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Venture Capital Coordination in Syndicates, Corporate Monitoring, and Firm Performance

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March 2021

Working Paper 20210304

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Keywords: Venture capital, geographic concentration, coordination, monitoring, exit, staged financing, board
JEL Classification: G23, G24, G34

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1. Introduction

The role of venture capital (VC) investment in creating value for early-stage entrepreneurial firms has been extensively examined in previous studies. For example, prior literature shows that venture capitalists play a critical role in promoting innovation and growth by actively monitoring their portfolio firms (e.g., Hellmann and Puri (2002), Chemmanur, Krishnan, and Nandy (2011), Puri and Zarutskie (2012), Bernstein, Giroud, and Townsend (2016)). However, despite the prevalence of syndication in the majority of VC investments,[1] VC investors' coordination in syndicates and their role in monitoring portfolio firms are less understood. In this study, we extend prior studies on the monitoring role of VC investors by examining how close coordination among VC investors affects firm performance and their choices of ex ante contractual investment terms.

VC investors' syndications and their coordination are particularly important for financing early-stage firms. Because the value of entrepreneurial firms is closely related to their growth options, which are characterized by high information asymmetry and uncertainty, sharing value-relevant private information about these firms among VC investors and providing value-added services to them become important issues in VC syndication.[2] However, the free-rider problem and divergent incentives within VC syndicates can cause coordination friction and thus prevent VC investors from effectively monitoring their portfolio firms (e.g., Casamatta and Haritchabalet (2007), Nanda and Rhodes-Knopf (2019)).[3] We argue that VC investors' geographic concentration mitigates this coordination friction and reduces the costs of coordinated actions, resulting in more effective coordination and monitoring.

Specifically, we use VC investors' geographic concentration to measure the incentives and effectiveness of their coordination efforts in syndication. We focus on VC investors' geographic concentration because the distance between the VC investors can have a significant effect on the time and effort that these investors need for effective networking, which is essential

[1] According to the VentureXpert database, approximately 79.4% of 22,247 VC-backed entrepreneurial portfolio firms in the United States received investments from multiple VC investors during 1995–2015.

[2] See, for example, Lerner (1994), Sorensen and Stuart (2001), Cestone, Lerner, and White (2006), Casamatta and Haritchabalet (2007), and Chemmanur and Tian (2011) for a detailed discussion of the importance of VC syndication in the financing of early-stage entrepreneurial firms.

[3] Previous studies show that differences in fund size, investment horizons, fundraising cycles, contracts with limited partners, market cycles, and the free-rider problem are important drivers of coordination frictions in VC syndicates (e.g., Barott (2016), Chakraborty and Ewens (2016), Nanda and Rhodes-Knopf (2019)).

to the functioning of VC.[4] For example, Bygrave (1987) shows that VC investors rely extensively on networking within their syndicates to share information. Hochberg, Ljungqvist, and Lu (2007) find that VC networks enhance fund performance by providing a broad range of inputs for entrepreneurial firms. The recent survey by Gompers et al. (2020) further shows that VC networks play essential roles in terms of both value-added activities and deal sourcing and that geography and social connections are important considerations for VC investors when choosing their syndicate partners, together with partners' expertise, past shared successes, track records, and capital. In addition, Wright and Lockett (2002) show that lead VC firms, which play an instrumental role in syndicate management, tend to communicate with other syndicate members every month and have quarterly face-to-face meetings. Thus, by reducing travel time and cost, VC investors' geographic concentration can help them engage in frequent networking, enabling the efficient sharing of their firm-specific information and enhancing corporate monitoring effectiveness (Pagano and Jappelli (1993), Hong, Kubik, and Stein (2005), Doblas-Madrid and Minetti (2013), Doidge et al. (2015)).[5]

These arguments suggest that VC investors' geographic concentration increases their coordination effort to share value-relevant soft information[6] and their ability to observe other VC investors' risk preferences and other behaviors, thus decreasing their information asymmetry vis-à-vis other VC investors. This lower information asymmetry reduces moral hazard problems

[4] VC investors in a syndicate frequently interact with each other in formal and informal ways, such as attending demo days and social meetings to exchanging information on existing investments and new deals. Important soft information, such as fundraising plans and investment horizons, that determines VC investors' investment priority and strategy can be credibly exchanged when they are close to each other. Moreover, geographically dispersed VC investors who face travel disadvantages may also face greater differences in culture and institutional environments relative to geographically proximate VC investors.

[5] Consistent with the prior literature (e.g., Bygrave (1987), Wright and Lockett (2002)), our private interviews with several VC industry professionals, including Mubadala Ventures and Samsung Ventures in the United States, Sequoia Capital in China, and CreditEase in Hong Kong, suggest that VC investors in a syndication network indeed visit each other to discuss issues related to their portfolio firms. The interviewees also indicate that, given the greater information asymmetry of early-stage firms, the communication intensity and demand for active commitment are particularly important in their VC investments. They further note that their coordination can be improved if a direct flight is introduced because such a flight reduces travel time. Overall, our interviews with VC investors show a consensus among VC fund managers that a change in the coordination cost arising from a reduction in travel time shifts the spatial range of their investments and their coordination intensity. We thank Shaun Lee at Mubadala Ventures, Andrew Wu at Sequoia Capital, Sunghoon Yang and Sangchul Bae at Samsung Ventures, and Seungha Ku at CreditEase for their discussions on issues related to VC investors' networking and coordination.

[6] The key characteristics of an entrepreneurial firm, such as skilled human capital, organizational endowment and culture, and superior technology, tend to mostly be soft information and are highly valuable to VC investors (Drucker (2012)). Cornelli, Kominek, and Ljungqvist (2013) highlight the importance of soft information in monitoring managers of private-equity-backed firms.

among VC investors and mitigates free-rider problems in corporate governance (Grossman and Hart (1980), Holmstrom (1982), Shleifer and Vishny (1986)), thereby increasing their monitoring and coordination incentives.[7] Although a close distance between VC investors and firms makes it easier for VC investors to obtain firm-specific private information, it does not allow VC investors to directly observe other VC investor-specific characteristics and actions, such as their risk preference and monitoring incentives, which are important to understanding VC investors' coordination incentives in syndicates.

These arguments suggest several testable predications. First, we expect that VC investors' geographic concentration improves coordination outcomes in portfolio firm exit performance and follow-up financing rounds through improved coordination among geographically proximate VC investors. Specifically, to the extent that VC investors' coordination improves portfolio firm performance through superior monitoring and value-added service, we predict that the portfolio firms of geographically proximate VC investors are more likely to exit successfully through IPOs or acquisitions than are those of geographically dispersed VC investors. We also predict that the proportion of existing VC investors who participate in follow-up financing rounds is higher for geographically proximate VC investors than for geographically dispersed VC investors because of their better coordination. A different composition of VC investors in the follow-up round of syndication could imply a significant free-rider problem in the previous round and additional coordination costs for newly joined investors (Chemmanur and Tian (2011)). Therefore, the continuous participation of existing geographically proximate VC investors in the follow-up round of syndication can be important evidence of their better coordination.

Second, we expect that the lower coordination costs associated with a close geographic concentration allow geographically proximate VC investors to effectively monitor their portfolio firms, thus reducing their incentives to extensively rely on ex ante costly contractual investment terms designed to help protect their downside risk. The previous literature shows that various contractual arrangements, such as staged financing, convertible securities, and board participation, help VC investors alleviate agency problems in early-stage firms. For example, the

[7] Holmstrom (1982) argues that information asymmetries arise because individuals' actions cannot be observed and that these information asymmetries are the main source of free-rider problems. To the extent that contracting monitoring/coordination terms among VC investors in the syndicate is difficult and costly, these information asymmetry problems are likely to be particularly severe in VC syndicates.

staging of capital investments can mitigate agency problems in portfolio firms and reduce the risk to VC investors by generating option-like payoffs to entrepreneurs (e.g., Sahlman (1990), Admati and Pfleiderer (1994), Gompers (1995), Tian (2011)). By refusing to provide follow-up funding or abandoning a project if the entrepreneur fails to meet milestones, VC investors can constrain the entrepreneur's behavior, thereby reducing incentive conflict problems.[8] Thus, we predict that geographically dispersed VC investors focus more on staged financing because their inferior ability to monitor firms incentivizes them to use stricter ex ante contractual terms and other alternative governance mechanisms.

Similarly, VC investors' use of convertible securities can protect them against downside risk and provide entrepreneurs with strong incentives to exert greater effort (Casamatta (2003), Cornelli and Yosha (2003), Kaplan and Stromberg (2003; 2004), Schmidt (2003), Repullo and Suarez (2004), Dessi (2005), Hellmann (2006)). To the extent that geographically dispersed VC investors face greater information asymmetry and larger free-rider problems in coordination and monitoring than geographically proximate VC investors, they might have stronger incentives to include downside-protecting contractual cash flow rights, such as convertible securities, in their investments. Therefore, to constrain entrepreneurs' behavior, we expect geographically dispersed VC investors to use a larger proportion of convertible securities in their investments than do geographically proximate VC investors.

To address difficulties with effective monitoring, geographically dispersed VC investors may also influence managers through board participation. As a vigilant protector of shareholders' interests, boards are expected to play an important role in monitoring managers' performance (Fama (1980), Hermalin and Weisbach (1998)). In particular, because private firms whose stocks are not listed on exchanges face little pressure from external governance forces (e.g., stock market monitoring and the market for corporate control), internal governance systems such as boards of directors are expected to play an instrumental role in disciplining the managers

[8] Although VC staging offers benefits to investors by giving them the option to reduce their losses and stop investing in unsuccessful portfolio firms, it can also impose significant costs on them (Tian (2011)). For example, divided capital infusions through staging could lead to inefficient project implementation and under-investment problems because of a lack of economies of scale in the investment (Wang and Zhou (2004)). Moreover, staging could induce portfolio firms' myopic behavior because entrepreneurs have strong incentives to secure subsequent rounds of financing for the success of their firms. Staging also incurs other direct and indirect contracting costs as a result of frequent negotiations. Therefore, VC investors engage in staged financing by considering both the costs and benefits of staging.

of these firms (Fama and Jensen (1983)). Thus, given that geographically dispersed VC investors face difficulties in information sharing and incur high costs when engaging in coordinated governance actions, we expect that these investors demand more board seats in their portfolio firms to overcome the disadvantages related to coordination.

Using a large sample of VC-backed U.S. entrepreneurial firms covered by Thomson Reuters' VentureXpert database during 1995-2015 and measuring VC investors' geographic concentration using VC (lead VC) fund-specific locations, we find results that are consistent with the previously described predictions. Specifically, after controlling for the physical distance between lead VC investors and portfolio firms; funding characteristics; and industry, year, first financing year, firm state, and lead VC investor fixed effects, we find that both the likelihood of a successful exit through IPOs or acquisitions and the proportion of existing VC investors who participate in a follow-up syndication round increase as the distance between VC investors decreases. To more clearly identify the causal inference in the effect of VC investors' geographic concentration on coordination outcomes, we use the introduction of new direct airline routes that reduce the travel times between VC investor locations as an exogenous shock to the geographic concentration (*Airline Shock*) (Giroud (2013), Bernstein, Giroud, and Townsend (2016)). Because we use the *Airline Shock* that occurs after initial VC investments, VC investors' initial screening abilities are largely fixed in our identification setting, allowing us to unambiguously examine VC investors' post-investment monitoring role in their portfolio firms.[9] Using difference-in-differences estimation, we find that the treatment increases the probability of a successful exit and the proportion of existing VC investors that participate in the follow-up syndication round by 5.3% and 1.4%, respectively. The results obtained using *Airline Shock* remain significant when we use a propensity score-matched sample and when we control for local economic conditions in the regressions. Overall, these results suggest that VC investors' better coordination—facilitated by their physical location—improves the coordination outcomes for portfolio firm exit performance and follow-up financing rounds by reducing information asymmetry and increasing monitoring effectiveness.

Turning to the analysis of the effects of VC investors' geographic concentration on their ex ante contractual terms and board participation, we find that the geographic dispersion of VC

[9] For example, the geographic proximity between VC investors can improve the screening abilities of VC syndicates and, thus, enable them to choose better startup firms with few entrepreneur moral hazard problems.

investors increases the extent of staged financing (i.e., a shorter time interval between successive rounds and a higher number of financing rounds) and the ratio of the amount of convertible securities used to the total funding amount in each financing round. Thus, geographically dispersed VC investors, who must incur high costs to monitor their portfolio firms because of location disadvantages, have strong incentives to impose ex ante contractual investment terms that help mitigate the agency conflicts of managers in portfolio firms. Moreover, using manually collected board information on portfolio firms, we find that the proportion of VC directors on the boards of their portfolio firms in an IPO year is negatively associated with VC investors' geographic concentration, suggesting that VC investors take more active positions on the board when geographic dispersion exacerbates coordination problems and increases the need for oversight. This result is again consistent with our prediction that a lack of effective coordination among VC investors encourages geographically dispersed VC investors to use alternative mechanisms to protect themselves.

To better understand the circumstances under which the impacts of VC investors' geographic concentration on their coordination outcomes and ex ante contractual investment terms are more pronounced, we examine whether the results from our identification tests are different across treatment and VC syndicate characteristics. We find that our results are driven primarily by reductions in travel time between lead VC investors and other VC investors, indicating that the airline shock helps increase the coordination between VC investors involving a lead VC investor. This result is consistent with our expectation, given that lead VC investors play an instrumental role in VC investments and networking in the syndicate and thus are very sensitive to coordination costs. We also find that the treatment effects are more pronounced for firms whose VC investors have little past experience to work together in the same syndicate, firms in the earlier years of the sample period (i.e., the period in which telecommunications technology is less developed), and firms with a larger number of VC investors in the syndicate. These results further support the view that the underlying channels for our results are closely related to VC investors' monitoring and coordination frictions in the post-investment period.

Our study contributes to the literature in at least three important ways. First, our study extends the literature on VC investments by showing the importance of VC investors' geographic concentration in their coordination and monitoring of portfolio firms. Previous studies exploring the role of geography in VC investments focus exclusively on the geographic

proximity between VC investors and portfolio firms and find evidence of local bias in VC investments (e.g., Sorenson and Stuart (2001), Cumming and Dai (2010)), higher representation of board membership in portfolio firms by geographically proximate VC investors (Lerner (1995)), and lower IPO underpricing of portfolio firms with geographically proximate VC investors (Butler and Goktan (2008)). More recently, Bernstein, Giroud, and Townsend (2016) show that entrepreneurs' innovation and exit performance are related to the geographic proximity of entrepreneurs and VC investors. Unlike these studies, we examine the coordination and monitoring roles of VC investors in syndicates using the geographic distance between VC investor locations to measure their coordination cost and provide new evidence on how their coordination affects firm performance and participation in a follow-up syndication round.

Second, our paper contributes to the VC literature by examining how VC investors' geographic concentration affects their incentives to choose certain ex ante contractual terms in VC investments. Existing studies show that VC contracts with entrepreneurs are consistent with the theoretical predictions of the principal-agent problem in financial contracting (e.g., Kaplan and Strömberg (2003), Hsu (2004), Cumming (2008), Bengtsson and Sensoy (2011), Da Rin, Hellmann, and Puri (2013)).[10] We focus on several aspects of contractual features in VC investments, such as staging, security choice, and board representation, and show how the difficulties in coordination and monitoring incentivize VC investors to choose contractual features designed to protect them from the downside risks of early-stage entrepreneurial firms.

Finally, our paper contributes to the literature that examines competing views on the rationales for VC syndication, that is, the value-added view versus the selection view.[11] By

[10] The previous literature on the principal-agent problem in financial contracting suggests that the free-rider problem within a VC syndicate can have a significant impact on VC contracts with entrepreneurs (Holmstrom (1979), Ross (1977), Diamond (1991), Aghion and Bolton (1992), Dewatripont and Tirole (1994), Kaplan and Strömberg (2003, 2004)). The coordination frictions within VC syndicates that arise from a free-rider problem among VC investors weaken these investors' incentives to monitor entrepreneurs, which increases entrepreneurs' agency problems, such as effort reductions after receiving VC investments, because they do not suffer the full consequences of effort reductions (Holmstrom (1979)). This increase in entrepreneurs' agency problems incentivizes VC investors to use more performance-sensitive, contingencies (e.g., staging and convertible securities) in VC contracts. Supporting this view, Gompers (1995) finds that firms with severe agency problems experience more frequent staging. Tian (2011) also finds that VC financing for portfolio firms far away from VC investors is characterized by a higher intensity of staging, shorter durations between successive rounds, and smaller investing amounts in each round.

[11] The value-added view suggests that VC syndication adds value to portfolio firms by pooling VC investors' complementary skills and information and providing intensive monitoring (e.g., Brander, Amit, and Antweiler (2002), Hochberg, Ljungqvist, and Lu (2007), Chemmanur and Tian (2011), Tian (2012), Bernstein, Giroud, and Townsend (2016)). In contrast, the selection view suggests that syndicates improve VC investors' ability to select better portfolio firms by certifying other VC investors' investments (e.g., Wilson (1968), Sah and Stiglitz (1986),

exploiting the exogenous variations in VC investors' coordination costs in the post-investment stage, we distinguish between these two competing views and find evidence supporting the value-added view of the monitoring role of VC syndication in exit outcomes and the design of ex ante contractual investment terms.[12]

The remainder of this paper is organized as follows. Section 2 discusses the sample, variable definitions, and summary statistics. Section 3 describes our identification strategy. In Section 4, we examine the effects of VC investors' geographic concentration on the likelihood of a successful exit and their continuous participation in the follow-up financing round. Section 5 presents the results of the impacts of VC investors' geographic concentration on the choice of ex ante contractual terms and board participation. In Section 6, we examine the heterogeneous effects of VC investors' geographic concentration on firm performance and ex ante contractual terms. Finally, we present our concluding remarks in Section 7.

2. Data, Measures of Geographic Concentration, and Summary Statistics

2.1. Sample

Our sample consists of VC-backed U.S. entrepreneurial firms covered in Thomson Reuters' VentureXpert database during 1995-2015.[13] VentureXpert, which has been used extensively in the prior literature, provides detailed firm-specific funding information, such as the VC investor's name, investment date of venture financing rounds, amount, security type, and

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Lerner (1994), Cestone, Lerner, and White (2006), Casamatta and Haritchabalet (2007), Das, Jo, and Kim (2011)) and by allowing VC investors to expand the spatial diversification of their portfolios (Sorensen and Stuart (2001)). See also Kaplan and Strömberg (2001) for theoretical and empirical comparisons between pre-investment screening and post-investment monitoring roles of VCs. Important to note is that the evidence regarding the VC investor's screening and monitoring efforts are closely interrelated, and both activities affect the design of the financial contracts between entrepreneurs and investors.

[12] Our findings do not necessarily suggest that VC investors should avoid syndicates with geographically distant VC investors because geographic dispersion incurs significant coordination costs. Several potential benefits stem from having syndicates with remote VC investors. For example, in their survey paper, Gompers et al. (2020) show that VC investors form syndicates mainly to obtain complementary expertise, to reduce capital constraints, and for risk sharing, suggesting that syndicate partners' expertise, past shared successes, reputations, and track records are important factors when forming a syndicate. To the extent that remote VC investors have better expertise and experience than nearby VC investors in VC investing, the benefits arising from geographic dispersion may exceed its costs (e.g., an increase in monitoring/coordination cost) for certain VC syndicates.

[13] Specifically, following previous VC studies (e.g., Tian (2011), Ewens, Rhodes-Kropf, and Strebulaev (2016), Cunninghamy, Ederer, and Ma (2020)), we use all VC-backed U.S. entrepreneurial firms that received their first VC financing between 1995 and 2010 and obtain information about their subsequent outcomes, such as the duration between financing rounds, exit outcomes, and follow-up syndication ratios for at least the next five years following the first financing.

the ultimate portfolio company outcome. We obtain VC fund- and portfolio firm-specific location information (nation, state, and city) from this database. We complement the VentureXpert database with the SDC Platinum and Compustat databases to construct firm- and industry-level control variables. We exclude firms with erroneous entries, such as for VC investment dates, stages, founding dates, and exit years. Our final sample consists of 10,594 unique VC-backed firms (45,604 VC investment rounds), including those that receive investments from a single VC investor (15.7% of our sample). Our main results are robust to excluding firms with a single VC investor from the sample.

