Buy Local? The Geography of Venture Capital

Henry Chen[*], Paul Gompers[**], Anna Kovner[***, ****], and Josh Lerner[**]

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We document geographic concentration by both venture capital firms and venture capital-financed companies in three metropolitan areas: San Francisco, Boston, and New York. We find that firms locate in regions with high success rates of venture capital-backed investments. Geography is also significantly related to outcomes. Venture capital firms based in locales that are venture capital centers outperform, regardless of the stage of the investment. This outperformance arises from outsized performance outside of the venture capital firms' office locations, including in peripheral locations. If the goal of state and local policy makers is to encourage venture capital investment, outperformance of non-local investments suggests that policy makers might want to mitigate costs associated with established venture capitalists investing in their geographies rather than encouraging the establishment of new venture capital firms.

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[*]New York University. [**]Harvard University and National Bureau of Economic Research. [***] Federal Reserve Bank of New York. [****] Corresponding author: Financial Intermediation Function, Federal Reserve Bank of New York, 33 Liberty St., New York, New York, 10038, (212) 720-8401 (ph.), (212) 720-8363 (fax), Anna.Kovner@ny.frb.org. Harvard Business School's Division of Research provided financial assistance. We are grateful for able research assistance from Monica Cox. We thank Sue Helper, Olav Sorenson, and William Strange for helpful discussions. All errors and omissions are our own. The views expressed in this paper are the authors' and should not be attributed to the Federal Reserve Bank of New York or the Federal Reserve System.

I. Introduction

From Silicon Valley to Herzliya, Israel, venture capital firms are concentrated in very few locations. More than half of the 1,000 venture capital offices listed in *Pratt's Guide to Private Equity and Venture Capital Sources* are located in just three metropolitan areas: San Francisco, Boston, and New York. More than 49% of the U.S.-based companies financed by venture capital firms are located in these same three cities. This paper examines the location decisions of venture capital firms and the impact that venture capital firm geography has on investments and outcomes.

The location of venture capital firms matters for the development of entrepreneurial firms because venture capitalists provide more than just risk capital. Venture capital firms typically invest in early-stage and high-technology companies where informational asymmetries are high. These are companies with highly uncertain future prospects. The potential for agency conflicts are severe. Venture capital funding contracts provide for staged financing and venture capitalists are constantly evaluating their portfolio companies (see, for example, Sahlman (1990), Gompers (1995), and Kaplan and Stromberg (2003)). Venture capitalists are actively involved in the governance of the companies they fund through board membership, management recruiting, and the provision of management incentives.

The cost of providing this oversight is likely to be sensitive to the distance between venture capitalists and the firms in which they invest. The ability to monitor the portfolio company, to coach the management team, and to provide introductions may depend upon the ability to interact frequently with the company. For example, Lerner (1995) shows that venture capitalists are more likely to serve on the boards of geographically proximate companies. Moreover, this involvement is likely to translate into tangible economic progress. Research

shows that venture capital-backed companies outperform their peers on many dimensions: i) operational growth (Hellmann and Puri (2000)) ii) post-IPO performance (Brav and Gompers (1997)) iii) innovation and patenting activity (Kortum and Lerner (2000)) and iv) potential for scale (Puri and Zarutskie (2008)). Similarly, Gompers and Lerner (2001) show that venture capital-backed companies have, relative to the amount of capital invested, disproportionately contributed to the creation of jobs, market value, and revenues. Mollica and Zingales (2007) find evidence that venture capital may have the primary role in fostering the entrepreneurial communities in which they are located. They show that venture capital firms increase both patents and the total number of new businesses, using the size of state pension funds as an instrument for the number of venture capital firms.

Reflecting this awareness, states and municipalities are placing increasing emphasis on encouraging the establishment of venture capital communities in their regions. A 2001 National Governors Association report stated, "Venture capital is critical to growing the new businesses that will drive the 'new economy.' Finding ways to nurture the culture of entrepreneurs, and the capital that feeds them, must be the top priority of states."[1] An estimate by the National Association of Seed and Venture Funds is that state venture capital funds in 2008 totaled $2.3 billion[2]; meanwhile, an increasing share of the approximately $50 billion that states spend on industrial incentives is going to venture-backed firms, a trend that is likely to be accelerated by provisions in the recently enacted stimulus bill favoring clean technologies (Engardio (2009)).

[1]National Governors Association, Center for Best Practices, "Issue Brief Growing New Businesses with Seed and Venture Capital: State Experiences and Options," 2001, http://www.nga.org/Files/pdf/VENCAPITAL.PDF (accessed April 11, 2009).

[2] http://www.nasvf.org/nasvf/web.nsf/pages/documents.html/$file/3-24-08%20Table%20of%20State%20Venture%20Funds%20Distributed%20to%20Response%20Group.pdf (accessed April 11, 2009).

