |
| *Equity invested* | -0.001* (0.000) | -0.000* (0.000) | -0.001* (0.000) |
| *Investment rounds* | 0.081** (0.010) | 0.081** (0.010) | 0.080** (0.010) |
| *Syndicate experience* | 0.001** (0.000) | 0.001** (0.000) | 0.001** (0.000) |
| *Potential dyads in syndicate* | -0.002 (0.003) | -0.000 (0.003) | -0.002 (0.003) |
| *Venture age* | 0.103** (0.008) | 0.121** (0.009) | 0.103** (0.008) |
| *Geographical concentration* | 0.008 (0.009) | 0.001 (0.008) | 0.044** (0.013) |
| *Prior co-investments* | 0.009** (0.003) | 0.023** (0.003) | 0.011** (0.003) |
| *Prior co-investments*$^2$ | -0.000* (0.000) | -0.000** (0.000) | -0.000* (0.000) |
| *Prior co-investments * Venture age* | | -0.002* (0.001) | |
| *Prior co-investments*$^2$ ** Venture age* | | 0.000** (0.000) | |
| *Prior co-investments * Geographical concentration* | | | -0.001** (0.000) |
| *Prior co-investments*$^2$ ** Geographical concentration* | | | 0.000** (0.000) |
| Venture location fixed effects | Yes | Yes | Yes |
| Venture industry fixed effects | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes |
| Constant | -4.199** (0.742) | -4.307** (0.744) | -4.208**(0.740) |
| Venture-year observations | 28,863 | 28,863 | 28,863 |
| Ventures | 4,550 | 4,550 | 4,550 |
| Log-likelihood | -8,782.462 | -8,753.993 | -8,774.561 |
| Wald chi² | 819.46** | 915.89** | 846.51** |

*Notes.* ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$.

All models fit a panel logit regression with random effects. The measure prior co-investment only takes into account prior co-investments arising within the last ten years and ignores older ones. Robust standard errors reported within parentheses. The dependent variable is the venture's likelihood of exiting through IPO or M&A.

**Table R9. Adjusting Prior co-investments for the recency of prior collaborationssss**

| Variable | 1 | 2 | 3 |
|---|---|---|---|
| *Market hotness* | 0.003** (0.001) | 0.003** (0.001) | 0.003** (0.001) |
| *Equity invested* | -0.000 (0.000) | -0.000 (0.000) | -0.000 (0.000) |
| *Investment rounds* | 0.094** (0.009) | 0.093** (0.009) | 0.095** (0.009) |
| *Syndicate experience* | 0.001** (0.000) | 0.001** (0.000) | 0.001** (0.000) |
| *Potential dyads in syndicate* | -0.002 (0.004) | -0.002 (0.004) | 0.000 (0.004) |
| *Venture age* | 0.099** (0.008) | 0.107** (0.008) | 0.099** (0.008) |
| *Geographical concentration* | -0.002 (0.012) | -0.004 (0.012) | 0.032+ (0.018) |
| *Prior co-investments* | 0.016** (0.005) | 0.030** (0.006) | 0.018** (0.005) |
| *Prior co-investments*$^2$ | -0.000** (0.000) | -0.000** (0.000) | -0.000** (0.000) |
| *Prior co-investments * Venture age* | | -0.003** (0.001) | |
| *Prior co-investments*$^2$ ** Venture age* | | 0.000 (0.000) | |
| *Prior co-investments * Geographical concentration* | | | -0.002* (0.001) |
| *Prior co-investments*$^2$ ** Geographical concentration* | | | 0.000** (0.000) |
| Venture location fixed effects | Yes | Yes | Yes |
| Venture industry fixed effects | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes |
| Constant | -4.192** (0.739) | -4.240** (0.740) | -4.208** (0.736) |
| Venture-year observations | 28,863 | 28,863 | 28,863 |
| Ventures | 4,550 | 4,550 | 4,550 |
| Log-likelihood | -8,809.705 | -8,803.762 | -8,807.173 |
| Wald chi² | 817.51** | 850.19** | 823.12** |

*Notes.* ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$.

All models fit a panel logit regression with random effects. Prior co-investments are weighted by recentness. Robust standard errors reported within parentheses. The dependent variable is the venture's likelihood of exiting through IPO or M&A.