For the analyses of the board structure, we manually collect data from the "Management" section of a firm's IPO prospectus as provided by the Securities and Exchange Commission (SEC). When a firm goes public, it is required to file Form 424B with the SEC, which contains a detailed description of its current management and board of directors, including their names, ages, positions, and brief profiles. We identify each firm's VC-affiliated directors by reading the profiles included in Form 424B. The sample consists of 817 IPO firms from 1995 to 2015.[14]

The data for identifying the introduction of new direct airline routes are collected from the T-100 Domestic Segment database, which contains monthly domestic nonstop segment information reported by both U.S. and foreign air carriers, including origins, destinations, departures performed, and ramp-to-ramp time when both the origin and destination airports are within the boundaries of the United States and its territories. All airlines with flights in the United States are required by law to file Form 41 with the U.S. Department of Transportation. These data are collected by the Office of Airline Information, Bureau of Transportation Statistics, Research and Innovative Technology Administration and are widely used by the aviation industry, press, and legislators to analyze information, such as traffic patterns.

2.2. Measures of Geographic Proximity among VC Investors

[14] Our sample size used in the analyses of the board structure is larger than those of prior studies (e.g., Lerner (1995), Baker and Gompers (2003)). We restrict our sample to VC-backed U.S. entrepreneurial firms that receive their first VC funding between 1995 and 2010 and exclude firms with erroneous information on VC investment and those with missing information on board structures from the sample.

We use the following three measures to calculate VC investors' geographic concentration.[15] *Ew Distances* is the logarithm of one plus the equally weighted geographic distance between all of a portfolio firm's VC investor pairs,[16] *Vw Distances (Equity)* is the logarithm of one plus the cumulative investment amount-weighted physical distance between all of a portfolio firm's VC investor pairs,[17] and *Lead Vw Distances (Equity)* is the logarithm of one plus the cumulative investment amount-weighted physical distance between a portfolio firm's lead VC investor and its other VC investors. Lead VC investors are identified as VC firms that invest the largest amount of equity in portfolio firms, as in Hochberg, Ljungqvist, and Lu (2007). For VC firms with an equal investment amount, we choose the one that invests in the firm at the earliest date as the lead VC investor. If ties still exist, we choose the lead VC investor based on its total fund size and the total number of firms in which it invests. Our results do not change when we define lead VC investors as those that invest the largest amount in the first financing round. Our results are also robust to using alternative measures of the VC investors' geographic concentration, including the number of unique states in which the VC fund is located, the portfolio-share-weighted physical distance between all of a portfolio firm's VC investor pairs, and the portfolio-share-weighted physical distance between a portfolio firm's lead VC investor and its other VC investors. We report these results in Online Appendix Table A.1.

We compute *Firm-Lead VC Distances* as the logarithm of one plus the physical distance between the portfolio firm and its lead VC investor. All of these physical distance measures are in units of miles and are calculated using the Haversine formula based on the geographic coordinates of the city locations for VC investors and portfolio firms. When the VC firm has

[15] When constructing VC investors' geographic concentration, we consider only U.S.-located VC funds because even a small number of foreign VC funds can exaggerate the VC investors' geographic concentration. In our sample, approximately 12% of the portfolio firms receive investments from at least one foreign VC investor in a certain round. As a robustness check, we examine whether our results are robust to controlling for the existence of foreign VC investors and find that the results do not change.

[16] We consider the syndicates within a firm rather than within each financing round. Entrepreneurial firms are most likely to issue new shares in each financing round because existing VC investors are rarely allowed to exit separately before IPOs or acquisitions given the tag-along rights in their shareholders agreements. Therefore, the cumulative composition of shareholders and the geographic concentration of all new and existing VC investors can better capture their coordination effectiveness.

[17] The ratio of a VC investor's cumulative investment amount to the firm's total cumulative VC funding by all VC investors is not necessarily the same as the VC investor's equity ownership in the firm because the portfolio firm value varies across financing rounds. We use the cumulative investment amount as the weight because the valuation data in VentureXpert and other databases (e.g., Venture Source) are limited to only a small proportion of our sample firms in each round.

multiple fund offices, we use the VC fund's location rather than the VC firm's headquarters location.[18]

2.3. Summary Statistics

Table 1 provides summary statistics for our sample firms at the financing round level. The arithmetic mean of the equally weighted geographic distances between all of a firm's VC investor pairs (i.e., *Ew Distances*) is 665 miles, and the average cumulative number of VC investors in a syndicate is 6.07. The arithmetic mean geographic distance between a firm and its lead VC investor (i.e., *Firm-Lead VC Distances*) is 756 miles. In untabulated tests, we find that VC investors are in an average of 2.24 different states. In all our regression analyses below, we use log-transformed distance measures to reduce the effect of skewed values on the outcome variables.

During our sample period, approximately 10% of our sample firms exit through an IPO (acquisition). On average, our sample portfolio firms receive their first round of VC financing 2.88 years after their foundation and have 3.83 rounds of financing. The mean ratio of the number of VC independent directors (independent directors) to the total number of directors on the board during the IPO year is 21% (80%), which is similar to the 28% reported by Baker and Gompers (2003), who use VC-backed IPO firms with a different sample period as their sample. The Appendix provides detailed descriptions of the variables reported in Table 1.

Table 2 presents the distribution of our sample firms and the main variables of interest by firm state. Consistent with the distribution reported in Tian (2011), we find that almost 55% of our sample firms are in California, Massachusetts, and New York. Among all of the states, VC investors in California and Massachusetts are more geographically dispersed than those in the other states and use a larger number of financing rounds. Figure 1 illustrates the extent of the geographic distances between VC investors by the firm headquarters state. The shade of each

[18] For example, Accel Partners manages two funds: Accel Internet Fund II L.P. in Palo Alto, California, and Accel Internet Fund III L.P. in Princeton, New Jersey. When Accel Internet Fund II L.P. serves as a VC investor for the portfolio firm, we use Palo Alto as the VC investor's location, not the location of Accel Partners' headquarters. We obtain the geographic coordinates from the MaxMind GeoIP Database and match the coordinates of each firm city with those of each VC fund city. We compute all of our distance measures using the most recent locations of VC investors and portfolio firms. Because their locations rarely change over time and fewer than 5% of our sample VC investors have fund offices in multiple locations, our approach should not create any systematic bias, as pointed out by Bernstein, Giroud, and Townsend (2016).

state indicates the extent of the average value of equally weighted physical distances between VC investors for VC-backed firms in that state. A darker color indicates that the firms in the state have more geographically dispersed VC investors. Figure 1 shows that the geographic dispersion of VC investors is generally common in many states, suggesting that the coordination problems in syndicates are not limited to certain states or regions.

Figure 2 plots the cumulative distribution functions (CDFs) of geographic proximity between VC investors, the investment amount-weighted distances between portfolio firms' lead VC investors and their other VC investors, and the physical distances between portfolio firms and their lead VC investors. The CDFs of these three geographic distance measures display similar patterns. Consistent with prior studies (e.g., Bernstein, Giroud, and Townsend (2016)), we find that approximately 30% of our sample firms are either financed by only one VC investor or multiple VC investors in the same city. However, Figure 2 shows that the median equally weighted VC distance (solid line) is 410 miles, and the median cumulative investment amount-weighted distance between a portfolio firm's lead VC investor and its other VC investors (dashed line) is 332 miles. Figure 2 also shows that approximately 35% of our sample firms are financed by VC investors located more than 1,000 miles away from each other. This large dispersion in the physical distance among VC investors in a syndicate allows us to perform identification tests that have adequate power.

3. Identification Strategy

The investment decisions of VC investors, specifically their syndication decisions, are not random and may be highly correlated with unobservable VC investor and portfolio firm characteristics that affect the portfolio firm's performance. This omitted variable problem can potentially bias the estimation of the effect of VC investors' geographic concentration on their monitoring activities and, thus, portfolio firm performance. For example, high-quality startup firms could decide to locate in one of the tech hubs and deliberately seek to be close to VC investors, whereas lower-quality startup firms must look for VC investors in other cities because of a lack of adequate local interests. Furthermore, promising deals can attract a group of VC investors that are geographically proximate to initial VC investors through better information sharing (i.e., reverse causality). It is also possible that VC investors' ability to identify profitable investments might be correlated with their locations. Alternatively, geographically proximate VC investors may have

similar preferences for certain startup firms or for specialties in investing in firms with certain characteristics, which can be correlated with firm performance and governance.

To address these endogeneity concerns, we use the reduction in travel time from the introduction of new direct airline routes as a quasi-natural experiment for VC investors' geographic concentration (Giroud (2013), Bernstein, Giroud, and Townsend (2016)). Giroud (2013) argues that the reduction in travel time from the introduction of new direct airline routes is exogenous to both firms' and institutional investors' characteristics. Thus, this reduction can serve as a valid quasi-natural experiment to mitigate the endogeneity problem associated with their geographic locations. Because the introduction of new direct airline routes unexpectedly reduces the travel time between VC investors, it should provide exogenous variations in their coordination costs and, thus, could be a valid instrument for their geographic concentration.

To measure the treatment effect, we first estimate the optimal travel time between the VC investor city pair by considering the driving time from a VC investor city to an airport city and the duration of a flight, including the average time spent at airports. The driving time between the VC investor city pair and between the VC investor city and the airport is calculated using the Google Maps API. A portfolio firm in a particular investment round is treated if, relative to the driving time between the VC investor city pair, the flight time between any of its existing VC investors is reduced by more than a half-hour in a round trip between the current and next investment rounds. The detailed algorithms used to compute the optimal itineraries and travel times are the same as those used by Giroud (2013) and Bernstein, Giroud, and Townsend (2016). We consider only direct flights because of the compounding probability of delays and cancellations and other types of disutility, such as anxiety about missing a connection or fatigue from longer transit times when taking indirect flights (e.g., Boeh and Beamish (2012)).[19] We define the treatment event *Reduction in Travel Time* as an indicator that takes the value of one if the travel time between a VC investor's city and other VC investors' cities is reduced by more

[19] The termination of existing direct airline routes between VC investors' locations can lead to an exogenous increase in the travel time between them. However, as pointed out by Giroud (2013), the termination events are less frequent and tend to occur on regional routes, resulting in minor effects on travel time and shareholder coordination. Our results remain unchanged if we include an additional treatment dummy for the termination of existing direct airline routes.

than a half-hour in a round trip because of *Airline Shock* between consecutive investment rounds and zero otherwise.[20]

A potential concern with using *Airline Shock* as an exogenous shock to geographic concentration is that airline routes are not randomly introduced. Local shocks in the region of either the VC investor or the portfolio firm could affect both the introduction of new direct airline routes and firm performance. For example, if the firm and its VC investor are in the same city, a booming economy in this city will lead to improved firm performance and a greater likelihood of new airline routes being introduced because of an increased number of passengers or lobbying by VC investors. Thus, we address this problem by restricting the shock to new routes that do not involve the city in which a portfolio firm is headquartered (Huang and Kang (2017)).

One important advantage of our identification setting is that it allows us to distinguish between the two competing views on VC involvement—the monitoring view and the screening view. To the extent that the introduction of a new direct airline is orthogonal to VC investors' screening abilities, *Airline Shock*, which results in a reduction of monitoring costs due to a decrease in travel time, increases VC investors' on-site involvement in their portfolio firms. Thus, *Airline Shock* provides an exogenous shock to VC investors' monitoring and coordination incentives, while their selection and screening abilities are largely fixed (Bernstein, Giroudand Townsend (2016)). Nevertheless, to further mitigate the concerns that the selection effects drive our results, we conduct propensity score matching analyses, in which we match a treatment firm to a control firm that has a similar predicted probability of being treated. We also examine the heterogeneous effects of VC investors' geographic concentration on outcome variables.

[20] Unlike Bernstein, Giroud, and Townsend (2016), who consider the period from the time of the *Airline Shock* and thereafter as the treatment period, we define the treatment period as the period from the year of the *Airline Shock* to the year during which the next financing round occurs after the *Airline Shock*. For example, suppose that a startup firm has five financing rounds before going public, and its two VC investors experience an *Airline Shock* between the second and third financing rounds. In our analyses, *Reduction in Travel Time* takes the value of one for the period between the year of the *Airline Shock* and the year of the third financing round and zero for all other years. By contrast, Bernstein, Giroud, and Townsend (2016) set the indicator for *Reduction in Travel Time* equal to one for the time of the *Airline Shock* and all subsequent years. Given that our setting involves multiple VC investors in a syndicate for each firm, whereas the setting of Bernstein, Giroud, and Townsend (2016) has only one lead VC investor for a firm, following their approach to define a treatment period would result in bias because firms with longer financing histories are more likely to be mechanically considered as treated groups. Changes in the composition of VC investors in syndicates over time further make it difficult to use their approach. To ensure that our identification strategy allows us to exploit the exogenous variation in VC investors' coordination costs, we focus on a shorter window spanning from the time of the treatment event to the time of the next immediate financing round after the treatment event, during which the composition of VC investors in syndicates does not change. In our sample, the average duration between the two consecutive financing rounds is 2.2 years.

4. VC Investors' Geographic Concentration and Coordination Outcomes

VC investors within a syndicate face coordination friction from heterogeneous fund characteristics, such as portfolio composition and investment horizon. Moreover, the divergent incentives within a syndicate, combined with free-rider problems among VC investors, decrease their incentives to pursue active monitoring. By facilitating efficient information sharing among VC investors and increasing the observability of their coordination efforts, a close geographic concentration helps alleviate coordination friction and drives efficient dynamics within a VC syndicate. In this section, we explore how VC investors' geographic concentration improves their coordination and, thus, affects coordination outcomes.

4.1. Exits through IPOs and Acquisitions: Main Tests

We first examine whether VC investors' geographic concentration affects the exit outcomes of their portfolio firms. We expect that better coordination of geographically proximate VC investors leads to an increase in the likelihood of a successful exit through IPOs or acquisitions. To test this prediction, we use two different approaches. First, we use the geographic distance among VC investors to measure geographic concentration. Specifically, using a sample of 45,604 firm-financing round observations, we estimate the following regression:

$$Exit_{i,t} = \beta_0 + \beta_1 \cdot VC\ Concentration_{i,t} + \beta_2 \cdot Firm\ Lead\ VC\ Distances_{i,t} + \beta' X_{i,t} + \alpha_i + \alpha_t + \gamma_i + \zeta_i + \eta_i + \varepsilon_{i,t} \quad (1)$$

where *i* and *t* index a portfolio firm and year, respectively, and $Exit_{i,t}$ is an indicator that takes the value of one if the firm goes public through an IPO or is acquired for a deal value greater than $25 million and zero otherwise. $VC\ Concentration_{i,t}$ is a measure of VC investors' geographic concentration discussed in the previous section, and $Firm\text{-}Lead\ VC\ Distances_{i,t}$ is the logarithm of one plus the physical distance between the portfolio firm and its lead VC investor.[21] We include this variable to control for potential concerns that our results might be driven by a traditional distance measure used in the previous literature (e.g., Lerner (1995), Sorenson and Stuart (2001), Cumming and Dai (2010), Tian (2011)). $X_{i,t}$ is a vector of control variables, including the cumulative number of investors, total funding, funding characteristics (firm age and total funding)

[21] Our results are robust to replacing *Firm-Lead VC Distances* with the logarithm of one plus the equally weighted physical distance between the portfolio firm and all of its VC investors.

in the first round of VC investment (Tian (2011)), an indicator that takes the value of one if the firm is in its seed or early stage when it receives its first VC financing and zero otherwise (*Early Stage*) (Nahata (2008), Tian (2011)), three measures of industry characteristics (market-to-book ratio, R&D intensity, and asset tangibility), and three measures of VC investor reputation (VC investors' average fund age, average amount of equity invested, and average total number of investment rounds since 1995). The regression also includes the following fixed effects: a portfolio firm's industry fixed effects at the three-digit SIC level (α_i), year fixed effects for financing rounds (α_t), first (entry) financing year fixed effects (γ_i), firm state fixed effects (ζ_i), and lead VC investor fixed effects (η_i). We include financing round year fixed effects to control for any common time trends that affect entrepreneurial firms' performance. We control for first (entry) financing year fixed effects because Povel et al. (2016) find a significant and persistent entry year effect, especially during industry booms or busts. We include lead VC investor fixed effects to mitigate the concern that unobserved heterogeneity among lead VC investors simultaneously affects both the geographic distribution of firms' VC investors and their staged investment patterns. We cluster the standard errors at the firm's industry level. Our key coefficient of interest is β_1, which measures the effect of VC investors' geographic concentration on exit performance.

The results are reported in columns (1)-(3) of Table 3 Panel A, in which we use geographic distance among VC investors to measure their geographic concentration. Consistent with our hypothesis, we find that the coefficients for all of the geographic concentration measures are negative and significant at the 5% level. Thus, the geographic proximity of VC investors increases the likelihood of firms going public or being acquired, suggesting that VC investors' geographic concentration reduces the coordination friction among them and improves their monitoring effectiveness. The effect of VC investors' geographic concentration on *Exit* is economically large and significant. In column (1), the economic magnitude of a one-standard-deviation decrease in *Ew Distances* translates into a 0.3% (= 0.001 x 3.11) increase in the likelihood of a successful exit for a portfolio firm, which accounts for a 6.2% increase relative to the unconditional mean probability of

exit (5%). The economic magnitudes of the effects of the other concentration measures on *Exit* are similar to those of *Ew Distances* on *Exit*.[22]

In column (4) of Table 3 Panel A, we estimate the difference-in-differences regressions using *Airline Shock* as an exogenous shock to VC investors' coordination costs. Our key independent variable of interest is *Reduction in Travel Time*. We find that the effects of VC investors' geographic dispersion on exit outcomes are consistent with those in columns (1)-(3), suggesting that our results are robust to controlling for potential endogeneity problems. The coefficient estimate for *Reduction in Travel Time* is 0.053, which suggests that the treatment increases the likelihood of a successful exit by 5.3%.[23]

4.2. Exits through IPOs and Acquisitions: Robustness Tests

4.2.1. Propensity Score Matching Analysis

Although *Airline Shock* is arguably exogenous, several observable VC investor-, firm-, and location-specific characteristics may still affect the probability of firms being treated. For example, firms with geographically dispersed VC investors are more likely to experience an airline shock because air travel tends to be optimal only for VC investors located sufficiently apart. However, this endogenous treatment selection would likely bias our results toward finding no treatment effect and thus is unlikely to drive our results. Nevertheless, to further address this concern, we use a propensity score matching approach. Specifically, we estimate the propensity scores using a probit regression in which the dependent variable is an indicator that takes the value of one if a firm experiences a reduction in travel time between the current and next investment rounds because of the introduction of a new direct airline route and zero otherwise. To calculate the propensity score, we use the following variables measured immediately prior to

[22] The Pearson correlation coefficients between *Firm-Lead VC Distances* and our VC dispersion measures for the full sample range from 0.22 to 0.28, raising concern over a multicollinearity problem. Although our endogeneity test using an airline shock below can address the multicollinearity problem, to further mitigate this concern, we divide the sample according to the sample median distance between the portfolio firm and its lead VC investor and reestimate the regressions in Tables 3-6 separately for the two subsamples. In untabulated tests, we find that our results hold for both subsamples. As additional tests, we omit *Firm-Lead VC Distances* and cumulative number of investors (total funding) from the regressions, respectively, and reestimate the regressions. We find that the results remain unchanged.