Thus, it is vitally important to understand the geography of venture capital and its association with success of the underlying portfolio companies.

First, we document the clustering of venture capital in three metropolitan areas (combined statistical areas or CSAs): San Francisco/San Jose, Boston, and New York. We call these cities "venture capital centers." There is a long literature on industrial clustering dating back to Marshall (1920). Some clustering is to be expected, since the forces that are likely to lead to agglomeration economies (input sharing, labor market pooling and knowledge spillovers) are likely to be important for both venture capital and the types of companies in which venture capital firms invest. We find a level of venture capital localization that far exceeds entrepreneurial localization more generally. The C(3) ratio of self employment was 10.7%,[3] while the comparable C(3) ratio of venture capital partners is 60.5%. We also find evidence that venture capital is far more localized than the overall financial services industry. In 2005, the location quotient of VC partners calculated relative to employment in financial services ranged from 2.12 for New York to 10.59 for San Francisco. The spatial Gini of VC partners calculated relative to overall employment was 0.155 versus a spatial Gini of 0.067 for employment in financial services relative to overall employment in 2005[4].

Glaeser (2007) finds that variation in the self-employment rate is related to variation in demography and industry concentration, but does not find any correlation between this broad measure of entrepreneurship and venture capital. We find that a one standard deviation increase in the number of venture capital offices in a region increases venture capital investments in that area by 49.7%. We find evidence for three factors that contributed to this clustering: First-order

[3] C(3) ratio of self-employment calculated using 2000 micro-level Census data from the Integrated Public Use Microdata Series (IPUMS) at http://usa.ipums.org/usa/.

[4] The spatial Gini coefficients are calculated as the proportion of overall venture capital employment (financial services industry employment) in the metropolitan area normalized by the proportion of overall employment in the metropolitan area squared and then summed across all metropolitan areas.

agglomeration externalities (among venture capital firms), second-order agglomeration externalities (among the types of companies in which venture capital firms invest), and the historical artifact of early venture capital firms' location in these cities.

We examine venture capitalists' location decisions. Instead of expanding to regions with few VC firms, VCs tend to open satellite offices in the same three cities that are existing centers for venture capital activity. For example, a Boston-based firm is more likely to open a San Francisco/San Jose office than they are an office in Austin, Texas. The success rate for previous VC investments explains an additional 10.9% of the variance in the number of offices in a region, suggesting that second order agglomeration externalities contribute to office location decisions.

Since the relationship between VC firm location and the location of their investments is endogenous, we examine the relationship between success and distance from VC investors. Overall, venture capital firms based in the venture capital centers outperform even after controlling for the selection effect of historically successful firms (firm experience). This may reflect a variety of factors, which are difficult to disentangle, including first and second order agglomeration economies, unobserved local advantage, the superior experience of these investors, their greater connections with elite limited partners and corporations, and their superior syndication networks (Sorenson and Stuart (2001)).

Surprisingly, much of the VC outperformance in these venture capital centers arises from their non-local investments. This finding is counterintuitive, since venture capitalists might be expected to be the most involved and add the most value to the geographically closest companies. We observe this outperformance of non-local companies in both early- and late-stage investments. Thus, this wedge in expected returns does not seem to be the result of

established VC firms' cherry-picking later-stage enterprises that they are more likely to successfully exit. The higher rates of return on non-local deals may indicate economically meaningful geographic differences in the availability of venture capital. One potential explanation for this higher return to non-local deals is that venture capitalists have a higher hurdle rate (i.e., require a higher expected rate of return) for investments that have a higher monitoring cost. This higher hurdle rate may reflect the imputed (personal) cost of traveling to remote locations.

We find additional evidence that there may be a higher investment or expected return threshold for non-local deals. If a venture capital firm has done or will do another investment in the same geographic area, there is a 2% drop in expected success. VCs may lower their threshold on a potential deal if they have a lower marginal cost of visiting the area, i.e., if the venture capitalist is already visiting one portfolio company, the personal cost of visiting a second company is substantially lower.

Venture capital firms are likely to locate in areas that offer them the highest concentration of profitable investments since geographically close investments are easier to for the venture capitalist to monitor. Travel to other geographies is costly and will be undertaken only when an investment offers prospects for a high enough return to, in expectation, compensate the venture capitalist for the additional time and money associated with monitoring a distant investment. The resulting concentration of venture capitalists and entrepreneurs may pose grounds for concern given the positive public externalities associated with the establishment of new firms. For example, Gompers, Lerner, and Scharfstein (2005) find that founders of venture capital-backed start-ups disproportionately come from prior positions at previously venture capital-backed companies. If the supply of venture capital is a limiting factor for the establishment of

new firms, policy makers in regions with low concentrations of venture capital may wish to provide incentives for established VCs based in venture capital centers to invest in their regions.