**Table R10. Replacing Prior co-investments with Prior successful co-investments (exited through IPO or M&A)**

| Variable | 1 | 2 | 3 |
|---|---|---|---|
| *Market hotness* | 0.003** (0.001) | 0.003** (0.001) | 0.003** (0.001) |
| *Equity invested* | -0.000 (0.000) | -0.000 (0.000) | -0.000 (0.000) |
| *Investment rounds* | 0.095** (0.009) | 0.092** (0.009) | 0.095** (0.009) |
| *Syndicate experience* | 0.001** (0.000) | 0.001** (0.000) | 0.001** (0.000) |
| *Potential dyads in syndicate* | 0.001 (0.004) | 0.001 (0.004) | 0.000 (0.004) |
| *Venture age* | 0.099** (0.008) | 0.108** (0.008) | 0.099** (0.008) |
| *Geographical concentration* | 0.000 (0.012) | -0.004 (0.012) | 0.039* (0.018) |
| *Prior successful co-investments* | 0.015** (0.004) | 0.029** (0.005) | 0.017** (0.004) |
| *Prior successful co-investments*$^2$ | -0.000** (0.000) | -0.000** (0.000) | -0.000** (0.000) |
| *Prior successful co-investments * Venture age* | | -0.002** (0.001) | |
| *Prior successful co-investments*$^2$ ** Venture age* | | 0.000** (0.000) | |
| *Prior successful co-investments * Geographical concentration* | | | -0.002** (0.001) |
| *Prior successful co-investments*$^2$ ** Geographical concentration* | | | 0.000** (0.000) |
| Venture location fixed effects | Yes | Yes | Yes |
| Venture industry fixed effects | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes |
| Constant | -4.193** (0.739) | -4.239** (0.740) | -4.211** (0.736) |
| Venture-year observations | 28,863 | 28,863 | 28,863 |
| Ventures | 4,550 | 4,550 | 4,550 |
| Log-likelihood | -8,805.838 | -8,797.195 | -8,802.575 |
| Wald chi² | 826.13** | 869.58** | 837.40** |

*Notes.* ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$.

All models fit a panel logit regression with random effects. Robust standard errors reported within parentheses. *Prior successful co-investments* only takes into accounts successful prior co-investments. The dependent variable is the venture's likelihood of exiting through IPO or M&A.

**Table R11a. Replacing Geographical concentration with Syndicate duration to test H3 interactions**

| Variable | 1 | 2 | 3 |
|---|---|---|---|
| *Market hotness* | 0.003** (0.001) | 0.003** (0.001) | 0.003** (0.001) |
| *Equity invested* | -0.000+ (0.000) | -0.000 (0.000) | -0.000+ (0.000) |
| *Investment rounds* | 0.092** (0.010) | 0.087** (0.010) | 0.088** (0.010) |
| *Syndicate experience* | 0.001* (0.000) | 0.001** (0.000) | 0.000+ (0.000) |
| *Potential dyads in syndicate* | -0.007 (0.005) | -0.011** (0.004) | -0.009* (0.004) |
| *Geographical concentration* | 0.006 (0.014) | -0.001 (0.013) | -0.002 (0.013) |
| *Venture age* | 0.098** (0.008) | 0.114** (0.009) | 0.099** (0.008) |
| *Syndicate duration* | 0.016** (0.003) | 0.021** (0.004) | 0.026** (0.004) |
| *Prior co-investments* | 0.008* (0.003) | 0.025** (0.004) | 0.017** (0.003) |
| *Prior co-investments*$^2$ | -0.000** (0.000) | -0.000** (0.000) | -0.000** (0.000) |
| *Prior co-investments * Venture age* | | -0.003** (0.001) | |
| *Prior co-investments*$^2$ ** Venture age* | | 0.000** (0.000) | |
| *Prior co-investments * Syndicate duration* | | | -0.001** (0.000) |
| *Prior co-investments*$^2$ ** Syndicate duration* | | | 0.000** (0.000) |
| Venture location fixed effects | Yes | Yes | Yes |
| Venture industry fixed effects | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes |
| Constant | -4.186** (0.743) | -4.264** (0.747) | -4.180** (0.745) |
| Venture-year observations | 28,863 | 28,863 | 28,863 |
| Ventures | 4,550 | 4,550 | 4,550 |
| Log-likelihood | -8,786.116 | -8,764.315 | -8,767.262 |
| Wald chi² | 812.26** | 849.59** | 843.33** |

*Notes.* ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$.

All models fit a panel logit regression with random effects. Robust standard errors reported within parentheses. The dependent variable is the venture's likelihood of exiting through IPO or M&A.