[23] As a robustness test, we divide our sample firms into two subgroups according to the sample median distance between the portfolio firm and its lead VC investor and reestimate the regressions in Tables 3-6 separately for these two subgroups. The results are report in Online Appendix Table A.2. We find that the results hold for both subgroups. In untabulated tests, we also find that our main results are robust to omitting *Firm-Lead VC Distances* from the regressions.

the introduction of new airline routes: *Ew Distances*, *Firm-Lead VC Distances*, cumulative number of VC investors and total funding, funding characteristics in the first round of a VC investment (firm age, total funding, and early-stage indicator), industry characteristics (market-to-book ratio, R&D intensity, and asset tangibility), VC investor reputation measures (VC investors' average fund age, average amount of equity invested, and average total number of investment rounds), and industry, year, first financing year, firm state, and lead VC investor fixed effects. We then match the control firm that does not experience the introduction of a new direct airline route on the basis of the predicted probability of being treated. Online Appendix Table A.3 compares the mean difference in characteristics between the treated and control financing rounds. We find that all characteristics are not significantly different between the two groups, indicating that propensity score matching effectively identifies the matching financing rounds. The results using a propensity-score-matched sample are reported in column (1) of Table 3 Panel B. We find that our treatment effects remain unchanged.

4.2.2. Excluding Treatment with Short Distances

If VC investors are closely located to each other, airline shocks are less likely to have a significant effect on their coordination efforts and monitoring incentives. Therefore, as a further robustness test, we exclude airline shocks with a short distance from the analysis and use only a shock in which the average distance between the VC investor pairs is greater than 200 kilometers in estimating the regressions. The results are reported in column (2) of Table 3 Panel B. We find that our treatment effects are robust to the exclusion of airline shocks with a short distance. The results are also robust to using different thresholds (60 and 150 miles) for the average distance between investors.

4.2.3. Excluding Portfolio Firms in California

Almost 39% of our sample firms and 36% of their lead VC investors are in California. To alleviate the concern that our main results are driven by firms in California, we exclude firms headquartered in California from the analysis and reestimate the difference-in-differences

regression.[24] The results are reported in column (3) of Table 3 Panel B. We find that our treatment effects remain unchanged.

4.2.4. Time-varying State Fixed Effects and Heterogeneity in Financing Rounds

Unobservable firm state- and year-specific heterogeneity, such as state-specific business cycles and regulatory changes, could affect our results from the difference-in-differences tests. To control for this concern, we reestimate the difference-in-differences regressions after including portfolio firm state-year fixed effects. The results reported in column (4) of Table 3 Panel B show that including these fixed effects does not change our results. Additionally, the contractual terms in VC investment and the motivation for syndication may differ across financing rounds. Thus, to control for the differences in VC investment dynamics across financing rounds, we reestimate the difference-in-differences regressions by including financing round fixed effects. The results are reported in column (5) of Table 3 Panel B. We find that our inferences remain the same, mitigating a potential concern that our results are driven by a mechanical effect of the increased number of investors over time. Finally, we reestimate the regressions by including lead VC investor-Metropolitan statistical area (MSA)-year fixed effects to control for omitted local- and lead VC investor-level characteristics. We find that the results in column (6) of Table 3 Panel B remain the same. Overall, these results suggest that the addition of new airline routes is plausibly exogenous to the characteristics of startup firms and VC investors.

4.2.5. Other Robustness Tests

We perform several additional robustness tests to further alleviate the potential endogeneity of VC investors' geographic location and report the results in the Online Appendix. First, we consider potential concerns on unobservable differences between treated and control firms by examining the treatment effects using only the eventually treated sample (Online Appendix Table A.4 Panel A). Second, we mitigate the concerns about the effect of unobservable local economic shocks on treated firms by excluding firms located in the same city as any of their VC investors from the sample (Online Appendix Table A.4 Panel B). Third, we

[24] After excluding firms in California, we find that the proportion of firms that experience an *Airline Shock* is approximately 11.1%, which is almost identical to the proportion for the full sample that includes firms in California, suggesting that our treatment is reasonably random across states.

exclude the top 10% of the observations wherein the states in which the lead VC investors are located experience greater economic booms, as measured by the state-level annual GDP growth rate (Online Appendix Table A.4 Panel C). Fourth, thus far, we have followed the previous literature in defining the airline shock as a reduction of the travel time by more than a half-hour in a roundtrip (Giroud (2013), Bernstein, Giroud, and Townsend (2016)). To examine whether our results are robust to using an alternative measure of a shock to VC investors' geographic concentration, we replace *Reduction in Travel Time (indicator)* with the average reduction in travel time and reestimate the regressions in Tables 3-6 (Online Appendix A.4.3 and Table A.4 Panel D). Finally, we control for persistent heterogeneous effects of the first VC financing characteristics by including the interactions of firm and VC-first round characteristics with year fixed effects (Online Appendix Table A.4 Panel E). Our inferences do not change.

4.3. Successive Syndications in Follow-up Rounds

Next, we investigate whether VC investors' geographic concentration improves their coordination outcomes in investment decisions. We expect that geographically concentrated VC investors are more likely to syndicate together in the follow-up financing round.

Table 4 reports the results from the OLS regressions in which the dependent variable is the ratio of the number of VC investors that participate in both current and previous rounds to the total number of VC investors in the previous round. Estimating the regressions using a two-limit Tobit model does not change the results. In columns (1)-(3), we find that VC investors' geographic dispersion significantly reduces the proportion of VC investors that participate in the follow-up syndication round.[25] In column (1), a one-standard-deviation increase in *Ew Distances* leads to a 3.0% (= 0.009 x 3.11) decrease in the proportion of VC investors who participate in the successive syndication in the follow-up round, accounting for more than 13.1% of the unconditional mean value of the successive VC syndication (23%) in the follow-up round. In column (4), we present the results for the difference-in-differences estimation using *Airline Shock*

[25] It is possible that certain early investors participate in subsequent rounds because they have an early-stage focus or have run out of capital. VCs may also prefer to have a new investor in each subsequent round because such an investor can price the new round. If these heterogeneous demands for syndicate partners drive our main results, we may find a weaker relation between VC investors' coordination friction from geographic dispersion and their successive syndication participation in subsequent financing stages. To address this concern, we repeat our analyses in Panel A of Table 4 by excluding early-stage financing rounds. As shown in Online Appendix Table A.5, we find that our results do not change.

as a shock to VC investors' coordination costs. Consistent with the findings in columns (1)-(3), the treatment increases the proportion of existing VC investors who participate in a follow-up syndication round by 1.4%.

In Panel B of Table 4, we present the results from the difference-in-differences robustness tests. Our regression specifications and sample are the same as those in Panel B of Table 3, except that we use the ratio of the number of VC investors that participate in both the current and previous rounds to the total number of VC investors in the previous round as the dependent variable. Our results do not change.

As an additional test of the effect of the VC investors' geographic concentration on coordination outcomes, we use the portfolio firms' IPO valuation as an alternative measure of the coordination outcome and examine whether this valuation is affected by the VC investors' geographic concentration. We find that entrepreneurial firms with geographically dispersed VC investors have a lower valuation on the first trading date compared to those with geographically concentrated VC investors. The results are reported in Online Appendix Table A.6.

5. VC Investors' Geographic Concentration and the Choice of Ex Ante Contractual Terms

Monitoring entrepreneur firms is costly, and these monitoring costs are expected to be larger for geographically dispersed VC investors because of their coordination disadvantages. Therefore, VC investors that face difficulties with coordination and monitoring due to their geographic dispersion might have strong incentives to overcome such difficulties by relying more on strict ex ante contractual terms, such as using more intensive staged financing and convertible securities and having greater board representation in portfolio firms. In this section, we investigate the extent to which VC investors' geographic concentration affects their choice of these contract terms.

5.1. Staged Financing

Our first measure of ex ante contractual terms is staged financing. We use a sample of 45,604 firm-financing round observations and estimate the regressions in Table 3 by replacing *Exit* with the duration (i.e., investment interval) of the financing rounds (*Log (1 + Duration between Two Financing Rounds)*) as the dependent variable. *The duration between two*

financing rounds is the duration measured in months between the current financing round and the next financing round.[26]

Panel A of Table 5 presents the results. In columns (1)-(3), we find that VC investors' geographic dispersion is associated with a significant decrease in time intervals between successive financing rounds. The economic magnitude is also large. For example, in column (2), an increase in *Ew Distances* from the 50th to the 75th percentile decreases the duration between two financing rounds by 2.1%. In column (4), we find that the treatment increases the duration between the two investment rounds by 11.9% (= 0.316/2.66).

As an additional test, in Online Appendix Table A.7, we replace *Log (1 + Duration between Two Financing Rounds)* with *Log (1 + Number of Financing Rounds)* as the dependent variable. Following the previous literature (e.g., Tian (2011)), we limit our attention to only the sample of each firm's final financing round. Specifically, when the firm goes public or is acquired, we use only its last financing round immediately before the IPO or acquisition. We find that VC investors' geographic dispersion is positively and significantly related to the number of financing rounds.

In Panel B of Table 5, we check the robustness of our results from the difference-in-differences tests using the same set of tests as that in Panel B of Table 3. Our results still hold.

These results suggest that VC investors that face higher coordination and monitoring costs because of their location disadvantages maintain a tight leash on entrepreneurs' behavior by shortening the duration between successive financing rounds and increasing the number of financing rounds. The results also suggest that for VC investors with better coordination, the marginal cost of improving portfolio firms' internal governance through strict contractual terms is higher than the benefit arising from having such contractual terms.

5.2. Use of Convertible Securities

Next, we use convertible securities as the measure of ex ante contract terms. VC investors that face high information asymmetry and agency problems in early-stage investments might

[26] Tian (2011) notes that duration data are right censored because a subsequent financing round is unobservable if firms exit the venture stage or are in the middle of an ongoing round. Following Tian (2011), we compute *Duration between Two Financing Rounds* as the duration between the last financing round date and an exit event date if the firm exits through either an IPO or acquisition (the end of our sample period if the firm is still in the middle of an ongoing round). As a robustness test, we restrict our sample to firms with an exit event and find that our results remain the same.

demand downside-protecting contractual cash flow rights, such as the use of convertible securities, especially when they face monitoring disadvantages in constraining entrepreneurs' behavior. Therefore, we expect the geographic dispersion of VC investors to be positively related to the ratio of the amount of convertible securities used in the investment.[27]

The results using a sample of 45,604 firm-financing round observations are reported in Panel A of Table 6. The dependent variable, *Ratio of Convertible Securities*, is the ratio of the amount of convertible debt and convertible preferred stock to the total funding amount in each financing round. We use the same control variables as those used in Table 3. In columns (1)-(3), we find that the coefficients of all VC investors' geographic concentration measures are positive and highly significant, suggesting that when VC investors face high coordination and monitoring costs because of their geographic dispersion, they use a larger proportion of convertible securities in their investment. In terms of economic significance, in column (1), a one-standard-deviation increase in *Ew Distances* leads to a 3.0% (= 0.009 x 3.11) increase in *Ratio of Convertible Securities*, which accounts for more than 6.5% of the unconditional mean *Ratio of Convertible Securities* (43%) used in VC investments. In column (4), in which we use *Airline Shock* as an exogenous shock to the geographic concentration among VC investors, we find that the treatment decreases *Ratio of Convertible Securities* by 4.4%.[28]

In Panel B of Table 6, we present the results from the robustness tests using *Airline Shock*. Our results remain the same as those in column (4) of Panel A, suggesting that VC investors' geographic dispersion affects the choice of contractual features in VC investments.

5.3. VC Investors' Board Participation

To the extent that geographically dispersed VC investors incur high coordination costs when engaging in monitoring actions and face difficulties in information sharing, they have strong incentives to participate in portfolio firms' boards as an alternative mechanism to overcome their disadvantages. In this subsection, we examine this prediction using manually

[27] Because of a lack of available data, we are not able to use other covenants or cash flow provisions (e.g., liquidation preference and anti-dilution) in VC investment contracts in our analyses. For studies that investigate the role of these contractual terms using proprietary data on a small number of sample firms, see Kaplan and Strömberg (2003, 2004), Cumming (2008), and Bengtsson and Sensoy (2011, 2015).

[28] Because *Ratio of Convertible Securities* is measured at the beginning of each financing round date, we use the lagged *Reduction in Travel Time*. We consider the first financing rounds as untreated when we use the lagged *Reduction in Travel Time*.

collected board information on 817 going-public startup firms with VC investments for which director information is available on Form 424B.[29]

The results are reported in Table 7, in which we use *the percentage of VC directors* as the dependent variable, which is the ratio of the number of VC-affiliated directors to the total number of directors on the board of a portfolio firm during an IPO year. In columns (1)-(3), we find that the coefficients for VC investors' geographic dispersion measures are all positive and significant at the 5% level. Thus, VC investors send a larger number of their representatives to their portfolio firms' boards when they have a greater need to oversee the firms because of coordination problems that arise from geographic dispersion. In terms of economic significance, the coefficient estimate of 0.013 on *Ew Distances* in column (1) suggests that a one-standard-deviation increase in *Ew Distances* leads to a 4.04 percentage point (= 0.013 x 3.11) increase in *Percent of VC Directors*. Given that the unconditional mean of the *percentage of VC directors* for the full sample is 21%, this number accounts for more than 19.3% of the sample mean.

In column (4), we estimate the regression using a difference-in-differences test in which *Reduction in Travel Time_Exit* is used as a new treatment variable. Consistent with the findings in columns (1)-(3), we find that travel time reduction leads to a decrease in *the percentage of VC directors*.[30] In untabulated tests, we reestimate the regressions in Table 7 using a two-limit Tobit model and find that the results do not change.

6. Cross-sectional Heterogeneity in the Treatment Effect

To better understand the circumstances under which the treatment effects are more pronounced, we examine whether the results from the endogeneity tests in Tables 3-6 are different across treatment and VC syndicate characteristics.

[29] Because of a dearth of data, little evidence exists on board monitoring by VC investors in VC-backed firms. The only exceptions are Lerner (1995), who finds that geographic proximity between VC investors and portfolio firms leads VC investors to occupy more board seats in their portfolio firms, and Bengtsson and Sensoy (2011), who show that highly experienced VC investors are more likely to join the boards of portfolio firms. Baker and Gompers (2003) and Hochberg (2012) further document that VC-backed firms have more independent directors on their boards than non-VC-backed firms at the time of an IPO.

[30] We note that the coefficients for *Firm-Lead VC Distances* are insignificant, which differs from the findings of Lerner (1995), who shows that geographically proximate VC investors are more likely to sit on the boards of their portfolio firms. To determine why the results are different between the two studies, we reestimate the regressions in Table 7 using the same regression specifications as those used in Lerner (1995), which do not include lead VC investor fixed effects. Consistent with Lerner (1995), we find that the coefficients for *Firm-Lead VC Distances* are negative and significant.

6.1. Treatment Effects for Lead and Non-Lead VC Investors

Because lead VC investors play a more instrumental role in syndicate management than other VC investors, their coordination and monitoring incentives tend to be particularly sensitive to reductions in their travel times (Bernstein, Giroud, and Townsend (2016)). Thus, although VC investors' coordination effort and involvement are not directly observable following the treatment, we can indirectly infer such effort and involvement by examining whether the results are more pronounced for treated VC investor pairs that involve a lead VC investor than for those that do not involve a lead VC investor.

To examine whether our results differ for lead and non-lead VC investors, we separate *Reduction in Travel Time* in column (4) of Panel A in Tables 3-6 into two treatment indicators and reestimate the regressions: *Lead VC Reduction in Travel Time*, which takes the value of one if the VC investor in a treated VC investor pair is a lead VC investor and zero otherwise, and *Non-Lead VC Reduction in Travel Time*, which takes the value of one if all of the VC investors in the treated VC investor pair are non-lead VC investors and zero otherwise. The results are reported in Panel A of Table 8. We find that the coefficients for *Lead VC Reduction in Travel Time* are significant in all four columns and those for *Non-Lead VC Reduction in Travel Time* are significant in columns (1)-(3). However, the magnitudes of the coefficients for *Lead VC Reduction in Travel Time* are significantly larger than those of the coefficients for *Non-Lead VC Reduction in Travel Time*, except for column (2), suggesting that the underlying channel of our treatment effects is derived mainly from the lead VC investors' enhanced monitoring and coordination.

6.2. Syndicate Experience History and Information Sharing

Our hypothesis predicts that the role of the geographic concentration among VC investors in effective information sharing is particularly evident for those who have not worked together in past VC syndicates because they tend to lack networking when sharing information about their investments.[31] In contrast, if VC investors have a long history of working together in syndicates, their networking may allow them to more effectively share soft information about portfolio

[31] Hochberg, Ljungqvist, and Lu (2007) show that firms with VC investors with greater network centrality, as measured using historical syndication data, experience better performances compared to other firms.

firms, which tends to reduce the cost of their coordinated governance actions. Thus, the importance of the geographic concentration among VC investors in information sharing is expected to be lesser for these VC investors. To test this prediction, we decompose *Reduction in Travel Time* into *Reduction in Travel Time with High Syndicate History* and *Reduction in Travel Time with Low Syndicate History* and reestimate the regressions in Panel A of Table 8 using these two indicators. *Reduction in Travel Time with High* (*Low*) *Syndicate History* takes the value of one if the proportion of VC investors that worked together in past syndicates formed during our sample period is greater (lower) than that of the highest sample decile and zero otherwise. The results are presented in Panel B of Table 8. We find that the coefficients for *Reduction in Travel Time with Low Syndicate History* are significant at the 1% level in all four columns, whereas those for *Reduction in Travel Time with High Syndicate History* are positive and significant only in column (3), in which the dependent variable is *Log (1 + Duration between Two Financing Rounds*). These results suggest that coordination costs among VC investors are an important factor affecting their effective coordination.

As a further test, we reestimate the difference-in-differences regressions by decomposing *Reduction in Travel Time* into *Reduction in Travel Time with High VC Overlap* and *Reduction in Travel Time with Low VC Overlap* according to the highest sample decile of a VC syndicate composition index (VCCI) used in Bayar, Chemmanur, and Tian (2020). The VCCI is measured as $\frac{\sum_{i=1}^{n}\sum_{j=1}^{t} VC_{i,j}}{NVC \times NROUNDS}$, where $VC_{i,j}$ represents VC investor *i* who invests in round *j*, NVC is the number of VC investors who invest in the entrepreneurial firm across all financing rounds, and NROUNDS is the number of financing rounds that the entrepreneurial firm receives. Thus, the VCCI captures the degree of overlap among VC syndicate members across financing rounds within an entrepreneurial firm. We expect our results to be more pronounced when VC syndicate partners have fewer overlaps in their previous syndicates and thus face higher coordination costs. Consistent with our expectation, the results reported in Online Appendix Table A.8 Panel A show that the hypothesized effects are stronger for *Reduction in Travel Time with Low VC Overlap* than for *Reduction in Travel Time with High VC Overlap*, except in column (3).