The paper is organized as follows. The next section describes the hypotheses and related literature. The following section details the construction of the data. Section IV examines the geography of venture capital firms and geographic factors associated with the supply of venture capital. Section V describes the geography of venture capital-backed companies. Section VI reviews the determinants of venture capital investment success. Section VII proposes some implications of venture capital expansion for policymakers and Section VIII concludes the paper.

II. Hypotheses and Related Literature

Economic theory presents three explanations for the observed clustering of venture capital: First-order agglomeration externalities, second-order agglomeration externalities (externalities in the types of companies in which venture capital firms invest), and the historical artifact of early venture capital firms' location in these cities. We present evidence for each of these explanations in Section IV and V.

First, venture capitalists might benefit from first-order agglomeration externalities. For example, geographic proximity might reduce costs of entrepreneurs seeking financing since they can visit several VC firms on one trip. Similarly, it may be less costly to monitor and thus co-invest with neighbors. There is evidence for the importance of geographical clusters in investment management. For example, Christoffersen and Sarkissian (2009) find evidence of knowledge spillovers and learning in the investment management industry, finding that mutual funds with experienced managers located in cities that are financial centers outperform. Hong, Kubik, and Stein (2005) document similarities in trading patterns for investment managers in the

same cities. More generally, there is an extensive literature documenting the continued importance of geographic clusters despite increasing globalization (see for example, Porter (1990), Krugman (1991) and Ellison and Glaeser (1997)).

Second, the first venture capital firms were located in the three venture capital centers. Since the venture capital industry has a high degree of performance persistence, firms which were early successes continue to be successful. Since the scalability of venture capital firms is limited, firms which co-locate may find it easier to attract capital or entrepreneurs that the best venture firms lack capacity to accommodate. Thus early concentration, combined with first-order agglomeration externalities results in continued concentration. In many industries, spin-offs of first movers also contribute to concentration as documented by Gompers, Lerner, and Scharfstein (2005) for venture-backed companies, Klepper and Sleeper (2005) for the laser industry, and Sorenson and Audia (2000) for the footwear industry. However, it is relatively rare to see partner-level venture capitalists leave existing venture capital firms to found firms in the same city. In a sample of 2,470 venture capital firm partners, we find only 80 (3.24%) who changed venture firms and continued investing.

Third, it is possible that the clusters we document arise from second-order agglomeration externalities, that is, VCs co-locate with the highly clustered industries in which they invest. The importance of agglomeration externalities in venture capital financed-industries has been documented by Saxenian (1994) who examined the importance of local industrial systems for entrepreneurial activity in Silicon Valley and along Route 128 near Boston. The importance of labor market pooling in the computer industry is found by Fallick, Fleischman, and Rebitzer (2006) who observe high rates of intra-industry labor mobility in Silicon Valley and Freedman (2008) who finds evidence for the importance of geographic clusters in a study of the software

publishing industry. Evidence of geographic knowledge spillovers is found in biotechnology by Zucker, Darby, and Brewer (1998) and more recently by Agrawal, Kapur, and McHale (2008), who document the importance of geographic proximity for inventors using patent data.

Section VI of the paper analyzes the implications of geographic clustering of venture capitalists for investing patterns and success. Regardless of the determinants of geographic clustering, understanding geographic patterns in venture capital is important because there is a growing interest in understanding conditions that foster entrepreneurship. Glaeser (2007) shows that more than half of the heterogeneity in the self-employment rate can be explained by demographic and industrial variation. Several papers document the importance of geographic factors such as local birth (Michelacci and Silva (2007)) and entrepreneurial levels of peers (Giannetti and Simonov (2008)). In terms of new product and new industry development, Duranton and Puga (2001) theorize that new products are developed in big cities, and production later moves to specialized industry clusters.

Geography is likely to matter in venture capital even more than in passive investment management because of the importance of frequent contact between venture investors and their investments. Several papers document how venture capitalists monitor and advise their portfolio companies (Barry, Muscarella, Peavy, and Vetsuypens (1990), Lerner (1995) and Hellmann and Puri (2002)). Bengtsson and Ravid (2009) find VC contracts are more high-powered as geographic distance increases, indicating that monitoring and soft information decrease with distance. Understanding the factors that affect the geographic distribution of venture capital offices and investment activity provides insights into the forces that drive concentration of industries and new firm formation.

III. Data Sources

We use the *Pratt's Guide to Private Equity and Venture Capital Sources* to identify the location of venture capital firm offices. The annually-updated *Pratt's Guide* collects information about the capabilities, focus, and size of venture capital and buyout organizations throughout the world. This information was collected by Venture Economics, formerly an independent research firm and later a unit of Thomson, through a survey annually distributed to private equity firms. We hand collect information from *Pratt's Guides* released between 1974 and 2005 about the office locations of venture capital firms. This information allows us to determine the location and year of founding and closing of each venture capital firm's main office and branch offices. We only include offices in the United States because that is where the Pratt's coverage is most comprehensive.