**Table R11b. Replacing Geographical concentration with Investment rounds to test H3 interactions**

| Variable | 2 | 3 | 4 |
|---|---|---|---|
| *Market hotness* | 0.003** (0.001) | 0.003** (0.001) | 0.003** (0.001) |
| *Equity invested* | -0.000 (0.000) | -0.000 (0.000) | -0.000 (0.000) |
| *Syndicate experience* | 0.001** (0.000) | 0.001** (0.000) | 0.001** (0.000) |
| *Potential dyads in syndicate* | 0.002 (0.004) | 0.001 (0.004) | 0.003 (0.004) |
| *Geographical concentration* | 0.002 (0.012) | -0.002 (0.012) | -0.002 (0.012) |
| *Venture age* | 0.099** (0.008) | 0.109** (0.008) | 0.101** (0.008) |
| *Investment rounds* | 0.095** (0.009) | 0.092** (0.009) | 0.115** (0.011) |
| *Prior co-investments* | 0.009** (0.003) | 0.020** (0.004) | 0.023** (0.004) |
| *Prior co-investments*$^2$ | -0.000** (0.000) | -0.000** (0.000) | -0.000** (0.000) |
| *Prior co-investments * Venture age* | | -0.002** (0.000) | |
| *Prior co-investments*$^2$ ** Venture age* | | 0.000* (0.000) | |
| *Prior co-investments * Investment rounds* | | | -0.003** (0.000) |
| *Prior co-investments*$^2$ ** Investment rounds* | | | 0.000* (0.000) |
| Venture location fixed effects | Yes | Yes | Yes |
| Venture industry fixed effects | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes |
| Constant | -4.193** (0.739) | -4.245** (0.740) | -4.270** (0.739) |
| Venture-year observations | 28,863 | 28,863 | 28,863 |
| Ventures | 4,550 | 4,550 | 4,550 |
| Log-likelihood | -8,807.505 | -8,798.411 | -8,789.510 |
| Wald chi² | 823.29** | 862.57** | 881.05** |

*Notes.* ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$.

All models fit a panel logit regression with random effects. Robust standard errors reported within parentheses. The dependent variable is the venture's likelihood of exiting through IPO or M&A.

**Table R12. Accounting for differences between syndicates vs solo investments (Heckman probit)**

| Variable | 1 | 2 | 3 |
|---|---|---|---|
| *Market hotness* | 0.001** (0.000) | 0.001** (0.000) | 0.001** (0.000) |
| *Equity invested* | -0.000 (0.000) | -0.000 (0.000) | -0.000 (0.000) |
| *Investment rounds* | 0.045** (0.005) | 0.044** (0.005) | 0.045** (0.005) |
| *Syndicate experience* | 0.000 (0.000) | 0.000+ (0.000) | 0.000 (0.000) |
| *Potential dyads in syndicate* | -0.004+ (0.002) | -0.004+ (0.002) | -0.004+ (0.002) |
| *Venture age* | 0.056** (0.003) | 0.061** (0.003) | 0.056** (0.003) |
| *Geographical concentration* | -0.000 (0.007) | -0.002 (0.007) | 0.009 (0.010) |
| *Prior co-investments* | 0.005** (0.001) | 0.010** (0.002) | 0.005** (0.002) |
| *Prior co-investments*$^2$ | -0.000** (0.000) | -0.000** (0.000) | -0.000+ (0.000) |
| *Prior co-investments * Venture age* | | -0.001** (0.000) | |
| *Prior co-investments*$^2$ ** Venture age* | | 0.000* (0.000) | |
| *Prior co-investments * Geographical concentration* | | | -0.000 (0.000) |
| *Prior co-investments*$^2$ ** Geographical concentration* | | | 0.000 (0.000) |
| Venture location fixed effects | Yes | Yes | Yes |
| Venture industry fixed effects | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes |
| Constant | -2.148** (0.308) | -2.184** (0.310) | -2.158** (0.308) |
| First stage venture-year obs. | 44,328 | 44,328 | 44,328 |
| Second stage venture-year obs. | 28,863 | 28,863 | 28,863 |
| Ventures | 4,550 | 4,550 | 4,550 |
| Log-likelihood | -26,443.00 | -26,435.29 | -26,442.39 |
| Wald chi² | 8,509.08** | 7,677.23** | 8,474.40** |

*Notes.* ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$.

All models fit a Heckman probit regression with selection correction for syndication. The dependent variable in the first stage is a dummy variable indicating whether the investment is syndicated. In the first stage we include all control variables, all fixed effects, the two moderators reported in the second stage. As instrument we include the number of VC investment rounds in the focal venture's industry-year. This variable is negative and significant (B = -0.000; p < 0.01). The dependent variable in the second stage is the venture's likelihood of exiting through IPO or M&A. Robust standard errors reported with parentheses.

----- END OF ONLINE APPENDIX -----