6.3. Technological Innovation and Time-varying Importance of Geography

During our sample period, groundbreaking developments have occurred in information technologies regarding communication and transportation that could enable investors to

coordinate more efficiently. Thus, if this technological innovation reduces the effects of the introduction of direct airline routes on VC investors' coordination and if the underlying channel of our treatment effects is associated with better coordination among VC investors, we expect the treatment effects to be stronger in the earlier years of the sample period. To test this prediction, we replace two treatment indicators in Panel A of Table 8 with *Pre-2005 Reduction in Travel Time* and *Post-2005 Reduction in Travel Time* and reestimate the regressions. *Pre-2005* (*Post-2005*) *Reduction in Travel* is an indicator that takes the value of one if a VC investor pair is treated before 2005 (in 2005 or after 2005) and zero otherwise. The results are reported in Panel C of Table 8. We find that the coefficients for both *Pre-2005 Reduction in Travel Time* and *Post-2005 Reduction in Travel Time* are significant. However, the absolute values of the coefficients for *Pre-2005 Reduction in Travel Time* are significantly larger than those for *Post-2005 Reduction in Travel Time*. Thus, although the importance of geography in VC investors' coordination still remains significant in the recent period, the development of information technologies during our sample period significantly reduces this importance.[32]

6.4. Number of VC Investors in Syndicates and Coordination Frictions

The literature suggests that investor dispersion increases coordination costs (e.g., Bolton and Scharfstein (1996), Bris and Welch (2005), Aslan and Kumar (2012)), indicating that our results may be driven by such dispersion. To examine this issue, we use the number of VC investors in a syndicate to measure coordination frictions and examine whether the treatment effect is particularly evident for firms with a larger number of VC investors in syndicates. Specifically, we separate *Reduction in Travel Time* into two indicators, *Reduction in Travel Time with High* (*Low*) *Number of Investors*, which take the value of one if the cumulative number of VC investors in syndicates is greater (lower) than that of the highest sample decile and zero otherwise. We then reestimate the regressions in Panel A of Table 8 using these two indicators

[32] Although the rapid development of telecommunications during the past decade has improved investors' ability to collect and communicate information and, thus, might reduce the importance of geographic proximity in effective information sharing among VC investors, VC investors rely relatively more on soft information (i.e., qualitative information obtained from direct contacts and private interactions with corporate managers and syndicate partners that is difficult to convert, store, and transmit in numbers (Stein (2002), Liberti and Petersen (2018)) when evaluating new and ongoing investments than on the hard information available from the Internet and online communication. Thus, our results suggest that irrespective of the development of communication technologies, compared with geographically dispersed VC investors, geographically proximate VC investors have better abilities to share private information about firms through informal discussions.

and report the results in Panel D of Table 8. We find that the absolute values of the coefficients for *Reduction in Travel Time with High Number of Investors* are significantly larger than those of the coefficients for *Reduction in Travel Time with Low Number of Investors* except for column (3). These results suggest that the treatment effects in our previous tests are mainly driven by VC investors' coordination frictions in the post-investment period.

In Online Appendix Table A.8 Panel B, we also examine whether VC investors' coordination within syndicates is more important in earlier rounds (i.e., the developmental stage) of entrepreneur firms than in later rounds of entrepreneur firms by decomposing *Reduction in Travel Time* according to whether the cumulative number of financing rounds is lower or greater than the highest sample decile: *Reduction in Travel Time in Earlier Rounds* and *Reduction in Travel Time in Later Rounds*. We find that the coefficients for both *Reduction in Travel Time in Earlier Rounds* and *Reduction in Travel Time in Later Rounds* are significant in columns (1)-(4), suggesting that the reduction in travel time between VC investors improves their coordination and monitoring effectiveness, regardless of the stages of their portfolio firms.

7. Summary and Conclusion

This paper examines the impact of VC investors' geographic concentration on firm performance and ex ante contractual features used in VC investments. We hypothesize that the geographic proximity of VC investors improves their coordination and monitoring effectiveness through better information sharing and reduced free-rider problems. This improved coordination and better monitoring enhance portfolio firms' exit and IPO performance and incentivize geographically concentrated VC investors to rely on costly ex ante contractual features less than do geographically dispersed VC investors.

Consistent with our hypotheses, we find that portfolio firms with geographically concentrated VC investors enjoy better coordination outcomes, as evidenced by a greater likelihood of a successful exit through IPOs or acquisitions and a higher proportion of the number of existing VC investors participating in the follow-up round of syndication. In addition, we find that relative to geographically concentrated VC investors, geographically dispersed VC investors use more intense staged financing and a larger proportion of convertible securities in their investments in entrepreneurial firms and are more likely to send their representatives to boards of portfolio firms to overcome their weaknesses in coordination and monitoring.

Overall, our results provide new evidence on the importance of the geography of VC investments in portfolio firms' value creation and VC investors' choice of ex ante contractual features in their investments.

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Figure 1
Geographic Distance of Venture Capital (VC) Investors across States

This figure shows the geographic distance between venture capital (VC) investors across states. The shade of each state indicates the extent of the average values of equally weighted physical distances between VC investors for VC-backed firms in that state. A darker color indicates that firms in the state have more geographically dispersed VC investors.

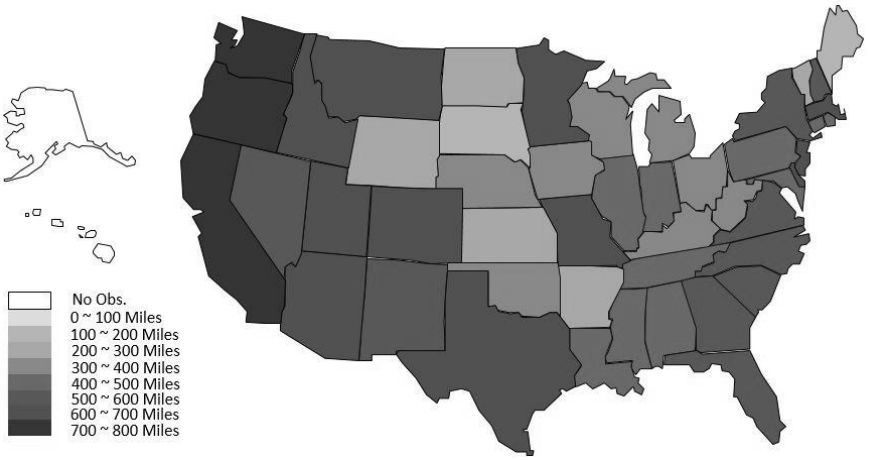

Figure 2
Cumulative Distribution Functions of VC Investor Distance and Firm-VC Investor Distance

This figure plots the cumulative distribution functions of the geographic proximity of VC investors and the physical distances between the portfolio firm and its lead VC investor. *Equally weighted VC Distance* (solid line) is the equally weighted physical distance in miles between all of a firm's VC investor pairs. *Equity-weighted Lead VC Distance* (dashed line) is the investment amount-weighted distance in miles between a firm's lead VC investor and its other VC investors. Only VC investor pairs with a lead VC investor are included in computing the distance. *Firm-Lead VC Distance* (dash-dotted line) is the physical distance in miles between the portfolio firm and its lead VC investor.

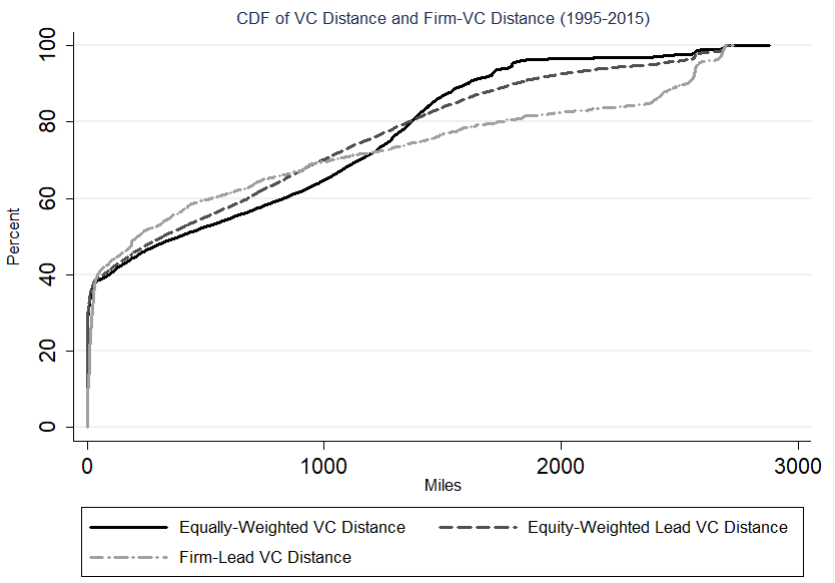

Table 1
Summary Statistics

This table presents summary statistics for entrepreneurial firms in the United States with venture capital (VC) investments during 1995-2015. The sample consists of 45,604 financing round observations for 10,594 startup firms. *Ew Distances* is the logarithm of one plus the equally weighted physical distance (in miles) between all of a firm's VC investor pairs. *Vw Distances (Equity)* is the logarithm of one plus the cumulative investment amount-weighted physical distance between all of a firm's VC investor pairs. *Lead Vw Distances (Equity)* is the logarithm of one plus the cumulative investment amount-weighted physical distance between a lead VC investor and the other VC investors. *Firm-Lead VC Distances* is the logarithm of one plus the physical distance between the portfolio firm and its lead VC investor. The numbers in parentheses are the arithmetic values in miles. The Appendix provides detailed descriptions of other variables.

Variable	Mean	Std. Dev.	25th	Median	75th	Obs.
Distance characteristics						
Ew Distances	4.39	3.11	0.00	6.02	7.16	45,604
	(665)	(710)	(0.00)	(410)	(1,280)	45,604
Vw Distances (Equity)	4.36	3.11	0.00	5.94	7.11	45,604
	(651)	(710)	(0.00)	(378)	(1,229)	45,604
Lead Vw Distances (Equity)	4.32	3.12	0.00	5.81	7.07	45,604
	(662)	(769)	(0.00)	(332)	(1,177)	45,604
Firm-Lead VC Distances	4.81	2.57	2.68	5.34	7.26	45,604
	(756)	(948)	(13.53)	(208)	(1,426)	45,604
Airline Shock characteristics						
Lead VC Reduction in Travel Time (indicator)	0.07	0.25	0.00	0.00	0.00	45,604
Non-Lead VC Reduction in Travel Time (indicator)	0.05	0.22	0.00	0.00	0.00	45,604
Pre-2005 Reduction in Travel Time (indicator)	0.05	0.21	0.00	0.00	0.00	45,604
Post-2005 Reduction in Travel Time (indicator)	0.07	0.25	0.00	0.00	0.00	45,604
Reduction in Travel Time with High Number of Investors	0.04	0.21	0.00	0.00	0.00	45,604
Reduction in Travel Time with Low Number of Investors	0.07	0.25	0.00	0.00	0.00	45,604
Reduction in Travel Time with High Syndicate Experience	0.01	0.11	0.00	0.00	0.00	45,604
Reduction in Travel Time with Low Syndicate Experience	0.10	0.30	0.00	0.00	0.00	45,604
Log (1 + Reduced Travel Time)	0.09	0.39	0.00	0.00	0.00	45,604
Reduction in Travel Time (indicator)	0.11	0.32	0.00	0.00	0.00	45,604
Reduction in Travel Time_Exit (indicator)	0.15	0.36	0.00	0.00	0.00	817
Reduction in Travel Time_Firm (indicator)	0.11	0.31	0.00	0.00	0.00	10,594
Firm and VC financing characteristics						
Being Acquired (indicator)	0.03	0.16	0.00	0.00	0.00	45,604
Being Acquired (indicator, firm)	0.10	0.31	0.00	0.00	0.00	10,594
Going Public (indicator)	0.02	0.15	0.00	0.00	0.00	45,604
Going Public (indicator, firm)	0.10	0.30	0.00	0.00	0.00	10,594
Exit (indicator)	0.05	0.22	0.00	0.00	0.00	45,604
Exit (indicator, firm)	0.20	0.40	0.00	0.00	0.00	10,594
Early Stage (indicator)	0.72	0.45	0.00	1.00	1.00	45,604
Industry Asset Intangibility (%)	90.16	9.49	81.32	93.40	97.54	45,604
Industry Market/Book Ratio	1.69	2.71	1.26	1.66	1.91	45,604
Industry R&D/Assets Ratio (%)	6.90	5.83	3.04	6.72	8.83	45,604
Number of Investors	6.07	4.90	3.00	5.00	8.00	45,604
Log (1 + Duration between Two Financing Rounds)	2.66	1.07	1.93	2.58	3.22	45,604
Firm Age at Round One	2.88	3.82	0.68	1.57	3.48	45,604
Number of Financing Rounds	3.83	2.88	2.00	3.00	5.00	45,604
Log (1 + Total Funding)	2.76	1.24	1.87	2.81	3.67	45,604
Log (1 + Total Funding at Round One)	1.63	0.92	0.92	1.61	2.20	45,604
Log (VC Investor Age)	2.32	0.93	1.86	2.48	2.95	45,604
Log (Total Equity Investment by VC Investors)	5.33	1.82	4.05	5.48	6.79	45,604
Log (Total Rounds VC Investors Participated)	4.52	1.49	3.50	4.69	5.68	45,604

Ratio of Convertible Securities	0.43	0.48	0.00	0.00	1.00	45,604
Successive VC Syndication	0.23	0.20	0.10	0.20	0.33	33,400
IPO characteristics						
IPO Valuation (Price to Book)	4.26	0.78	3.81	4.26	4.65	692
Number of VC Directors	1.51	1.32	0.00	1.00	2.00	817
Percent of Independent Directors	0.80	0.11	0.75	0.83	0.88	817
Percent of VC Directors	0.21	0.18	0.00	0.18	0.33	817

Table 2

Distribution of Sample Firms by Firm State and the Venture Capital (VC) Investors' Geographic Distance and Investment Characteristics

This table presents the distribution of sample startup firms by firm state and venture capital (VC) investors' geographic distance and investment characteristics. The sample consists of 45,604 financing round observations for 10,594 startup firms in the United States with VC investments during 1995-2015. For a firm that eventually goes public or is acquired, we use only its last financing round immediately before an IPO or acquisition. For other firms, we use observations from the last available financing round. VC investors' geographic distance (*EW Distances*) and *Firm-Lead VC Distances* are reported in miles. The Appendix provides detailed variable descriptions.

Firm State	Obs.	Ew Distances	Firm-Lead VC Distances	Number of Rounds	Exit (indicator)	Firm State	Obs.	Ew Distances	Firm-Lead VC Distances	Number of Rounds	Exit (indicator)
Alabama	36	387	852	3.00	0.08	Nebraska	17	523	989	2.47	0.29
Arizona	90	475	1452	3.99	0.17	Nevada	20	514	1340	3.55	0.30
Arkansas	2	313	1239	3.50	0.50	New Hampshire	65	415	547	4.58	0.08
California	4,090	792	869	4.50	0.23	New Jersey	252	563	573	4.00	0.23
Colorado	261	678	952	4.56	0.18	New Mexico	25	515	792	4.24	0.08
Connecticut	162	433	577	4.19	0.19	New York	646	617	725	3.68	0.15
Delaware	12	510	908	4.08	0.17	North Carolina	209	569	731	4.53	0.23
Florida	188	484	1133	3.36	0.19	North Dakota	5	327	841	3.60	0.20
Georgia	261	564	764	4.22	0.20	Ohio	155	355	489	3.45	0.09
Idaho	18	701	1242	2.39	0.17	Oklahoma	15	319	857	3.47	0.20
Illinois	228	504	701	3.57	0.17	Oregon	94	738	1042	4.10	0.17
Indiana	44	412	443	2.95	0.18	Pennsylvania	382	365	418	3.69	0.16
Iowa	17	92	379	2.29	0.18	Rhode Island	27	339	405	3.70	0.11
Kansas	41	306	464	3.44	0.12	South Carolina	23	521	780	3.22	0.13
Kentucky	28	343	337	3.64	0.21	South Dakota	4	180	422	1.75	0.25
Louisiana	20	374	349	3.65	0.05	Tennessee	82	474	615	3.99	0.22
Maine	17	201	470	2.35	0.18	Texas	558	680	918	4.23	0.19
Maryland	296	428	509	3.33	0.15	Utah	85	626	837	3.55	0.13
Massachusetts	1,102	716	699	4.80	0.24	Vermont	11	354	708	5.27	0.09
Michigan	93	382	445	3.66	0.08	Virginia	291	583	694	3.68	0.19
Minnesota	150	587	769	4.05	0.27	Washington	386	755	1012	4.10	0.21
Mississippi	9	414	668	5.33	0.22	West Virginia	4	643	492	1.25	0.25
Missouri	23	570	909	3.74	0.09	Wisconsin	45	322	508	3.56	0.18
Montana	3	286	1233	4.67	0.33	Wyoming	2	507	798	4.00	0.50
						Total	10,594	660	788	4.21	0.20

Table 3
Geographic Concentration of Venture Capital (VC) Investors and Likelihood of Going Public and Being Acquired

This table reports the results from linear probability model regressions of VC firms' exit performance (columns (1)-(3) of Panel A) and difference-in-differences tests using the introduction of new direct airline routes that reduce the travel time between VC investors (*Airline Shock*) as an exogenous shock to geographic concentration among VC investors (column (4) of Panel A and Panel B). The sample consists of 45,604 financing round observations for 10,594 startup firms with VC investments during 1995-2015 except for column (1) of Panel B, in which the sample consists of a propensity score-matched sample of 8,581 financing round observations for 4,143 startup firms with VC investments during the sample period. The dependent variable is an indicator that takes the value of one if the firm goes public through an IPO or is acquired for a deal value greater than $25 million and zero otherwise (*Exit*). In columns (1)-(3) of Panel A, the key independent variables are *Ew Distances* (logarithm of one plus the equally weighted physical distance (in miles) between all of a firm's VC investor pairs), *Vw Distances (Equity)* (logarithm of one plus the cumulative investment amount-weighted physical distance between all of a firm's VC investor pairs), and *Lead Vw Distances (Equity)* (logarithm of one plus the cumulative investment amount-weighted physical distance between a lead VC investor and the other VC investors). In column (4) of Panel A and all columns of Panel B, the key independent variable is *Reduction in Travel Time* (indicator that takes the value of one if the round-trip travel time between a VC investor's city and other VC investors' cities is reduced by more than a half-hour because of an *Airline Shock* between consecutive investment rounds and zero otherwise). In column (1) of Panel B, we match a treatment financing round of the firm that experiences an *Airline Shock* (the introduction of new direct airline routes that reduces the travel time between VC investors) to a control financing round of the firm that does not experience *an Airline Shock* based on the predicted probability of being treated. We use as matching variables *Ew Distances*, *Firm-Lead VC Distance*, cumulative number of VC investors and total funding, funding characteristics in the first round of VC investments (firm age, total funding, early-stage indicator), industry characteristics (market-to-book ratio, R&D intensity, and asset tangibility), VC investor reputation measures (VC investors' average fund age, average amount of equity invested, and average total number of investment rounds), and industry, year, first financing year, firm state, and lead VC investor fixed effects. We choose a control financing round, without replacement, that has the closest propensity score with a caliper of 0.01. In column (2) of Panel B, we treat an *Airline Shock* with a distance reduction of less than 200 kilometers as no shock (i.e., zero value for *Reduction in Travel Time*). In column (3) of Panel B, we exclude startup firms with VC investments that are headquartered in California from the analysis. In columns (4)-(6) of Panel B, we additionally control for firm state-year fixed effects, financing round fixed effects, and lead VC investor-MSA-year fixed effects. The Appendix provides detailed variable descriptions. Standard errors reported in parentheses are robust and clustered by industry. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Main Tests

	Dependent Variable = Exit (indicator)			
	Using Geographic Distance among VC Investors as the Measure of Geographic Concentration			Using *Airline Shock* as a Shock to Geographic Concentration
Independent Variable	(1)	(2)	(3)	(4)
Ew Distances	-0.001**			
	(0.000)			
Vw Distances (Equity)		-0.001**		
		(0.001)		
Lead Vw Distances (Equity)			-0.001**	
			(0.001)	
Reduction in Travel Time (indicator)				0.053***
				(0.005)
Firm-Lead VC Distances	0.000	0.000	0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Number of Investors	0.002***	0.002***	0.002***	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Log (1 + Total Funding)	0.028***	0.028***	0.028***	0.027***
	(0.003)	(0.003)	(0.003)	(0.003)
Log (1 + Firm Age at Round One)	0.002	0.002	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
Log (1 + Total Funding at Round One)	0.003	0.003	0.003	0.004
	(0.002)	(0.002)	(0.002)	(0.003)