We collect each venture capital office's zip code from *Pratt's Guides* and it to a Combined Statistical Area (CSA). In cases such as San Diego, where a city is not located in a CSA, we assign venture capital offices in the city to the appropriate Metropolitan Statistical Area (MSA). Our use of CSA as the unit of location is driven by the narrow definition of certain MSAs. For example, the cities of Palo Alto/Menlo Park, Berkeley, and San Francisco, CA are located in three different MSAs. On the east coast, New York City is located in a different MSA from nearby cities such as Stamford and Greenwich, Connecticut, where New York area investors often choose to base their operations. Therefore we use CSAs that appropriately assign Palo Alto and San Francisco to one location and similarly assign New York and Greenwich in one location.

We gather information on venture capital financing activity from Thomson's VentureXpert (formerly Venture Economics) database. The database was started in 1977 and has since been back-filled through the 1960s. It provides information about the dates of venture financings, the investors involved in each financing round, the amounts invested in each round, and the outcome of each venture capital-backed company in the database. We use these data to create our main outcome measure of venture capital investment success: whether each venture-backed company went public through an IPO or has registered for an IPO. In addition to information on financing rounds and outcomes of venture capital investments, the database also provides information about the location of each portfolio company. As with the *Pratt's Guide* office location data, we assign portfolio companies to a locale at the CSA level and, in cases where a portfolio company is located in an MSA that is not located in a CSA, at the MSA level. For the purposes of this study, we restrict our analysis period to investments made between 1975 and 2005. We drop investments prior to 1975 due to data quality concerns discussed by Gompers and Lerner (2004) and omit companies receiving initial investments after 2005 to account for the typical start-up to exit maturation period of venture capital-backed companies.

We merge the *Pratt's Guide* and VentureXpert data and obtain investment information for 2,039 of the 3,290 venture capital firms cataloged by *Pratt*'s. Conversely, we were able to match 80% of VentureXpert investments to firms tracked by *Pratt*'s. 75% of all venture capital firms identified by VentureXpert with at least 5 or more investments are matched to the *Pratt's Guide* location data. The remaining unmatched VentureXpert firms are mostly foreign venture capital firms, corporate VCs, and banking institutions.

Using venture capital office location information from the *Pratt's Guide* merged with investment and portfolio company information from the VentureXpert database, we are able to

generate variables indicating the location of the venture capital firm relative to the location of the portfolio company it is investing in. For each portfolio company a venture capital invests in, we use our merged data set to classify the deal as:

1. Main Office – portfolio company is located in the same CSA as the investing venture capital firm's main office (defined as the first office opened by the investing venture capital firm. If the firm was established with multiple offices, the CSA in which the firm made the most investments in its first five years of existence is classified as the main office);
2. Branch Office – portfolio company is located in the same CSA as one of the investing venture capital firm's branch offices (defined as any location in which the firm has an office, other than the main office); or
3. Outside – portfolio company is located in a CSA in which the investing venture capital firm does not have its main office or a branch office.

This classification allows us to examine differences in outcomes based on the proximity of the venture capital firm to a portfolio company, as well as differences in performance by office type.

In addition to our venture capital data, we collect state-level information on characteristics related to employment and innovation. Information about the level of educational attainment in a state is from annual editions of the *Statistical Abstract of the United States.* Each state's Gross Product is taken from the Department of Commerce's Bureau of Economic Analysis. To measure the business environment of each state, we obtain information on state marginal income tax rates and long-term capital gains tax rates from the National Bureau of Economic Research's TAXSIM model. Finally, we collect information about local innovation and patenting rates from the U.S. Patent and Trademark Office.

IV. Geography of Venture Capital Firms

Table I reports the location of venture capital firms by CSA across time. The three centers of venture capital activity, San Francisco/San Jose, New York City, and Boston, are home to more than half of all venture capital offices in all years reported. Over time, the three venture capital centers have maintained their numerical advantage despite an approximately three-fold increase in the number of venture capital firms and branch offices between 1985 and 2000. The concentration of offices in the venture capital centers has been relatively stable over time, slightly above 50%. To the extent that the observed concentrations are solely a historical artifact, we would also expect the shares of the three centers to remain stable. However, San Francisco/San Jose has been growing share over the past 20 years.

Also notable is the paucity of venture capital offices located in smaller CSAs. Less than a third of all venture capital main offices and branch offices are located outside of the top nine CSAs. In contrast, approximately 80% of the working-age population lived outside of the top nine CSAs in 2000.[5] Furthermore, only 20% of all venture capital partners are located outside of the top nine CSAs in 2005 versus 68.5% of the population employed in the financial services sector.