Early Stage (indicator)	-0.020***	-0.020***	-0.020***	-0.021***
	(0.003)	(0.003)	(0.003)	(0.003)
Industry Market/Book Ratio	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Industry R&D/Asset Ratio	-0.002**	-0.002**	-0.002**	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
Industry Asset Tangibility	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Log (VC Investor Age)	-0.002	-0.002	-0.002	-0.002*
	(0.001)	(0.001)	(0.001)	(0.001)
Log (Total Equity Investment	-0.003	-0.003	-0.003	-0.003
by VC Investors)	(0.005)	(0.005)	(0.005)	(0.005)
Log (Total Rounds VC Investors	-0.001	-0.001	-0.001	-0.001
Participated)	(0.006)	(0.006)	(0.006)	(0.006)
Industry & Year Fixed Effects	Yes	Yes	Yes	Yes
First Financing Year Fixed Effects	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes
Observations	45,604	45,604	45,604	45,604
Adjusted *R*-squared	0.068	0.068	0.068	0.072

Panel B. Robustness Tests for the Analyses Using *Airline Shock* as a Shock to Geographic Concentration

	Dependent Variable = Exit (indicator)					
	Using Propensity Score Matched Sample	Treating *Airline Shock* with Distance Less Than 200 km as No Shock	Excluding Firms Headquartered in California	Controlling for Firm State-Year Fixed Effects	Controlling for Financing Round Fixed Effects	Controlling for Lead VC Investor-MSA-Year Fixed Effects
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)
Reduction in Travel Time	0.059***	0.053***	0.056***	0.055***	0.053***	0.059***
(indicator)	(0.009)	(0.005)	(0.007)	(0.005)	(0.005)	(0.006)
Controls in Panel A	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm State-Year Fixed Effects	No	No	No	Yes	No	No
Financing Round Fixed Effects	No	No	No	No	Yes	No
Lead VC MSA-Year Fixed Effects	No	No	No	No	No	Yes
Observations	8,581	45,604	26,883	45,515	45,604	36,915
Adjusted *R*-squared	0.089	0.072	0.087	0.073	0.072	0.057

Table 4
Geographic Concentration of Venture Capital (VC) Investors and Successive VC Syndication

This table reports the results from OLS regressions of the proportion of existing VC investors that participate in a follow-up round (columns (1)-(3) of Panel A) and difference-in-differences tests using the introduction of new direct airline routes that reduce the travel time between VC investors (*Airline Shock*) as an exogenous shock to geographic concentration among VC investors (column (4) of Panel A and Panel B). The sample consists of 33,400 financing round observations for 10,594 startup firms with VC investments during 1995-2015 except for column (1) of Panel B, in which the sample consists of a propensity score-matched sample of 8,304 financing round observations for 3,986 startup firms with VC investments during the sample period. The dependent variable is the ratio of the number of existing VC investors that participate in both the current and previous syndication rounds to the total number of VC investors in the previous syndication (*Successive VC Syndication*). In columns (1)-(3) of Panel A, the key independent variables are *Ew Distances* (logarithm of one plus the equally weighted physical distance (in miles) between all of a firm's VC investor pairs), *Vw Distances (Equity)* (logarithm of one plus the cumulative investment amount-weighted physical distance between all of a firm's VC investor pairs), and *Lead Vw Distances (Equity)* (logarithm of one plus the cumulative investment amount-weighted physical distance between a lead VC investor and the other VC investors). In column (4) of Panel A and all columns of Panel B, the key independent variable is *Reduction in Travel Time* (indicator that takes the value of one if the round-trip travel time between a VC investor's city and other VC investors' cities is reduced by more than a half-hour because of an *Airline Shock* between consecutive investment rounds and zero otherwise). In column (1) of Panel B, we match a treatment financing round of the firm that experiences an *Airline Shock* (the introduction of new direct airline routes that reduces the travel time between VC investors) to a control financing round of the firm that does not experience an *Airline Shock* based on the predicted probability of being treated. We use as matching variables *Ew Distances*, *Firm-Lead VC Distance*, the same set of control variables in Panel A, and industry, year, first financing year, firm state, and lead VC investor fixed effects. We choose a control financing round, without replacement, that has the closest propensity score with a caliper of 0.01. In column (2) of Panel B, we treat an *Airline Shock* with a distance reduction of less than 200 kilometers as no shock (i.e., zero value for *Reduction in Travel Time*). In column (3) of Panel B, we exclude startup firms with VC investments that are headquartered in California from the analysis. In columns (4)-(6) of Panel B, we additionally control for firm state-year fixed effects, financing round fixed effects, and lead VC investor-MSA-year fixed effects. The Appendix provides detailed variable descriptions. Standard errors reported in parentheses are robust and clustered by industry. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Main Tests

	Dependent Variable = Successive VC Syndication			
	Using Geographic Distance among VC Investors as the Measure of Geographic Concentration			Using *Airline Shock* As a Shock to Geographic Concentration
Independent Variable	(1)	(2)	(3)	(4)
Ew Distances	-0.009***			
	(0.001)			
Vw Distances (Equity)		-0.009***		
		(0.001)		
Lead Vw Distances (Equity)			-0.009***	
			(0.001)	
Reduction in Travel Time (indicator)				0.014***
				(0.003)
Firm-Lead VC Distances	0.001*	0.001**	0.002**	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Number of Investors	-0.008***	-0.008***	-0.008***	-0.009***
	(0.001)	(0.001)	(0.001)	(0.001)
Log (1 + Total Funding)	0.021***	0.021***	0.021***	0.015***
	(0.003)	(0.003)	(0.003)	(0.003)
Log (1 + Firm Age at Round One)	0.000	-0.000	-0.000	0.001
	(0.002)	(0.002)	(0.002)	(0.002)
Log (1 + Total Funding at Round One)	0.003	0.003	0.003	-0.000
	(0.004)	(0.004)	(0.004)	(0.004)
Early Stage (indicator)	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Industry Market/Book Ratio	-0.000	-0.000	-0.000	-0.000

	(0.002)	(0.002)	(0.002)	(0.001)
Industry R&D/Asset Ratio	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Industry Asset Tangibility	-0.005	-0.005	-0.005	-0.004
	(0.003)	(0.003)	(0.003)	(0.003)
Log (VC Investor Age)	0.029***	0.029***	0.029***	0.031***
	(0.006)	(0.006)	(0.006)	(0.007)
Log (Total Equity Investment	-0.010*	-0.010*	-0.010*	-0.010*
by VC Investors)	(0.005)	(0.005)	(0.005)	(0.005)
Log (Total Rounds VC Investors	0.009***	0.009***	0.009***	0.009***
Participated)	(0.002)	(0.002)	(0.002)	(0.002)
Industry & Year Fixed Effects	Yes	Yes	Yes	Yes
First Financing Year Fixed Effects	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes
Observations	33,400	33,400	33,400	33,400
Adjusted *R*-squared	0.286	0.286	0.286	0.278

Panel B. Robustness Tests for the Analyses Using *Airline Shock* as a Shock to Geographic Concentration

	Dependent Variable = Successive VC Syndication					
	Using Propensity Score Matched Sample	Treating *Airline Shock* with Distance Less Than 200 km as No Shock	Excluding Firms Headquartered in California	Controlling for Firm State-Year Fixed Effects	Controlling for Financing Round Fixed Effects	Controlling for Lead VC Investor-MSA-Year Fixed Effects
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)
Reduction in Travel Time	0.008**	0.013***	0.016***	0.015***	0.017***	0.011***
(indicator)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)
Controls in Panel A	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm State-Year Fixed Effects	No	No	No	Yes	No	No
Financing Round Fixed Effects	No	No	No	No	Yes	No
Lead VC MSA-Year Fixed Effects	No	No	No	No	No	Yes
Observations	8,304	33,400	19,312	33,295	33,398	26,415
Adjusted *R*-squared	0.213	0.279	0.319	0.285	0.283	0.288

Table 5
Geographic Concentration of Venture Capital (VC) Investors and Duration of Financing Rounds

This table reports the results from OLS regressions of the duration (investment interval) of financing rounds (columns (1)-(3) of Panel A) and difference-in-differences tests using the introduction of new direct airline routes that reduce the travel time between VC investors (*Airline Shock*) as an exogenous shock to geographic concentration among VC investors (column (4) of Panel A and Panel B). The sample consists of 45,604 financing round observations for 10,594 startup firms with VC investments during 1995-2015 except for column (1) of Panel B, in which the sample consists of a propensity score-matched sample of 8,581 financing round observations for 4,143 startup firms with VC investments during the sample period. The dependent variable is the logarithm of one plus the duration in months between the current and the next financing (exit time if there is no additional financing) rounds. In columns (1)-(3) of Panel A, the key independent variables are *Ew Distances* (logarithm of one plus the equally weighted physical distance (in miles) between all of a firm's VC investor pairs), *Vw Distances (Equity)* (logarithm of one plus the cumulative investment amount-weighted physical distance between all of a firm's VC investor pairs), and *Lead Vw Distances (Equity)* (logarithm of one plus the cumulative investment amount-weighted physical distance between a lead VC investor and the other VC investors). In column (4) of Panel A and all columns of Panel B, the key independent variable is *Reduction in Travel Time* (indicator that takes the value of one if the round-trip travel time between a VC investor's city and other VC investors' cities is reduced by more than a half-hour because of an *Airline Shock* between consecutive investment rounds and zero otherwise). In column (1) of Panel B, we match a treatment financing round of the firm that experiences an *Airline Shock* (the introduction of new direct airline routes that reduces the travel time between VC investors) to a control financing round of the firm that does not experience an *Airline Shock* based on the predicted probability of being treated. We use as matching variables *Ew Distances*, *Firm-Lead VC Distance*, the same set of control variables in Panel A, and industry, year, first financing year, firm state, and lead VC investor fixed effects. We choose a control financing round, without replacement, that has the closest propensity score with a caliper of 0.01. In column (2) of Panel B, we treat an *Airline Shock* with a distance reduction of less than 200 kilometers as no shock (i.e., zero value for *Reduction in Travel Time*). In column (3) of Panel B, we exclude startup firms with VC investments that are headquartered in California from the analysis. In columns (4)-(6) of Panel B, we additionally control for firm state-year fixed effects, financing round fixed effects, and lead VC investor-MSA-year fixed effects. The Appendix provides detailed variable descriptions. Standard errors reported in parentheses are robust and clustered by industry. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Main Tests

	Dependent Variable = Log (1 + Duration between Two Financing Rounds)			
	Using Geographic Distance among VC Investors as the Measure of Geographic Concentration			Using *Airline Shock* as a Shock to Geographic Concentration
Independent Variable	(1)	(2)	(3)	(4)
Ew Distances	-0.010***			
	(0.002)			
Vw Distances (Equity)		-0.011***		
		(0.003)		
Lead Vw Distances (Equity)			-0.011***	
			(0.003)	
Reduction in Travel Time (indicator)				0.316***
				(0.015)
Firm-Lead VC Distances	0.005*	0.005*	0.005*	0.001
	(0.003)	(0.003)	(0.003)	(0.003)
Number of Investors	-0.014***	-0.014***	-0.014***	-0.023***
	(0.002)	(0.002)	(0.002)	(0.002)
Log (1 + Total Funding)	0.052***	0.053***	0.053***	0.045***
	(0.010)	(0.010)	(0.010)	(0.009)
Log (1 + Firm Age at Round One)	0.091***	0.091***	0.091***	0.090***
	(0.009)	(0.009)	(0.009)	(0.009)
Log (1 + Total Funding at Round One)	-0.068***	-0.068***	-0.067***	-0.074***
	(0.012)	(0.012)	(0.012)	(0.012)
Early Stage (indicator)	-0.004**	-0.004**	-0.004**	-0.004**
	(0.001)	(0.001)	(0.001)	(0.001)
Industry Market/Book Ratio	0.006	0.006	0.006	0.007*

	(0.004)	(0.004)	(0.004)	(0.004)
Industry R&D/Asset Ratio	-0.004**	-0.004**	-0.004**	-0.005**
	(0.002)	(0.002)	(0.002)	(0.002)
Industry Asset Tangibility	-0.005	-0.005	-0.005	-0.003
	(0.012)	(0.012)	(0.012)	(0.010)
Log (VC Investor Age)	0.008	0.008	0.008	0.011
	(0.027)	(0.027)	(0.027)	(0.027)
Log (Total Equity Investment	0.024	0.025	0.025	0.023
by VC Investors)	(0.022)	(0.022)	(0.022)	(0.022)
Log (Total Rounds VC Investors	-0.005	-0.006	-0.006	-0.007
Participated)	(0.010)	(0.010)	(0.010)	(0.010)
Industry & Year Fixed Effects	Yes	Yes	Yes	Yes
First Financing Year Fixed Effects	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes
Observations	45,604	45,604	45,604	45,604
Adjusted *R*-squared	0.115	0.115	0.115	0.121

Panel B. Robustness Tests for the Analyses Using *Airline Shock* as a Shock to Geographic Concentration

	Dependent Variable = Log (1 + Duration between Two Financing Rounds)					
	Using Propensity Score Matched Sample	Treating *Airline Shock* with Distance Less Than 200 km as No Shock	Excluding Firms Headquartered in California	Controlling for Firm State-Year Fixed Effects	Controlling for Financing Round Fixed Effects	Controlling for Lead VC Investor-MSA-Year Fixed Effects
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)
Reduction in Travel Time	0.363***	0.322***	0.331***	0.318***	0.312***	0.348***
(indicator)	(0.017)	(0.017)	(0.022)	(0.015)	(0.016)	(0.022)
Controls in Panel A	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm State-Year Fixed Effects	No	No	No	Yes	No	No
Financing Round Fixed Effects	No	No	No	No	Yes	No
Lead VC MSA-Year Fixed Effects	No	No	No	No	No	Yes
Observations	8,581	45,604	26,883	45,515	45,604	36,915
Adjusted *R*-squared	0.109	0.072	0.087	0.073	0.072	0.057

Table 6
Geographic Concentration of Venture Capital (VC) Investors and Use of Convertible Securities

This table reports the results from OLS regressions of the ratio of convertible securities (columns (1)-(3) of Panel A) and difference-in-differences tests using the introduction of new direct airline routes that reduce the travel time between VC investors (*Airline Shock*) as an exogenous shock to geographic concentration among VC investors (column (4) of Panel A and Panel B). The sample consists of 45,604 financing round observations for 10,594 startup firms with VC investments during 1995-2015 except for column (1) of Panel B, in which the sample consists of a propensity score-matched sample of 8,581 financing round observations for 4,143 startup firms with VC investments during the sample period. The dependent variable is the ratio of the amount of convertible debt and convertible preferred stock to the total funding amount in each financing round (*Ratio of Convertible Securities*). In columns (1)-(3) of Panel A, the key independent variables are *Ew Distances* (logarithm of one plus the equally weighted physical distance (in miles) between all of a firm's VC investor pairs), *Vw Distances (Equity)* (logarithm of one plus the cumulative investment amount-weighted physical distance between all of a firm's VC investor pairs), and *Lead Vw Distances (Equity)* (logarithm of one plus the cumulative investment amount-weighted physical distance between a lead VC investor and the other VC investors). In column (4) of Panel A and all columns of Panel B, the key independent variable is *Reduction in Travel Time* (indicator that takes the value of one if the round-trip travel time between a VC investor's city and other VC investors' cities is reduced by more than a half-hour because of an *Airline Shock* between consecutive investment rounds and zero otherwise). In column (1) of Panel B, we match a treatment financing round of the firm that experiences an *Airline Shock* (the introduction of new direct airline routes that reduces the travel time between VC investors) to a control financing round of the firm that does not experience an *Airline Shock* based on the predicted probability of being treated. We use as matching variables *Ew Distances*, *Firm-Lead VC Distance*, the same set of control variables in Panel A, and industry, year, first financing year, firm state, and lead VC investor fixed effects. We choose a control financing round, without replacement, that has the closest propensity score with a caliper of 0.01. In column (2) of Panel B, we treat an *Airline Shock* with a distance reduction of less than 200 kilometers as no shock (i.e., zero value for *Reduction in Travel Time*). In column (3) of Panel B, we exclude startup firms with VC investments that are headquartered in California from the analysis. In columns (4)-(6) of Panel B, we additionally control for firm state-year fixed effects, financing round fixed effects, and lead VC investor-MSA-year fixed effects. The Appendix provides detailed variable descriptions. Standard errors reported in parentheses are robust and clustered by industry. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Main Tests

	Dependent Variable = Ratio of Convertible Securities			
	Using Geographic Distance among VC Investors as the Measure of Geographic Concentration			Using *Airline Shock* as a Shock to Geographic Concentration
Independent Variable	(1)	(2)	(3)	(4)
Ew Distances	0.009***			
	(0.001)			
Vw Distances (Equity)		0.009***		
		(0.001)		
Lead Vw Distances (Equity)			0.009***	
			(0.001)	
Reduction in Travel Time (indicator)				-0.044***
				(0.009)
Firm-Lead VC Distances	0.001	0.001	0.001	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Number of Investors	0.007***	0.007***	0.007***	0.009***
	(0.001)	(0.001)	(0.001)	(0.001)
Log (1 + Total Funding)	0.045***	0.044***	0.045***	0.052***
	(0.006)	(0.006)	(0.006)	(0.006)
Log (1 + Firm Age at Round One)	-0.020***	-0.020***	-0.020***	-0.021***
	(0.004)	(0.004)	(0.004)	(0.004)
Log (1 + Total Funding at Round One)	0.068***	0.068***	0.068***	0.072***
	(0.007)	(0.007)	(0.007)	(0.007)
Early Stage (indicator)	-0.001***	-0.001***	-0.001***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)

Industry Market/Book Ratio	-0.002**	-0.002**	-0.002**	-0.003**
	(0.001)	(0.001)	(0.001)	(0.001)
Industry R&D/Asset Ratio	-0.001	-0.000	-0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Industry Asset Tangibility	-0.022***	-0.022***	-0.022***	-0.023***
	(0.005)	(0.005)	(0.005)	(0.005)
Log (VC Investor Age)	-0.041***	-0.041***	-0.041***	-0.041***
	(0.012)	(0.012)	(0.012)	(0.011)
Log (Total Equity Investment	0.014	0.014	0.014	0.013
by VC Investors)	(0.011)	(0.011)	(0.011)	(0.010)
Log (Total Rounds VC Investors	-0.002	-0.002	-0.002	-0.003
Participated)	(0.002)	(0.002)	(0.003)	(0.003)
Industry & Year Fixed Effects	Yes	Yes	Yes	Yes
First Financing Year Fixed Effects	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes
Observations	45,604	45,604	45,604	45,604
Adjusted *R*-squared	0.245	0.245	0.245	0.244

Panel B. Robustness Tests for the Analyses Using *Airline Shock* as a Shock to Geographic Concentration

	Dependent Variable = Ratio of Convertible Securities					
	Using Propensity Score Matched Sample	Treating *Airline Shock* with Distance Less Than 200 km as No Shock	Excluding Firms Headquartered in California	Controlling for Firm State-Year Fixed Effects	Controlling for Financing Round Fixed Effects	Controlling for Lead VC Investor-MSA-Year Fixed Effects
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)
Reduction in Travel Time	-0.037***	-0.045***	-0.055***	-0.043***	-0.043***	-0.042***
(indicator)	(0.011)	(0.009)	(0.018)	(0.009)	(0.008)	(0.013)
Controls in Panel A	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm State-Year Fixed Effects	No	No	No	Yes	No	No
Financing Round Fixed Effects	No	No	No	No	Yes	No
Lead VC MSA-Year Fixed Effects	No	No	No	No	No	Yes
Observations	8,581	45,604	26,883	45,515	45,604	36,915
Adjusted *R*-squared	0.212	0.244	0.246	0.247	0.259	0.305

Table 7
Geographic Concentration of Venture Capital (VC) Investors and Proportion of Directors Who Are Representatives of VC Investors on the Board: Firm-level Analyses

This table reports the results from OLS regressions of the proportion of directors affiliated with VC investors on startup-firm boards (*Percent of VC Directors*). The sample consists of 817 going-public startup firms in the United States with VC investments during 1995-2015. The dependent variable is *the percentage of VC directors* in the IPO year. *Reduction in Travel Time_Exit* is an indicator that takes the value of one if VC investors experience a reduction in travel time because of an *Airline Shock* (the introduction of new direct airline routes that reduce the travel time between VC investors) that occurs during the past three years before an exit. The Appendix provides detailed variable descriptions. Standard errors reported in parentheses are robust and clustered by industry and exit year. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Dependent Variable = Percent of VC Directors			
	Using Geographic Distance among VC Investors as the Measure of Geographic Concentration			Using *Airline Shock* as a Shock to Geographic Concentration
Independent Variable	(1)	(2)	(3)	(4)
Ew Distances	0.013**			
	(0.006)			
Vw Distances (Equity)		0.013**		
		(0.006)		
Lead Vw Distances (Equity)			0.013**	
			(0.006)	
Reduction in Travel Time_Exit (indicator)				-0.082*
				(0.045)
Firm-Lead VC Distances	-0.005	-0.006	-0.006	-0.004
	(0.009)	(0.009)	(0.009)	(0.007)
Number of Investors	0.000	0.001	0.001	0.004
	(0.005)	(0.004)	(0.004)	(0.004)
Log (1 + Total Funding)	0.023	0.022	0.023	0.028
	(0.018)	(0.018)	(0.018)	(0.035)
Log (1 + Firm Age at Round One)	-0.010	-0.010	-0.010	-0.007
	(0.042)	(0.042)	(0.041)	(0.034)
Log (1 + Total Funding at Round One)	-0.029	-0.030	-0.029	-0.028
	(0.020)	(0.019)	(0.019)	(0.035)
Early Stage (indicator)	-0.008	-0.007	-0.008	-0.006
	(0.021)	(0.021)	(0.020)	(0.035)
Industry Market/Book Ratio	0.013	0.013	0.013	0.015
	(0.013)	(0.013)	(0.012)	(0.010)
Industry R&D/Asset Ratio	0.000	0.000	-0.000	-0.002
	(0.006)	(0.006)	(0.005)	(0.006)
Industry Asset Tangibility	0.000	-0.000	-0.000	-0.001
	(0.026)	(0.026)	(0.026)	(0.025)
Log (VC Investor Age)	0.058*	0.059*	0.060*	0.010
	(0.028)	(0.029)	(0.030)	(0.063)
Log (Total Equity Investment	-0.031	-0.032	-0.033	-0.015
by VC Investors)	(0.054)	(0.056)	(0.056)	(0.048)
Log (Total Rounds VC Investors	-0.024	-0.024	-0.023	-0.025
Participated)	(0.027)	(0.027)	(0.027)	(0.026)
Industry Fixed Effects	Yes	Yes	Yes	Yes
Exit Year Fixed Effects	Yes	Yes	Yes	Yes
First Financing Year Fixed Effects	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes
Observations	817	817	817	817
Adjusted *R*-squared	0.159	0.158	0.158	0.176

Table 8
Endogeneity Tests: Cross-sectional Analysis

This table reports the results from difference-in-differences tests using the introduction of new direct airline routes that reduce the travel time between VC investors (*Airline Shock*) as an exogenous shock to geographic concentration among VC investors. The sample consists of 45,604 financing round observations for 10,594 startup firms with VC investments during 1995-2015. The dependent variable in column (1) is an indicator that takes the value of one if the firm goes public through an IPO or is acquired for a deal value greater than $25 million and zero otherwise (*Exit*). The dependent variable in column (2) is the ratio of the number of existing VC investors that participate in both the current and previous syndication rounds to the total number of VC investors in the previous syndication (*Successive VC Syndication*). The dependent variable in column (3) is the logarithm of one plus the duration in months between the current and the next financing (exit time if there is no additional financing) rounds. The dependent variable in column (4) is the ratio of the amount of convertible debt and convertible preferred stock to the total funding amount in each financing round (*Ratio of Convertible Securities*). In Panel A, we separate *Reduction in Travel Time* (treatment indicator that takes the value of one if the round-trip travel time between a VC investor's city and other VC investors' cities is reduced by more than a half-hour because of an *Airline Shock* between consecutive investment rounds and zero otherwise) into two indicators: *Lead VC Reduction in Travel Time*, which takes the value of one if the treatment is associated with a travel time reduction for lead VC investors and zero otherwise, and *Non-Lead VC Reduction in Travel Time*, which takes the value of one if the treatment is associated with a travel time reduction for non-lead VC investors and zero otherwise. In Panel B, we separate *Reduction in Travel Time* into two indicators: *Reduction in Travel Time with High Syndicate Experience* and *Reduction in Travel Time with Low Syndicate Experience*, which take the value of one if the ratio of VC investors that worked together in past syndicates formed during our sample period is greater and lower than the highest sample decile, respectively, and zero otherwise. In Panel C, we separate *Reduction in Travel Time* into two indicators: *Pre-2005 Reduction in Travel Time* and *Post-2005 Reduction in Travel Time*, which take the value of one if a VC investor pair is treated before and after 2005, respectively, and zero otherwise. In Panel D, we separate *Reduction in Travel Time* into two indicators: *Reduction in Travel Time with High Number of Investors* and *Reduction in Travel Time with Low Number of Investors*, which take the value of one if the cumulative number of VC investors in a syndicate is greater and lower than the highest sample decile, respectively, and zero otherwise. The Appendix provides detailed variable descriptions. Standard errors reported in parentheses are robust and clustered by industry. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Decomposing *Reduction in Travel Time* into *Lead VC Reduction in Travel Time* and *Non-Lead VC Reduction in Travel Time*

	Exit (indicator)	Successive VC Syndication	Log (1 + Duration between Two Financing Rounds)	Ratio of Convertible Securities
Independent Variable	(1)	(2)	(3)	(4)
Lead VC Reduction in Travel Time: a	0.061***	0.010***	0.364***	-0.051***
	(0.005)	(0.001)	(0.020)	(0.011)
Non-Lead VC Reduction in Travel Time: b	0.043***	0.013***	0.251***	-0.016
	(0.008)	(0.002)	(0.032)	(0.012)
P-value for the Test of the Difference in Coefficients between (a) and (b)	0.040**	0.208	0.008***	0.048**
Controls (Same As Table 3)	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
First Financing Year Fixed Effects	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes
Observations	45,604	33,400	45,604	45,604
Adjusted *R*-squared	0.073	0.198	0.121	0.244

Panel B. Decomposing *Reduction in Travel Time* into *Reduction in Travel Time with High Syndicate History* and *Reduction in Travel Time with Low Syndicate History*

	Exit (indicator)	Successive VC Syndication	Log (1 + Duration between Two Financing Rounds)	Ratio of Convertible Securities
Independent Variable	(1)	(2)	(3)	(4)
Reduction in Travel Time	0.024	0.003	0.291***	-0.032
with High Syndicate Experience: a	(0.018)	(0.009)	(0.074)	(0.027)
Reduction in Travel Time	0.057***	0.015***	0.320***	-0.040***
with Low Syndicate Experience: b	(0.005)	(0.003)	(0.014)	(0.010)
P-value for the Test of the Difference in	0.071*	0.261	0.707	0.809

Coefficients between (a) and (b)				
Controls (Same As Table 3)	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
First Financing Year Fixed Effects	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes
Observations	45,604	33,400	45,604	45,604
Adjusted *R*-squared	0.072	0.278	0.121	0.225

Panel C. Decomposing *Reduction in Travel Time* into *Pre-2005 Reduction in Travel Time* and *Post-2005 Reduction in Travel Time*

	Exit (indicator)	Successive VC Syndication	Log (1 + Duration between Two Financing Rounds)	Ratio of Convertible Securities
Independent Variable	(1)	(2)	(3)	(4)
Pre-2005 Reduction in Travel Time: a	0.073***	0.026***	0.413***	-0.074***
	(0.007)	(0.006)	(0.031)	(0.014)
Post-2005 Reduction in Travel Time: b	0.039***	0.009**	0.247***	-0.032**
	(0.005)	(0.004)	(0.018)	(0.013)
P-value for the Test of the Difference in Coefficients between (a) and (b)	0.000***	0.021**	0.000***	0.051***
Controls (Same As Table 3)	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
First Financing Year Fixed Effects	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes
Observations	45,604	33,400	45,604	45,604
Adjusted *R*-squared	0.073	0.278	0.121	0.244

Panel D. Decomposing *Reduction in Travel Time* into *Reduction in Travel Time with High Number of Investors* and *Reduction in Travel Time with Low Number of Investors*

	Exit (indicator)	Successive VC Syndication	Log (1 + Duration between Two Financing Rounds)	Ratio of Convertible Securities
Independent Variable	(1)	(2)	(3)	(4)
Reduction in Travel Time	0.078***	0.032***	0.324***	-0.082***
with High Number of Investors: a	(0.009)	(0.009)	(0.028)	(0.017)
Reduction in Travel Time	0.043***	0.006	0.313***	-0.018**
with Low Number of Investors: b	(0.007)	(0.004)	(0.018)	(0.009)
P-value for the Test of the Difference in Coefficients between (a) and (b)	0.005***	0.011**	0.726	0.000***
Controls (Same As Table 3)	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
First Financing Year Fixed Effects	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes
Observations	45,604	33,400	45,604	45,604
Adjusted *R*-squared	0.073	0.278	0.121	0.225

Appendix
Variable Definitions

The Appendix provides detailed descriptions of all of the variables used in the tables.

Variable Name	Definition	Data Source
Distance characteristics		
Ew Distances	Logarithm of one plus the equally weighted geographic distance in miles between all of a firm's VC investor pairs. Specifically, if the geographic distances between the VC investor pairs are $dist_{12}$, $dist_{13}$, …, and $dist_{ij}$, then *Ew Distances* is the logarithm of one plus the average of these distances. When there is only one existing VC investor, *Ew Distances* equals zero.	VentureXpert, MaxMind GeoIP Database
Vw Distances (Equity)	Logarithm of one plus the investment amount-weighted distance in miles between all of a firm's VC investor pairs. Specifically, if the geographic distances between the VC investor pairs are $dist_{12}$, $dist_{13}$, …, and $dist_{ij}$, then the investment amount-weighted distance between the VC investors (i.e., *Vw Distances (Equity)*) is the logarithm of one plus $(\sum_{ij} dist_{ij} * w_{ij})$, where w_{ij} is the sum of the investment amounts by VC investor *i* and VC investor *j* divided by the sum of the investment amounts by all VC investor pairs. When only one existing VC investor exists, *Vw Distances (Equity)* equals zero.	VentureXpert, MaxMind GeoIP Database
Lead Vw Distances (Equity)	Logarithm of one plus the investment amount-weighted distance in miles between a firm's lead VC investor and its other VC investors. Only VC investor pairs with a lead VC investor are included in computing the distance. Specifically, if the geographic distances between a firm's lead VC investor *i* and its other VC investors are $dist_{i1}$, $dist_{i2}$, …, and $dist_{ij}$, then the investment amount-weighted distance between lead VC investor *i* and the other non-lead VC investors (i.e., *Lead Vw Distances (Equity)*) is the logarithm of one plus $(\sum_{ij} dist_{ij} * w_{ij})$, where w_{ij} is the sum of the investment amounts by lead VC investor *i* and non-lead VC investor *j* divided by the sum of the investment amounts by all lead VC investor and non-lead VC investor pairs. When only one VC investor exists that is a lead VC investor, *Lead Vw Distances (Equity)* equals zero. Lead VC investors are VC firms that invest the largest amount of equity in the portfolio firms.	VentureXpert, MaxMind GeoIP Database
Firm-Lead VC Distances	Logarithm of one plus the physical distance in miles between the portfolio firm and its lead VC investor	VentureXpert, MaxMind GeoIP Database
Airline shock characteristics		
Lead VC Reduction in Travel Time (indicator)	Indicator that takes the value of one if the treatment (*Reduction in Travel Time*) is associated with a reduction in travel time for VC investor pairs involving a lead VC investor and zero otherwise	VentureXpert, T-100 Domestic Segment Database, Google Maps
Log (1 + Reduced Travel Time)	Logarithm of one plus the average reduction in travel time in hours between the cities of VC investor pairs for each firm-round observation	VentureXpert, T-100 Domestic Segment Database, Google Maps
Non-Lead VC Reduction in Travel Time (indicator)	Indicator that takes the value of one if the treatment (*Reduction in Travel Time*) is associated with a reduction in travel time for VC investor pairs without involving any lead VC investor and zero otherwise	VentureXpert, T-100 Domestic Segment Database, Google Maps
Pre-2005 (Post-2005) Reduction in Travel Time (indicator)	Indicator that takes the value of one if the treatment (*Reduction in Travel Time*) is associated with a reduction in travel time before (after) 2005 and zero otherwise	VentureXpert, T-100 Domestic Segment Database, Google Maps
Reduction in Travel Time (indicator)	Indicator that takes the value of one if the round-trip travel time between a VC investor's city and other investors' VC cities is reduced by more than a half-hour because of the introduction of new direct airline routes between consecutive investment rounds and zero otherwise. We restrict new direct airline routes to those that do not involve the city in which the firm is headquartered.	VentureXpert, T-100 Domestic Segment Database, Google Maps
Reduction in Travel Time with High (Low) Number of Investors	Indicator that takes the value of one if the treatment (*Reduction in Travel Time*) is associated with a reduction in travel time for VC investor pairs where the cumulative number of VC investors in a syndicate is greater (lower) than	VentureXpert, T-100 Domestic Segment Database,

	the highest decile of the sample and zero otherwise	Google Maps
Reduction in Travel Time with High (Low) Syndicate Experience	Indicator that takes the value of one if the treatment (*Reduction in Travel Time*) is associated with a reduction in travel time for VC investor pairs where the ratio of VC investors that work together in past syndicates formed during our sample period is greater (lower) than the highest sample decile and zero otherwise	VentureXpert, T-100 Domestic Segment Database, Google Maps
Reduction in Travel Time with High (Low) VC Overlap	Indicator that takes the value of one if the treatment (*Reduction in Travel Time*) is associated with a reduction in travel time for VC investor pairs where the degree of overlap of VC syndicate members across financing rounds within an entrepreneurial firm used in Bayar, Chemmanur, and Tian (2020) is greater (lower) than the highest sample decile and zero otherwise	VentureXpert, T-100 Domestic Segment Database, Google Maps
Reduction in Travel Time with Earlier (Later) Rounds	Indicator that takes the value of one if the treatment (*Reduction in Travel Time*) is associated with a reduction in travel time for VC investor pairs where the cumulative number of financing rounds is lower (greater) than the highest sample decile and zero otherwise	VentureXpert, T-100 Domestic Segment Database, Google Maps
Reduction in Travel Time_Exit (indicator)	Indicator that takes the value of one if the round-trip travel time between a VC investor's city and other investors' VC cities is reduced by more than a half-hour because of the introduction of new direct airline routes that occurs within the past three years before an exit and zero otherwise. We restrict new direct airline routes to those that do not involve the city in which the firm is headquartered.	VentureXpert, T-100 Domestic Segment Database, Google Maps
Reduction in Travel Time_Firm (indicator)	Indicator that takes the value of one if the round-trip travel time between a VC investor's city and other investors' VC cities is reduced by more than a half-hour because of the introduction of new direct airline routes between the starting year of the first financing round and the last year of the final financing round (or exit year when an exit event takes place) and zero otherwise. We restrict new direct airline routes to those that do not involve the city in which the firm is headquartered.	VentureXpert, T-100 Domestic Segment Database, Google Maps
Firm and VC financing characteristics		
Being Acquired (indicator)	Indicator that takes the value of one if the firm receives VC financing from being acquired with a deal value greater than $25 million and zero otherwise	VentureXpert
Early Stage (indicator)	Indicator that takes the value of one if the firm receives its first VC investment in the seed or early stage and zero otherwise	VentureXpert
Exit (indicator)	Indicator that takes the value of one if the firm receives VC financing through an IPO or from being acquired with a deal value greater than $25 million and zero otherwise	VentureXpert
Going Public (indicator)	Indicator that takes the value of one if the firm receives VC financing through an IPO and zero otherwise	VentureXpert
Industry Market/Book Ratio	Median ratio of the market value of equity to the book value of equity in the same three-digit SIC code industry	Compustat
Industry R&D/Asset Ratio (%)	Median ratio of R&D expenditures (zero if missing) to total assets in the same three-digit SIC code industry	Compustat
Industry Asset Tangibility (%)	Median ratio of tangible assets to total assets in the same three-digit SIC code industry	Compustat
Log (1 + Duration between Two Financing Rounds)	Logarithm of one plus the duration in months between the current and next financing rounds. Following Tian (2011), *Duration between Two Financing Rounds* is computed as the duration between the last financing round date and an exit event date if the firm exits through either an IPO or acquisition (the end of our sample period if the firm is still in the middle of an ongoing round).	VentureXpert
Log (1 + Firm Age at Round One)	Logarithm of one plus firm age in years during the first financing round	VentureXpert
Log (1 + Number of Financing Rounds)	Logarithm of one plus the total number of financing rounds that the firm receives from VC investors	VentureXpert
Log (1 + Total Funding)	Logarithm of one plus total VC funding ($ millions) that the firm has received	VentureXpert
Log (1 + Total Funding at Round One)	Logarithm of one plus total VC funding ($ millions) that the firm received during the first financing round	VentureXpert
Log (VC Investor Age)	Logarithm of VC investors' average age when the entrepreneurial firm receives the first round of financing from its VC investors. A VC investor's age is measured as the number of years between its founding year and the venture round year.	VentureXpert
Log (1 + Total Equity Investment by VC investors)	Logarithm of one plus the average amount of equity that VC investors have invested	VentureXpert

Log (1 + Total Rounds VC Investors Participated)	Logarithm of one plus the average number of investment rounds in which VC investors have participated	VentureXpert
Ratio of Convertible Securities	Ratio of the amount of convertible debt and convertible preferred stock to the total funding amount in each financing round	VentureXpert
Successive VC Syndication	Ratio of the number of VC investors that participate in both the current and previous syndication rounds to the total number of VC investors in the previous syndication round	VentureXpert
IPO characteristics		
IPO Valuation (Price to Book)	Ratio of the first-day closing price to the book value of equity per share after the IPO	VentureXpert, SDC Platinum
Number of VC Directors	Number of a portfolio firm's board seats held by VC investors during the IPO year	VentureXpert, SEC Form 424B
Percent of Independent Directors	Ratio of the number of independent directors in a portfolio firm to the total number of directors on the board during the IPO year	VentureXpert, SEC Form 424B
Percent of VC Directors	Ratio of the number of a portfolio firm's board seats held by VC investors to the total number of directors on the board during the IPO year	VentureXpert, SEC Form 424B

Online Appendix for

"Venture Capital Coordination in Syndicates, Corporate Monitoring, and Firm Performance"

September 21, 2020

This appendix discusses the results of additional analyses that are not reported in the paper and reports tables displaying these results.

The appendix table includes the following:

- Table A.1: Alternative Measures of VC Investors' Geographic Concentration
- Table A.2: VC Geographic Concentration and Firm-Lead VC Distance
- Table A.3: Descriptive Statistics for the Propensity Score-Matched Sample
- Table A.4: Endogeneity Tests of VC Investors' Geographic Concentration: Additional Robustness Tests
- Table A.5: Geographic Concentration of VC Investors and Successive VC Syndication: Tests Focusing on Later Stage VC Financing
- Table A.6: VC Investors' Geographic Concentration and IPO Valuation
- Table A.7: Geographic Concentration of VC Investors and the Number of Staged Financing
- Table A.8: Cross-Sectional Heterogeneity in the Treatment Effect: Additional Robustness Tests

A.1. Alternative Measures of VC Investors' Geographic Concentration

In Online Appendix Table A.1, we report the results from the estimation of the regressions in Tables 3-6 using alternative measures of VC investors' geographic concentrations. To capture VC investors' geographic concentration, we use the following three alternative distance measures: 1) the number of unique states in which VC investors are located (*Log (Number of States)*), 2) portfolio-share-weighted physical distance between all of a portfolio firm's VC investor pairs (*Vw Distances (Portfolio)*), and 3) portfolio-share-weighted physical distance between a portfolio firm's lead VC investor and its other VC investors (*Lead Vw Distances (Portfolio)*). [33] The results using these alternative measures of VC investors' geographic concentration are reported in Panels A, B, and C, respectively. We find that our results are robust to alternative distance measures.