In Table II, we report localization measures for the venture capital industry. In the first column, we report the location quotient of venture capital partners. We calculate this measure using employees with the title of "partner" or equivalent rather than all employees listed in the *Pratt's Directory* because Pratt's coverage of non-partner employees is not systematic across firms, and might be biased in favor of more information on lower level employees of firms

[5] Calculated using 2000 micro-level Census data from the Integrated Public Use Microdata Series (IPUMS) at http://usa.ipums.org/usa/.

located in the venture capital centers. This measure is defined as the percentage of overall venture capital partners based in the CSA in 2005 divided by the percentage of overall financial services employees based in the CSA in 2005. The location quotient of venture capital partners indicates that venture capital employment is far more localized than financial services industry employment. The location quotients for the three venture capital centers are all greater than 2, indicating that the proportion of overall venture capital partners located in each of the three venture capital centers is more than double the proportion of overall financial services workers located in each of the three venture capital centers. We find similar results when focusing on venture capital offices in the second column. The location quotient of VC offices is equal to the percentage of overall venture capital offices located in the CSA in 2005 divided by the percentage of overall financial services GDP dollars generated in the CSA in 2005. Again, the location quotients for the venture capital centers are all greater than 2, indicating that the proportion of overall venture capital offices located in each of the three venture capital centers is more than double the proportion of overall financial services dollars generated in each of the three venture capital centers.

In Table III, we compare the lifespan of main offices and branch offices. We calculate a simple measure of longevity, the number of years between the office's opening and closing. In cases where the office remains open through the end of our sample in 2005, we calculate the number of years between the office opening and 2005. Since the data is right censored, more recently opened offices will have lower life spans. Therefore we construct a second measure, potential lifespan, in which we normalize the age of each office by dividing the age of the office by the number of potential years the office could have been open. Potential years are defined as the number of years between office opening and 2005. On average, a main office's lifespan is

2.2 years greater than the lifespan of a branch office. This difference is statistically significant; the result is similar when using the potential lifespan measure. The relatively longer longevity of main offices is true in the venture capital centers as well, although branch offices located in the venture capital centers have longer relative life spans than other branch offices.

The finding that main offices are longer-lived than branch offices suggests that venture capital firms are more likely to close branch offices. Venture capital offices in the venture capital centers (main or branch) are longer-lived than offices in other locales. This longevity may reflect differences in deal flow (supply of venture capital investments) between these locations. This difference in deal flow may arise because of first-order agglomeration externalities, if more entrepreneurs come to the venture capital centers seeking financing or if limited partners who invest in venture capital firms want to reduce due diligence costs by visiting fewer cities. The difference in deal flow may also come from second-order agglomeration externalities if more entrepreneurs choose to locate near their competitors who tend to be located in venture capital centers and prefer local investors. Shorter-lived branch offices outside the VC centers are either evidence that the industries they invest in need to reach a certain scale to achieve agglomeration externalities (or those externalities are short-lived), or that these agglomeration externalities are so large in the VC centers that VC-backed industries are unlikely to thrive in other cities.

In Table IV, we take a multivariate approach to analyzing the determinants of venture capital firm location. We estimate a series of models in which the dependent variables measure the number of total, main, and branch venture capital offices in a CSA in a given year. All regression models are estimated at the CSA-Year level. We restrict the analysis to CSAs where at least one main or branch office existed between 1975 and 2005. In some CSA-Years, the

number of offices can equal zero. For example, this can occur in the case where a venture firm opens an office in a remote area such as Sioux City, Iowa in 1995 and closes it in 2000. Prior to 1995 and after 2000, the number of offices reported in Sioux City would equal zero.

A key explanatory variable of interest is the success rate of all VCs in the CSA over the past five years. This variable is constructed by calculating the percentage of all venture capital investments in the CSA over the past five years that led to an Initial Public Offering. We also include controls for local characteristics which may be associated with venture capital investments. These controls include the log gross state product per capita, the state's marginal income tax rate, and the state's long-term capital gains tax rate in the year prior to the investment. In order to capture an area's potential for innovation, we control for the percentage of population with a college degree in that CSA, as well as the log number of patents per capita issued in the state in the previous year. We include year fixed effects to control for changes in the supply of venture capital and investment opportunities, and in some specifications, CSA fixed effects. Finally, all standard errors are robust and calculated after clustering at the CSA level