A.2. VC Geographic Concentration and Firm-Lead VC Distances

We examine whether the effects of VC investors' geographic concentrations on our outcome variables are different between firms with high firm-VC distance and those with low firm-VC distance. We divide our sample firms into two subgroups according to the sample median distance between the portfolio firm and its lead VC investor and separately reestimate the regressions in Tables 3-6 for these two subgroups. The results are reported in Online Appendix Table A.2. In Panel A, in which we use the geographic distance among VC investors as the measure of geographic concentration, we find that the coefficient for *Ew Distance* for both subgroups is significant at the 1% level in all regressions except for the regression in column (7).

[33] *Vw Distances (Portfolio)* is measured as the natural logarithm of one plus the portfolio share-weighted distance in miles between all of a firm's VC investor pairs. Specifically, if the geographic distances between the VC investor pairs are $dist_{12}$, $dist_{13}$, …, and $dist_{ij}$, then the portfolio share-weighted distance between the VC investors (i.e., *Vw Distances (Portfolio)*) is the logarithm of one plus $(\sum_{ij} dist_{ij} * w_{ij})$, where *wij* is the sum of the cumulative investment share in VC investor *i*'s portfolio and the cumulative investment share in VC investor *j*'s portfolio divided by the sum of the cumulative investment shares in the portfolios of all VC investor pairs. When only one VC investor exists, *Vw Distances (Portfolio)* equals zero. *Lead Vw Distances (Portfolio)* is measured as the natural logarithm of one plus the portfolio share-weighted distance in miles between a firm's lead VC investor and its other VC investors. Only VC investor pairs with a lead VC investor are included in computing the distance. Specifically, if the geographic distances between a firm's lead VC investor *i* and its other VC investors are $dist_{i1}$, $dist_{i2}$, …, and $dist_{ij}$, then the portfolio share-weighted distance between lead VC investor *i* and the other non-lead VC investors (i.e., *Lead Vw Distances (Portfolio)*) is the logarithm of one plus $(\sum_{ij} dist_{ij} * w_{ij})$, where *wij* is the sum of the cumulative investment share in lead VC investor *i*'s portfolio and the cumulative investment share in non-lead VC investor *j*'s portfolio divided by the sum of the cumulative investment shares in the portfolios of all lead VC investor and non-lead VC investor pairs. When only one VC investor exists, *Lead Vw Distances (Portfolio)* equals zero. Lead VC investors are VC firms that invest the largest amount of equity in the portfolio firms.

The results using *Airline Shock* as an exogenous shock to geographic concentration among VC investors in Panel B are similar.

A.3. Propensity Score-Matched Sample

Online Appendix Table A.3 reports the mean statistics for the propensity score-matched sample used in Tables 3-6 of the paper. We match a treatment financing round of the firm that experiences an *Airline Shock* to a control financing round of the firm that does not experience an *Airline Shock* on the basis of the predicted probability of being treated. The significance in the test-of-difference column is based on the *t*-tests for equality of means. We find that no characteristics are significantly different between the two groups, indicating that propensity score matching effectively identifies the matching financing rounds.

A.4. Additional Robustness Tests for Difference-in-Differences Regressions

A.4.1. Eventually Treated Sample

In our identification test, the staggering introduction of new airline routes mitigates the selection bias of being treated because eventually treated firms are included in both the control and treatment groups in different financing rounds. To further examine this issue, we restrict both the treatment and control samples used in the regressions to eventually treated firms and reestimate the regressions in Tables 3-6 following Bertrand and Mullainathan (2003), Giroud (2013), and Bernstein, Giroud, and Townsend (2016). The results reported in Online Appendix Table A.4 Panel A show that our main results in Tables 3-6 remain the same.

A.4.2. Addressing Unobservable Local Shock

In our main analysis, we address a concern that *Airline Shock* is associated with portfolio firms' unobservable local economic shocks by restricting the shock to new routes that do not involve the city in which a portfolio firm is headquartered. To further mitigate this concern, in Online Appendix Table A.4 Panel B, we omit all firms in the same *city* as any of their VC investors and reestimate the regressions in Tables 3-6. We find that 19.45% of our sample firms

are in the same city as their VC investors. The results do not change.[34] Moreover, it should be noted that as shown in Figure 1 and discussed in Section 4.2.3, VC investors' geographic dispersion and treatment events vary across many states, which further mitigates the concern that our results are driven by a small number of treatment firms that are in major venture cities.

We also exclude the top 10% of the observations for the states in which the lead VC investors are located and experience greater economic booms based on the state-level annual GDP growth rate when estimating the regressions. We find that the results do not change. The results are reported in Online Appendix Table A.4 Panel C.

Overall, these results suggest that our main findings are unlikely to be driven by unobservable local economic shocks on startup firms and VC investors.

A.4.3. Using Reduced Travel Time as a Shock to VC Investors' Geographic Concentration

In our paper, we follow Giroud (2013) and Bernstein, Giroud, and Townsend (2016) when defining the treatment (i.e., a half-hour time-saving). However, we acknowledge that the choice of a half-hour is not based on the evidence that such a reduction in travel time significantly increases the frequency of the interactions among VC investors. To address this concern, we replace *Reduction in Travel Time* with reduced travel time between VC investors caused by an *Airline Shock*. Specifically, we measure the travel time reduction as the natural logarithm of one plus the average reduction in travel time between treated VC investor pairs for each firm-round observation (*Log (1 + Reduced Travel Time)*). The results are presented in Online Appendix Table A.4 Panel D. We find that a larger travel time reduction has a stronger treatment effect than does a shorter travel time reduction. These results further support our hypothesis that the reduction in travel time between VC investors improves their coordination and monitoring effectiveness.

A.4.4. Time-varying First VC Financing Round Effects

Another concern is that portfolio firms' first VC financing characteristics in different years could have persistent heterogeneous effects on exit performance and contractual

[34] The results are robust to excluding all firms within 50 (100, 150) miles of any of their VC investors. Approximately 66% (72%) of our sample firms have at least one VC investor within 50 (150 miles) of their headquarters.

investments (Bernstein, Giroud, and Townsend (2016)). To address this concern, in addition to including first financing year fixed effects, we also add interaction terms between the firm- and VC-first round characteristics (*Ew Distances*, *Firm-VC Distances*, firm age, VC investment amount, number of VC investors in the syndication, average VC investor age, and average number of portfolio firms held by VC investors) with year fixed effects to the regressions in Tables 3-6 and reestimate them. The results reported in Online Appendix Table A.4 Panel E show that our main findings do not change.

A.5. Robustness Test Focusing on Later Stage VC Financing

The demand for syndicate partners may differ across financing rounds. Although our robustness test conducted by including financing round fixed effects can address this issue, to further examine whether it affects our results on successive VC syndication in Table 4, we repeat our analyses in Panel A of Table 4 by excluding early-stage financing rounds. As shown in Online Appendix Table A.5, our results do not change.

A.6. VC Investors' Geographic Concentration and IPO Valuation

As an additional test of the effect of VC investors' geographic concentration on coordination outcomes, we examine the relation between this concentration and portfolio firms' IPO valuation using IPO firms as the sample. Our hypothesis predicts that VC investors' geographic concentration leads to higher IPO valuations for their portfolio firms because of better coordination and monitoring. Using 692 IPO firms as the sample, we estimate both OLS and difference-in-differences regressions in which the dependent variable is the ratio of the first trading-day closing stock price to the book value of equity per share (i.e., book value of common equity divided by shares outstanding after the IPO). The results are reported in Online Appendix Table A.6. We find that all of the coefficients for the geographic dispersion measures are negative and significant, and the coefficient for *Reduction in Travel Time_Exit*, which takes the value of one if VC investors experience a reduction in travel time because of an *Airline Shock* that occurs during the past three years before an exit, is positive and significant. Thus, entrepreneurial firms with geographically dispersed VC investors tend to have lower valuations on the first trading date than those with geographically concentrated VC investors.

A.7. Geographic Concentration of Venture Capital Investors and the Number of Staged Financing

As an additional test of the effect of VC investors' geographic concentration on staged financing, we replace (*Log (1 + Duration between Two Financing Rounds)* with *Log (1 + Number of Financing Rounds)* as the dependent variable. Following the previous literature (e.g., Tian (2011)), we limit our attention to only the sample of each firm's final financing round. The sample consists of 10,594 final financing round observations for 10,594 startup firms with VC investments during 1995-2015. Specifically, when the firm goes public or is acquired, we use only its last financing round immediately before the IPO or acquisition. The results are reported in Online Appendix Table A.7. In columns (1)-(3), we find that VC investors' geographic dispersion is positively and significantly related to the number of financing rounds at the 1% level. In terms of economic significance, we find that an increase in *Ew Distances* from the 50th to the 75th percentile is associated with an increase in the number of rounds by 1.9% relative to the unconditional sample mean (column (1)).

In column (4), we estimate the regression using a difference-in-differences test in which we use *Reduction in Travel Time_Firm* (indicator that takes the value of one if VC investors experience a reduction in travel time between the starting year of the first financing round and the last year of the final financing round (or the exit year when an exit event takes place) and zero otherwise) as a new treatment variable. Consistent with the findings in the OLS regressions, we find that the reduction in travel time leads to a decrease in the number of financing rounds.

A.8. Cross-Sectional Heterogeneity in the Treatment Effect: Additional Robustness Tests

We conduct two additional tests for the cross-sectional variation in treatment effects. First, as a robustness test for the difference-in-differences tests in Section 6.2, in which we show that the impact of the geographic concentration among VC investors is more pronounced for those who have not worked together in past VC syndicates, we examine whether syndicate overlap among VC investors within an entrepreneurial firm affects our treatment results. Specifically, we decompose *Reduction in Travel Time* into *Reduction in Travel Time with High VC Overlap* and *Reduction in Travel Time with Low VC Overlap* and then reestimate the difference-in-differences regressions in Tables 3-6. We use a VCCI used in Bayar, Chemmanur, and Tian (2020) to measure the degree of overlap of VC syndicate members across financing rounds within an entrepreneurial firm. The

results are reported in Online Appendix Table A.8 Panel A. We find that the results in Tables 3-6 are more pronounced for *Reduction in Travel Time with Low VC Overlap* than for *Reduction in Travel Time with High VC Overlap* except for column (3). Thus, improvements in VC syndicate partners' coordination and monitoring that arise from an airline shock are particularly evident when they have less overlap in their previous syndicates and face higher coordination costs.

Second, we examine whether VC investors' coordination within syndicates is more important in earlier rounds (i.e., developmental stage) of entrepreneur firms than in later rounds of entrepreneur firms. We replace two airline shock indicators used in Online Appendix Table A.8 Panel A with *Reduction in Travel Time in Earlier Rounds* and *Reduction in Travel Time in Later Rounds* and reestimate the regressions. *Reduction in Travel Time in Earlier Rounds* and *Reduction in Travel Time in Later Rounds* take the value of one if the cumulative number of financing rounds is lower and greater than the highest sample decile, respectively, and zero otherwise. The results reported in Online Appendix Table A.8 Panel B show that the coefficients for both indicators are significant in all regressions. Thus, the reduction in travel time between VC investors improves their coordination and monitoring effectiveness, regardless of the stages of their portfolio firms.

Table A.1
Alternative Distance Measures for VC Investors' Geographic Concentration

This table reports the results from the estimation of the regressions in Tables 3-6 using the alternative measures of VC investors' geographic concentrations. The sample consists of 45,604 financing round observations for 10,594 startup firms with VC investments during 1995-2015. The dependent variable in column (1) is an indicator that takes the value of one if the firm goes public through an IPO or is acquired for a deal value greater than $25 million and zero otherwise (*Exit*). The dependent variable in column (2) is the ratio of the number of existing VC investors that participate in both the current and previous syndication rounds to the total number of VC investors in the previous syndication (*Successive VC Syndication*). The dependent variable in column (3) is the logarithm of one plus the duration in months between the current and the next financing (exit time if there is no additional financing) rounds. The dependent variable in column (4) is the ratio of the amount of convertible debt and convertible preferred stock to the total funding amount in each financing round (*Ratio of Convertible Securities*). In Panel A, we use the number of unique states in which VC investors are headquartered, *Number of States*, to measure VC investors' geographic concentration. In Panels B and C, we use *Vw Distances (Portfolio)* and *Lead Vw Distances (Portfolio)*, the logarithm of one plus the portfolio share-weighted physical distance between all of a firm's VC investor pairs and the logarithm of one plus the portfolio share-weighted physical distance between a lead VC investor and the other VC investors, as measures of VC investors' geographic concentration, respectively. The Appendix provides detailed variable descriptions. Standard errors reported in parentheses are robust and clustered by industry. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Using *Number of States* as the Measure of VC Investors' Geographic Concentration

	Exit (indicator)	Successive VC Syndication	Log (1 + Duration between Two Financing Rounds)	Ratio of Convertible Securities
Independent Variable	(1)	(2)	(3)	(4)
Log (Number of States)	-0.006**	-0.020***	-0.054***	0.050***
	(0.003)	(0.004)	(0.020)	(0.007)
Controls (Same As Table 3)	Yes	Yes	Yes	Yes
Industry Fixed Effects & Year Fixed Effects	Yes	Yes	Yes	Yes
First Financing Year Fixed Effects	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes
Observations	45604	33400	45604	45604
Adjusted *R*-squared	0.068	0.279	0.115	0.245

Panel B. Using *Vw Distances (Portfolio)* as the Measure of VC Investors' Geographic Concentration

	Exit (indicator)	Successive VC Syndication	Log (1 + Duration between Two Financing Rounds)	Ratio of Convertible Securities
Independent Variable	(1)	(2)	(3)	(4)
Vw Distances (Portfolio)	-0.001**	-0.009***	-0.011***	0.009***
	(0.000)	(0.001)	(0.003)	(0.001)
Controls (Same As Table 3)	Yes	Yes	Yes	Yes
Industry Fixed Effects & Year Fixed Effects	Yes	Yes	Yes	Yes
First Financing Year Fixed Effects	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes
Observations	45604	33400	45604	45604
Adjusted *R*-squared	0.068	0.286	0.115	0.245

Panel C. Using *Lead Vw Distances (Portfolio)* as the Measure of VC Investors' Geographic Concentration

	Exit (indicator)	Successive VC Syndication	Log (1 + Duration between Two Financing Rounds)	Ratio of Convertible Securities
Independent Variable	(1)	(2)	(3)	(4)
Lead Vw Distances (Portfolio)	-0.001*	-0.009***	-0.011***	0.009***
	(0.001)	(0.001)	(0.003)	(0.001)
Controls (Same As Table 3)	Yes	Yes	Yes	Yes
Industry Fixed Effects & Year Fixed Effects	Yes	Yes	Yes	Yes
First Financing Year Fixed Effects	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes
Observations	45604	33400	45604	45604
Adjusted *R*-squared	0.068	0.286	0.115	0.245

Table A.2
VC Geographic Concentration and Firm-Lead VC Distance

This table reports the results from the estimation of the regressions in Tables 3-6 by *Firm-Lead VC Distances*. The sample consists of 45,604 financing round observations for 10,594 startup firms with VC investments during 1995-2015. The sample is divided into two groups, *Large Firm-Lead Distances* (columns (1)-(4)) and *Small Firm-Lead VC Distances* (columns (5)-(8)), according to the sample median *Firm-Lead VC Distances.* The dependent variable in columns (1) and (5) is an indicator that takes the value of one if the firm goes public through an IPO or is acquired for a deal value greater than $25 million and zero otherwise (*Exit*). The dependent variable in columns (2) and (6) is the ratio of the number of existing VC investors that participate in both the current and previous syndication rounds to the total number of VC investors in the previous syndication (*Successive VC Syndication*). The dependent variable in columns (3) and (7) is the logarithm of one plus the duration in months between the current and the next financing (exit time if there is no additional financing) rounds. The dependent variable in columns (4) and (8) is the ratio of the amount of convertible debt and convertible preferred stock to the total funding amount in each financing round (*Ratio of Convertible Securities*). In Panel A, the key independent variable is *Ew Distances* (logarithm of one plus the equally weighted physical distance (in miles) between all of a firm's VC investor pairs). In Panel B, the key independent variable is *Reduction in Travel Time* (indicator that takes the value of one if the round-trip travel time between a VC investor's city and other VC investors' cities is reduced by more than a half-hour because of the introduction of new direct airline routes (*Airline Shock*) between consecutive investment rounds and zero otherwise). The Appendix provides detailed variable descriptions. Standard errors reported in parentheses are robust and clustered by industry. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Subsample Analysis Using the Geographic Distance among VC Investors as the Measure of Geographic Concentration

	Large Firm-Lead VC Distances				Small Firm-Lead VC Distances			
	Exit (indicator)	Successive VC Syndication	Log (1 + Duration between Two Financing Rounds)	Ratio of Convertible Securities	Exit (indicator)	Successive VC Syndication	Log (1 + Duration between Two Financing Rounds)	Ratio of Convertible Securities
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ew Distances	-0.001**	-0.012***	-0.015***	0.008***	-0.001**	-0.005***	-0.005	0.009***
	(0.001)	(0.001)	(0.003)	(0.002)	(0.000)	(0.001)	(0.003)	(0.001)
Controls (Same As Table 3)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects & Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First Financing Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	22,394	16,531	22,394	22,394	22,475	16,366	22,475	22,475
Adjusted *R*-squared	0.071	0.346	0.111	0.250	0.073	0.308	0.126	0.265

Panel B. Subsample Analysis using *Airline Shock* as an Exogenous Shock to Geographic Concentration among VC Investors

	Large Firm-Lead VC Distances				Small Firm-Lead VC Distances			
	Exit (indicator)	Successive VC Syndication	Log (1 + Duration between Two Financing Rounds)	Ratio of Convertible Securities	Exit (indicator)	Successive VC Syndication	Log (1 + Duration between Two Financing Rounds)	Ratio of Convertible Securities
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Reduction in Travel Time (indicator)	0.054***	0.006	0.373***	-0.040**	0.053***	0.018***	0.240***	-0.051*
	(0.008)	(0.004)	(0.025)	(0.016)	(0.005)	(0.005)	(0.032)	(0.026)
Controls (Same As Table 3)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects & Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First Financing Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Lead VC Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	22,394	16,531	22,394	22,394	22,475	16,366	22,475	22,475
Adjusted *R*-squared	0.076	0.334	0.120	0.249	0.077	0.306	0.129	0.264