The three principal findings of these regression models are as follows: 1) venture capital offices are concentrated in locales where venture capital investments have previously been successful; 2) regions with high concentrations of venture capital offices are in states with higher levels of gross state product per capita; and 3) venture capital offices are concentrated in areas with high levels of innovation as measured by the number of patents per capita issued in the previous year. Focusing on the first column, where the dependent variable measures the log number of total venture capital offices, moving from the 25^{th} percentile of the regional success rate for venture capital investments over the past five years to the 75^{th} percentile of the regional

success rate increases the number of offices in a CSA by 2.3. Increasing log gross state product per capita from the 25th percentile value to the 75th percentile value increases the number of offices in a CSA by 4.1. Finally, with respect to innovation, a CSA in a state at the 75th percentile of innovation as measured by patents per capita will have 1.2 more offices than a CSA in a state at the 25th percentile level of innovation. Relative to an average of 11.5 venture capital offices in a CSA-year, these factors are economically and statistically associated with the number of venture capital offices in a CSA. The results for the remaining regression models, which utilize dependent variables representing the log number of main offices and branch offices yield similar results. The results are driven by cross-sectional differences in CSAs, rather than by changes within CSAs. This is unsurprising given the persistent nature of the measures and the slow adjustment of office locations. These findings appear consistent with second-order agglomeration economies and findings about the development of venture capital ecosystems (Saxenian (1994)). Prior successes and innovation attract additional venture capital to a region and aid in the development of a self-sustaining environment for entrepreneurs. Similarly, as Gompers, Lerner, and Scharfstein (2005) show, the feedstock for future venture capital-backed start-ups come from prior venture capital-backed companies.

The results also highlight the "catch 22" issue in venture capital offices. A high level of existing venture capital activity and success induce entry into a market. Yet a nascent start-up market may find it difficult to attract venture capital investors.

V. Geography of Venture Capital-Backed Portfolio Companies

Much like venture capital firms, venture capital-backed portfolio companies are heavily concentrated in three cities. Table V presents a distribution of the geography of portfolio

companies from our combined *Pratt's Guide*/VentureXpert data set. As with venture capital offices, approximately half of all venture capital-backed portfolio companies are located in San Francisco/San Jose, New York, or Boston. 49% of all investments in venture capital-backed companies (54% of VC-company observations) are made in companies located in these three cities. Moving beyond the three central cities, 79% of all portfolio companies are located in the top 12 CSAs and 81% of all venture capital investments are made in companies in the top 12 CSAs.

We examine the location of portfolio companies in relation to the offices of their venture capital investors. Of the 12,358 investments in the sample that involve a venture capital investor located in the same CSA, 80% of these are in one of the three venture capital centers. More than 60% of San Francisco/San Jose companies have their venture capital investor located in their region, while less than 15% of companies headquartered in Philadelphia can say the same. Despite the importance of monitoring in venture capital, many venture capitalists do invest outside of their home region. Overall, most investments (57%) are made by venture capital firms outside of their home CSA. San Francisco/San Jose and New York are the only two CSAs in which a majority of the venture capital-backed companies were investments made by local venture capitalists (main or branch). The fact that companies include investments from both local and non-local venture capitalists suggests that any first order agglomeration externalities are not unlikely to be generated by geographically proximate co-investors. Venture capitalists' willingness to invest outside of their home regions suggests that even if the companies they invest in are geographically clustered, they do not necessarily need to be similarly clustered.

In Table VI, we explore the determinants of the number of new venture capital financed companies in each CSA year. We include "new" companies only once, in the year in which we

observe the first investment by any venture capital firm in VentureXpert. We exclude CSAs in which no venture capital investment has ever been observed. Similar to Table IV, these models are estimated at the CSA-Year level, include year fixed effects, and report robust standard errors are calculated after clustering for CSA. On average, 4.2 portfolio companies are formed in a given CSA-Year. In the third regression column, we estimate that the number of venture capital firms in a CSA is positively associated with the number of venture capital-backed companies. Moving from the 25th percentile to the 75th percentile of venture capital offices in a CSA increases the number of venture capital-backed companies formed annually by 1.8 companies. This result indicates that increasing the number of venture capital firms in a CSA, and hence the availability of capital in a CSA, should be associated with an increase in the number of innovative start-up companies in the CSA that are venture-capital backed. It is also suggestive against the importance of second-order agglomeration economies, because the clustering of venture capital firms chronologically leads the foundation of proximate new ventures. When we add CSA fixed effects, the results are somewhat less significant in a few instances, but generally unchanged.

Interestingly, we also predict that five additional venture capital-backed portfolio companies will be formed in San Francisco/San Jose versus another CSA that shares the other observed features. All else equal, venture capital firms still invest in a greater number of San Francisco/San Jose portfolio companies than in other CSAs. Finally, we observe that more venture capital-backed companies are formed in CSAs with greater levels of past success. Moving from a CSA at the 25th percentile of the previous success rate to a CSA at the 75th percentile previous success rate increases the number of venture capital-backed companies formed by 0.4 companies. This suggests that second order agglomeration externalities may be

particularly important in this region. These results support the findings of Gompers, Lerner, and Scharfstein (2005), who find that regions with previously successful venture capital-backed companies that went public are more likely to spawn additional venture capital-backed companies.

VI. Determinants of Venture Capital Investment Success

It is natural to wonder whether there are any performance consequences of the geographic concentration we observe. In essence, if there is a venture funding gap in other cities, i.e., if supply of good ideas exceeds the availability of capital, remote venture capital locations may have greater success rates than firms in the three leading venture capital markets. We next compare the performance of firms based in and outside of the venture capital centers. Table VII compares the mean success rates of venture capital center-based firms and firms based outside of those centers. Overall, firms based in the venture capital centers have an average success rate that is 4.4% higher than venture-backed firms based outside those centers. Central VC firms outperform other VC firms, whether we examine main office, branch office, or outside investments. These differences are all statistically significant at the 1% level. VC firms from the venture capital center cities appear to outperform, when restricting our sample to investments made inside the venture capital center cities (17.3% vs. 14.2%) or to those outside of the venture capital center cities (19.0% vs. 13.1%). This outperformance also persists when we restrict the sample to early-stage (15.1% vs. 11.3%) or late-stage deals (20.7% vs. 15.7%). These bi-variate analyses provide strong suggestive evidence that VC firms from the venture capital center cities outperform VC firms based outside of the central cities. To confirm these results, we analyze the determinants of success using a multivariate approach.

Table VIII reports summary statistics for variables used in the multivariate analyses of the determinants of venture capital investment success. 66.4% of the investments in the sample are made by VC firms based in one of the three venture capital center cities. The overall investment success rate is 16.4%. Interestingly, investments in the main office region appear to underperform relative to other geographies. Average success rates for investments in the main office regions are 14.5%, while the branch office and outside office investment success rates are both approximately 17%, a difference that is statistically significant at the 1% level. Of course, our success measure is relatively blunt, and does not distinguish between home runs and singles (investments that return ten times vs. two times invested capital). Of course, venture capital firm quality may vary and be associated with geography and outcomes. We proxy for quality with experience: the average adjusted VC firm experience in the sample is 0.48, indicating that the average VC making an investment is more experienced than the average VC firm in that year. This is not unexpected because more successful VC firms tend to make more investments. Another important variable is the stage of the company at the time of investment. In terms of company stage at financing, more than half (51%) of venture capital investments in the sample are made in the initial round of investment. A greater proportion of main office investments (56.6%) are made in the initial round versus 44.5% of branch office investments and 47.9% of outside investments. Finally, industries may have different geographic patterns and success rates. Venture capital investments in the sample are heavily concentrated in three industries: computers and internet (45.3%), biotech and healthcare (21.3%), and communications (17.6%).

Table IX uses a multivariate approach to analyze the factors associated with successful venture capital investments. All regression models control for the quality of the venture capital firm (using adjusted experience), year of investment, the round of investment, the industry of the

portfolio company, and the location of the portfolio company. The first column reports a key finding of the paper. The coefficient on the dummy variable indicating that the VC firm is based in one of the three venture capital centers (*CENTRAL*), which is statistically significant, indicates that venture capital firms based in the venture capital centers have a 3.1% higher probability of succeeding. Controlling for location, branch office investments and outside investments have an approximately 2.0% higher probability of success than main office investments. Of course, performance models produce only correlations. The concentration of venture capital firms may lead to better investments, but of course, the presence of better investments may result in the concentration of better venture capital firms, especially because so many investments are local.

To identify the source of excess performance of venture capital firms based in the venture capital centers, we add interactions between *CENTRAL* and the branch office investment and outside investment dummy variables in the third column of Table IX. After adding these interaction variables, the coefficient on *CENTRAL* falls from 0.031 to 0.010 and is no longer statistically different from zero. As expected, venture capital firm experience continues to have a positive and statistically significant association with investment success. At the means of the other variables, venture capital firms at the 25th percentile of adjusted VC firm experience have a predicted success rate of 12.0%, versus a predicted success rate of 13.4% for firms at the 75th percentile of adjusted VC firm experience. However, the interaction of *CENTRAL* and adjusted VC firm experience is not statistically different than zero. This indicates that firm experience is not mediated through the firm being located in a venture capital center.

The coefficient on the interaction of *CENTRAL* and outside investment is 0.029 and statistically significant at the one percent level. Investments made by venture capital firms from the venture capital centers in portfolio companies located in CSAs not local to the venture capital

firm's offices have a 2.9% higher probability of succeeding. The coefficient on the interaction of *CENTRAL* and branch investment is 0.021, not statistically different than zero. The drop in value of the coefficient on *CENTRAL* and the statistical significance of the interaction between *CENTRAL* and outside investment provide evidence that the outperformance of venture capital firms based in the venture capital centers can be attributed to their outsized performance in investments made outside of the venture capital firms' office locations.

In the fourth column, we present evidence that venture capital firms may lower the threshold for investment quality in areas where they invest multiple times. The coefficient on the dummy variable indicating that the venture capital firm has made one or more investments in the CSA in the two years before or after the date of investment is -0.021. When a VC firm has recently invested or will invest in the near future, its investments have a 2.1% lower probability of success. Perhaps venture capital firms lower the bar on a new investment if they have a lower marginal cost of visiting the company. A general partner may be willing to make an investment in a company with less promising prospects than the average company she invests in if another investment already takes her to the CSA on a regular basis.