Table A.3
Descriptive Statistics for the Propensity Score-Matched Sample

This table presents the mean statistics for a propensity score-matched sample used in Tables 3-6 of the paper. The sample consists of 9,358 financing round observations (4,679 treated financing rounds and 4,679 control financing rounds) with venture capital (VC) investments during 1995-2015. We match a treatment financing round of the firm that experiences an *Airline Shock* (the introduction of new direct airline routes that reduces the travel time between VC investors) with a control financing round of the firm that does not experience an *Airline Shock* using the predicted probability of being treated. We use as matching variables *Ew Distances*, *Firm-Lead VC Distances*, cumulative number of VC investors and total funding, funding characteristics in the first round of VC investments (firm age, total funding, early-stage indicator), industry characteristics (market-to-book ratio, R&D intensity, and asset tangibility), VC investor reputation measures (VC investors' average fund age, average amount of equity invested, and average total number of investment rounds), and industry, year, first financing year, firm state, and lead VC investor fixed effects. We choose a control financing round, without replacement, that has the closest propensity score with a caliper of 0.01. The significance in the test-of-difference column is based on the *t*-tests for equality of means. The Appendix provides detailed variable descriptions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Treated Sample: A	Control Sample: B	Test of difference: (A - B)
Variable	Mean	Mean	*t*-statistics
Ew Distances	6.87	6.89	-1.59
Firm-Lead VC Distances	10.78	10.74	0.40
Number of Investors	3.71	3.72	-0.71
Log (1 + Total Funding)	1.00	1.02	-1.00
Log (1 + Firm Age at Round One)	1.74	1.76	-1.05
Log (1 + Total Funding at Round One)	0.76	0.76	0.56
Early Stage (indicator)	1.70	1.71	-0.92
Industry Market/Book Ratio	7.56	7.61	-0.36
Industry R&D/Asset Ratio	90.09	90.09	0.03
Industry Asset Tangibility	2.36	2.38	-0.77
Log (VC Investor Age)	5.95	5.95	-0.19
Log (Total Equity Investment by VC Investors)	4.92	4.92	-0.05
Log (Total Rounds VC Investors Participated)	6.87	6.89	-1.59
Log (IPO Proceeds)	10.78	10.74	0.40

Table A.4
Endogeneity Tests of Venture Capital (VC) Investors' Geographic Concentration: Additional Robustness Tests

This table reports the results from additional difference-in-differences tests using the introduction of new direct airline routes that reduce the travel time between VC investors (*Airline Shock*) as an exogenous shock to the geographic concentration among VC investors. The sample consists of 45,604 financing round observations for 10,594 startup firms with VC investments during 1995–2015. The dependent variable in column (1) is an indicator that takes the value of one if the firm goes public through an IPO or is acquired for a deal value greater than $25 million and zero otherwise (*Exit*). The dependent variable in column (2) is the ratio of the number of existing VC investors that participate in both the current and previous syndication rounds to the total number of VC investors in the previous syndication (*Successive VC Syndication*). The dependent variable in column (3) is the logarithm of one plus the duration in months between the current and the next financing (exit time if there is no additional financing) rounds. The dependent variable in column (4) is the ratio of the amount of convertible debt and convertible preferred stock to the total funding amount in each financing round (*Ratio of Convertible Securities*). In Panel A, we use only the eventually treated firms (i.e., firms treated at least once during our sample period) as the treatment and control samples. In Panel B, we exclude firms in the same cities as any of their VC investors. In Panel C, we exclude the top 10% of the observations for the states in which the lead VC investors are located and experience greater economic booms based on the state-level annual GDP growth rate. In Panel D, we use the logarithm of one plus the average reduced travel time between the treated VC investor pairs for each firm-round observation (*Log (1 + Reduced Travel Time)*) as the measure of a shock to VC investors' geographic concentration. In Panel E, we include the interactions of firm and VC-first round characteristics with year fixed effects. The Appendix provides detailed variable descriptions. Standard errors reported in parentheses are robust and clustered by industry. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Using the Eventually Treated Sample Only

	Exit (indicator)	Successive VC Syndication	Log (1 + Duration between Two Financing Rounds)	Ratio of Convertible Securities
Independent Variable	(1)	(2)	(3)	(4)
Reduction in Travel Time (indicator)	0.111***	0.011**	0.511***	-0.047***
	(13.65)	(2.54)	(19.63)	(-4.93)
Controls (Same As Table 3)	Yes	Yes	Yes	Yes
Industry Fixed Effects & Year Fixed Effects	Yes	Yes	Yes	Yes
First Financing Year Fixed Effects	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes
Observations	13,887	11,535	13,887	13,887
Adjusted *R*-squared	0.097	0.246	0.131	0.246

Panel B. Excluding Firms In the Same Cities as Any of Their VC Investors from the Sample

	Exit (indicator)	Successive VC Syndication	Log (1 + Duration between Two Financing Rounds)	Ratio of Convertible Securities
Independent Variable	(1)	(2)	(3)	(4)
Reduction in Travel Time (indicator)	0.057***	0.015***	0.310***	-0.039***
	(10.00)	(4.42)	(17.72)	(-4.37)
Controls (Same As Table 3)	Yes	Yes	Yes	Yes
Industry Fixed Effects & Year Fixed Effects	Yes	Yes	Yes	Yes
First Financing Year Fixed Effects	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes
Observations	36,572	26,169	36,572	36,572
Adjusted *R*-squared	0.073	0.308	0.129	0.257

Panel C. Excluding the Top 10% of the Observations for States in which the Lead VC Investors are Located Experience Greater Economic Booms based on State-level Annual GDP Growth Rate

	Exit (indicator)	Successive VC Syndication	Log (1 + Duration between Two Financing Rounds)	Ratio of Convertible Securities
Independent Variable	(1)	(2)	(3)	(4)
Log (1 + Reduced Travel Time)	0.050***	0.015***	0.303***	-0.128***
	(8.42)	(4.44)	(23.67)	(-5.43)
Controls (Same As Table 3)	Yes	Yes	Yes	Yes
Industry Fixed Effects & Year Fixed Effects	Yes	Yes	Yes	Yes
First Financing Year Fixed Effects	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes
Observations	40,894	30,360	40,894	40,894
Adjusted *R*-squared	0.068	0.279	0.122	0.287

Panel D. Using Average Reduction in Travel Time as a Shock to VC Investors' Geographic Concentration

	Exit (indicator)	Successive VC Syndication	Log (1 + Duration between Two Financing Rounds)	Ratio of Convertible Securities
Independent Variable	(1)	(2)	(3)	(4)
Log (1 + Reduced Travel Time)	0.023***	0.003	0.153***	-0.020***
	(3.87)	(0.78)	(11.17)	(-3.21)
Controls (Same As Table 3)	Yes	Yes	Yes	Yes
Industry Fixed Effects & Year Fixed Effects	Yes	Yes	Yes	Yes
First Financing Year Fixed Effects	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes
Observations	45,604	33,400	45,604	45,604
Adjusted *R*-squared	0.069	0.278	0.117	0.244

Panel E. Controlling for Heterogeneous Time Trends by Interacting the Firm and VC-first Round Characteristics with Year Fixed Effects

	Exit (indicator)	Successive VC Syndication	Log (1 + Duration between Two Financing Rounds)	Ratio of Convertible Securities
Independent Variable	(1)	(2)	(3)	(4)
Reduction in Travel Time (indicator)	0.054***	0.012***	0.326***	-0.046***
	(10.43)	(3.89)	(20.06)	(-5.21)
Controls (Same As Table 3)	Yes	Yes	Yes	Yes
First Round Characteristics*Year Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects & Year Fixed Effects	Yes	Yes	Yes	Yes
First Financing Year Fixed Effects	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes
Observations	45,047	32,870	45,047	45,047
Adjusted *R*-squared	0.075	0.289	0.124	0.250

Table A.5
Geographic Concentration of Venture Capital (VC) Investors and Successive VC Syndication: Tests Focusing on Later Stage VC Financing

This table reports the results from OLS regressions of the proportion of existing VC investors that participate in a follow-up round (columns (1)-(3) of Panel A) and difference-in-differences tests using the introduction of new direct airline routes that reduce the travel time between VC investors (*Airline Shock*) as an exogenous shock to geographic concentration among VC investors (column (4) of Panel A and Panel B). The sample consists of 27,356 financing round observations for 8,500 startup firms with VC investments during 1995-2015 except for column (1) of Panel B, in which the sample consists of a propensity score-matched sample of 7,676 financing round observations for 3,756 startup firms with VC investments during the sample period. We exclude from the sample seed and early-stage VC financing rounds. The dependent variable is the ratio of the number of existing VC investors that participate in both the current and previous syndication rounds to the total number of VC investors in the previous syndication (*Successive VC Syndication*). In columns (1)-(3) of Panel A, the key independent variables are *Ew Distances* (logarithm of one plus the equally weighted physical distance (in miles) between all of a firm's VC investor pairs), *Vw Distances (Equity)* (logarithm of one plus the cumulative investment amount-weighted physical distance between all of a firm's VC investor pairs), and *Lead Vw Distances (Equity)* (logarithm of one plus the cumulative investment amount-weighted physical distance between a lead VC investor and the other VC investors). In column (4) of Panel A and all columns of Panel B, the key independent variable is *Reduction in Travel Time* (indicator that takes the value of one if the round-trip travel time between a VC investor's city and other investors' VC cities is reduced by more than a half-hour because of an *Airline Shock* between consecutive investment rounds and zero otherwise). In column (1) of Panel B, we match a treatment financing round of the firm that experiences an *Airline Shock* to a control financing round of the firm that does not experience an *Airline Shock* using the predicted probability of being treated. We use as matching variables *Ew Distances*, *Firm-Lead VC Distance*, the same set of control variables in Panel A, and industry, year, first financing year, firm state, and lead VC investor fixed effects. We choose a control financing round, without replacement, that has the closest propensity score with a caliper of 0.01. In column (2) of Panel B, we treat an *Airline Shock* with a distance reduction of less than 200 kilometers as no shock (i.e., zero value for *Reduction in Travel Time*). In column (3) of Panel B, we exclude startup firms with VC investments that are headquartered in California from the analysis. In columns (4)-(6) of Panel B, we additionally control for firm state-year fixed effects, financing round fixed effects, and lead VC investor-MSA-year fixed effects. The Appendix provides detailed variable descriptions. Standard errors reported in parentheses are robust and clustered by industry. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Main Tests

	Dependent Variable = Successive VC Syndication			
	Using Geographic Distance among VC Investors as the Measure of Geographic Concentration			Using *Airline Shock* as a Shock to Geographic Concentration
Independent Variable	(1)	(2)	(3)	(4)
Ew Distances	-0.009***			
	(0.001)			
Vw Distances (Equity)		-0.009***		
		(0.001)		
Lead Vw Distances (Equity)			-0.010***	
			(0.001)	
Reduction in Travel Time (indicator)				0.013***
				(0.003)
Controls (Same as Table 4 Panel A)	Yes	Yes	Yes	Yes
Industry & Year Fixed Effects	Yes	Yes	Yes	Yes
First Financing Year Fixed Effects	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes
Observations	27,356	27,356	27,356	27,356
Adjusted *R*-squared	0.301	0.301	0.302	0.293

Panel B. Robustness Tests for the Analyses Using *Airline Shock* as a Shock to Geographic Concentration

	Dependent Variable = Successive VC Syndication					
	Using Propensity Score Matched Sample	Treating *Airline Shock* with Distance Less Than 200 km as No Shock	Excluding Firms Headquartered in California	Controlling for Firm State-Year Fixed Effects	Controlling for Financing Round Fixed Effects	Controlling for Lead VC Investor-MSA-Year Fixed Effects
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)
Reduction in Travel Time (indicator)	0.007*	0.012***	0.013***	0.015***	0.015***	0.011***
	(0.004)	(0.003)	(0.005)	(0.003)	(0.003)	(0.003)
Controls (Same as Panel A)	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm State-Year Fixed Effects	No	No	No	Yes	No	No
Financing Round Fixed Effects	No	No	No	No	Yes	No
Lead VC MSA-Year Fixed Effects	No	No	No	No	No	Yes
Observations	7,676	27,356	15,778	27,236	27,356	20,934
Adjusted *R*-squared	0.217	0.294	0.336	0.301	0.296	0.300

Table A.6
Geographic Concentration of Venture Capital (VC) Investors and IPO Valuation

This table reports the results from OLS regressions of the IPO valuation (columns (1)-(3)) and a difference-in-differences test using the introduction of new direct airline routes that reduce the travel time between VC investors (*Airline Shock*) as an exogenous shock to geographic concentration among VC investors (column (4)). The sample consists of 692 IPO firms with VC investments during 1995–2015. The dependent variable is the ratio of the first-trading-day closing price to the book value of equity per share after the IPO. In columns (1)-(3), the key independent variables are *Ew Distances* (logarithm of one plus the equally weighted physical distance (in miles) between all of a firm's VC investor pairs), *Vw Distances (Equity)* (logarithm of one plus the cumulative investment amount-weighted physical distance between all of a firm's VC investor pairs), and *Lead Vw Distances (Equity)* (logarithm of one plus the cumulative investment amount-weighted physical distance between a lead VC investor and the other VC investors). In column (4), the key independent variable is *Reduction in Travel Time* (indicator that takes the value of one if the round-trip travel time between a VC investor's city and other VC investors' cities is reduced by more than a half-hour because of an *Airline Shock* between consecutive investment rounds and zero otherwise). *Reduction in Travel Time_Exit* is an indicator that takes the value of one if VC investors experience a reduction in travel time because of an *Airline Shock* that occurred during the past three years before an exit. All distance and control variables are measured using the previous cumulative financing rounds' characteristics. The Appendix provides detailed variable descriptions. Standard errors reported in parentheses are robust and clustered by industry and exit year. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Dependent Variable = IPO Valuation (Price to Book)			
	Using Geographic Distance among VC Investors as the Measure of Geographic Concentration			Using *Airline Shock* as a Shock to Geographic Concentration
Independent Variable	(1)	(2)	(3)	(4)
Ew Distances	-0.589*			
	(0.314)			
Vw Distances (Equity)		-0.580*		
		(0.295)		
Lead Vw Distances (Equity)			-0.520*	
			(0.296)	
Reduction in Travel Time_Exit (indicator)				2.563*
				(1.329)
Controls (Same As Table 3)	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Exit Year & First Financing Year Fixed	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes
Observations	692	692	692	692
Adjusted *R*-squared	0.472	0.470	0.466	0.447

Table A.7
Geographic Concentration of Venture Capital (VC) Investors and the Number of Staged Financing

This table reports the results of OLS regressions of the number of staged financing for portfolio firms by venture capital (VC) investors (columns (1)-(3)) and a difference-in-differences test using the introduction of new direct airline routes that reduce the travel time between VC investors (*Airline Shock*) as an exogenous shock to geographic concentration among VC investors (column (4)). The sample consists of 10,594 final financing round observations for 10,594 startup firms with VC investments during 1995–2015. For a firm that eventually goes public or is acquired, we use only its last financing round immediately before the IPO or acquisition. For other firms, we use only observations from the last available financing round. The dependent variable is the logarithm of one plus the total number of financing rounds that the entrepreneur firm receives from VC investors. In columns (1)-(3), the key independent variables are *Ew Distances* (logarithm of one plus the equally weighted physical distance (in miles) between all of a firm's VC investor pairs), *Vw Distances (Equity)* (logarithm of one plus the cumulative investment amount-weighted physical distance between all of a firm's VC investor pairs), and *Lead Vw Distances (Equity)* (logarithm of one plus the cumulative investment amount-weighted physical distance between a lead VC investor and the other VC investors). In column (4), the key independent variable is *Reduction in Travel Time_Firm* (indicator that takes the value of one if VC investors experience a reduction in travel time between the starting year of the first financing round and the last year of the final financing round (or exit year when an exit event occurs) and zero otherwise). The Appendix provides detailed variable descriptions. Standard errors reported in parentheses are robust and clustered by industry and final year. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Dependent Variable = Log (1 + Number of Financing Rounds)			
	Using Geographic Distance among VC Investors as the Measure of Geographic Concentration			Using *Airline Shock* as a Shock to Geographic Concentration
Independent Variable	(1)	(2)	(3)	(4)
Ew Distances	0.007***			
	(0.002)			
Vw Distances (Equity)		0.007***		
		(0.002)		
Lead Vw Distances (Equity)			0.008***	
			(0.002)	
Reduction in Travel Time_Firm (indicator)				-0.018**
				(0.009)
Controls (Same As Table 3)	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Final Year & First Financing Year Fixed	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes
Observations	10,594	10,594	10,594	10,594
Adjusted *R*-squared	0.767	0.768	0.768	0.767

Table A.8
Cross-Sectional Heterogeneity in the Treatment Effect: Additional Robustness Tests

This table reports the results from difference-in-differences tests using the introduction of new direct airline routes that reduce the travel time between VC investors (*Airline Shock*) as an exogenous shock to geographic concentration among VC investors. The sample consists of 45,604 financing round observations for 10,594 startup firms with VC investments during 1995-2015. The dependent variable in column (1) is an indicator that takes the value of one if the firm goes public through an IPO or is acquired for a deal value greater than $25 million and zero otherwise (*Exit*). The dependent variable in column (2) is the ratio of the number of existing VC investors that participate in both the current and previous syndication rounds to the total number of VC investors in the previous syndication (*Successive VC Syndication*). The dependent variable in column (3) is the logarithm of one plus the duration in months between the current and the next financing (exit time if there is no additional financing) rounds. The dependent variable in column (4) is the ratio of the amount of convertible debt and convertible preferred stock to the total funding amount in each financing round (*Ratio of Convertible Securities*). In Panel A, we separate *Reduction in Travel Time* (treatment indicator that takes the value of one if the round-trip travel time between a VC investor's city and other VC investors' cities is reduced by more than a half-hour because of an *Airline Shock* between consecutive investment rounds and zero otherwise) into two indicators: *Reduction in Travel Time with High VC Overlap* and *Reduction in Travel Time with Low VC Overlap*, which take the value of one if the degree of overlap of VC syndicate members across financing rounds within an entrepreneurial firm used in Bayar, Chemmanur, and Tian (2020) is greater and lower than the highest sample decile, respectively, and zero otherwise. In Panel B, we separate *Reduction in Travel Time* into two indicators: *Reduction in Travel Time in Earlier Rounds* and *Reduction in Travel Time in Later Rounds*, which take the value of one if the cumulative number of financing rounds is lower and greater than the highest sample decile, respectively, and zero otherwise. The Appendix provides detailed variable descriptions. Standard errors reported in parentheses are robust and clustered by industry. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Decomposing *Reduction in Travel Time* into *Reduction in Travel Time with High VC Overlap* and *Reduction in Travel Time with Low VC Overlap*

	Exit (indicator)	Successive VC Syndication	Log (1 + Duration between Two Financing Rounds)	Ratio of Convertible Securities
Independent Variable	(1)	(2)	(3)	(4)
Reduction in Travel Time	0.029**	0.046	0.430***	0.057
with High VC Overlap: a	(0.011)	(0.034)	(0.051)	(0.104)
Reduction in Travel Time	0.053***	0.013***	0.309***	-0.049***
with Low VC Overlap: b	(0.005)	(0.003)	(0.016)	(0.009)
P-value for the Test of the Difference in Coefficients between (a) and (b)	0.023**	0.335	0.031**	0.322
Controls (Same As Table 3)	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
First Financing Year Fixed Effects	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes
Observations	45,604	33,400	45,604	45,604
Adjusted *R*-squared	0.072	0.278	0.121	0.244

Panel B. Decomposing *Reduction in Travel Time* into *Reduction in Travel Time in Earlier Rounds* and *Reduction in Travel Time in Later Rounds*

	Exit (indicator)	Successive VC Syndication	Log (1 + Duration between Two Financing Rounds)	Ratio of Convertible Securities
Independent Variable	(1)	(2)	(3)	(4)
Reduction in Travel Time	0.059***	0.029***	0.333***	-0.023**
in Earlier Rounds: a	(0.006)	(0.002)	(0.021)	(0.010)
Reduction in Travel Time	0.035***	0.013**	0.261***	-0.090***
in Later Rounds: b	(0.006)	(0.007)	(0.030)	(0.018)
P-value for the Test of the Difference in Coefficients between (a) and (b)	0.005***	0.013**	0.091*	0.000***
Controls (Same As Table 3)	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes

Year Fixed Effects	Yes	Yes	Yes	Yes
First Financing Year Fixed Effects	Yes	Yes	Yes	Yes
Lead VC Fixed Effects	Yes	Yes	Yes	Yes
Firm State Fixed Effects	Yes	Yes	Yes	Yes
Observations	45,604	33,400	45,604	45,604
Adjusted *R*-squared	0.072	0.278	0.121	0.244