We also test to see if a local co-investor matters. If non-local investors can delegate monitoring to a local investor, this should mitigate the estimated effect of distance. The fifth specification of Table IX includes a dummy variable indicating if there are one or more local investors in the syndicate. The coefficient on this dummy variable is not statistically different from zero, and the coefficient on the interaction of *CENTRAL* and outside investment remains of the same magnitude. This result suggests that local co-investors may not be adequate monitoring substitutes for venture capital center-based VC investors. It is also evidence that

increasing the number of local VCs may not necessarily impact the decision of VCs in venture capital centers to invest in a region.

We also find that these results are robust to excluding investments made during 1999 and 2000, the years most closely associated with the technology bubble (as shown in the sixth specification). In the seventh specification we redefine success to include the investment being merged or acquired in addition to an initial public offering. These results are similar to our previous findings in Table IX.

Another concern with the analysis was that we looked only at whether the investments were successful, not how successful they were. For a subset of 5,109 investments for which we were able to find valuation information from SDC or Factset, we looked at the scale of investment success. We calculate exit multiples on venture capital investments as the exit value of the portfolio company divided by paid-in capital. While branch office investments and outside investments are more likely to IPO, exit multiples are similar across main office investments, branch office investments, and outside investments.

In unreported specifications, we tested to see if the number of airplane departures from the location of a portfolio company to venture capital centers is associated with success, but did not find any relationship. We also tested to see if the number of airplane departures between the location of the venture capital firm investor and the location of the portfolio company but found no relationship. This may be because airplane departures are not a good proxy for personal costs of venture capitalist travel, who may rely on private planes.

To the extent that location is important because venture capital firms are actively monitoring the businesses they invest in, we would expect location to be particularly important for early-stage businesses. Table X restricts our regression models to include only early-stage

investments, with of course a reduced sample size. The control variables in Table X are identical to the controls in Table IX, with the exception that we omit investment round controls from the specifications in Table X. In the first column, we again find that venture capital firms from the three leading venture cities outperform venture capital firms based in other locales. The coefficient on *CENTRAL*, which is statistically significant, is 0.014, indicating that venture capital firms based in the central cities have a 1.4% higher probability of succeeding than venture capital firms based outside of the three central cities. This difference in probability of success between these and other firms is lower than the difference for the entire sample, but still represents a significant level of outperformance. Furthermore, we find that branch office investments have a 2.5% higher probability of success versus main office investments and outside investments have a 1.5% higher probability of success versus main office investments. Similar to the specifications in Table IX, we add interactions between *CENTRAL* and branch investment and *CENTRAL* and outside investment in the third column of Table X and obtain similar results to those shown in Table IX. In column four, we find that the coefficient on the dummy variable indicating that the venture capital firm has made one or more investments in the CSA in the two years before or after the date of investment is also similar. In column five, we continue to estimate no impact of a local co-investor. Thus, even in early-stage investments, we find evidence of lower success rates in regions where VCs are located and in regions where VCs make multiple investments.

The findings from Tables IX and X are also similar if estimated only using the first fifteen investments of a venture capital organization, although not statistically significant. The lack is significance is unsurprising, because the sample size is much smaller. This is suggestive evidence that the results are not merely artifacts of past success.

VII. Implications

The concentration of venture capital firms that we document may be a rational allocation of scarce resources. Many venture capital investments are in industries where geographically localized knowledge spillovers are likely to be important (second-order agglomeration externalities). Accordingly, venture capital firms locate to maximize benefits from these spillovers and also maximize opportunities for localized knowledge spillovers within the venture capital community as investors and entrepreneurs seeking financing need to visit a smaller number of geographic locations (first-order agglomeration externalities). Early successes by venture capital firms are reinforced when the most talented new entrepreneurs seek capital from previously successful firms (historical artifact). A virtuous cycle of co-location is maintained as entrepreneurs choose to locate their businesses closer to funding sources, pools of talented employees, and academic researchers. The higher success rate for companies based in the venture capital centers suggests that these may be optimal geographies for founding new venture-backed businesses.

The virtuous cycle in which first- and second-order agglomeration economies reinforce historical concentration patterns may be a vicious cycle for regions which are not venture capital centers. These economies drive both venture capital firms and entrepreneurs to locate in the venture capital centers and may make it even more difficult for other regions to build critical mass. While economically efficient, this allocation of resources may not be desirable from the perspective of local governments and other cities that seek local employment growth and consequent spillovers.

Our results suggest that anything that policy makers do that contributes to an increase in the number of successful venture-backed investments in a region will also increase the probability of a venture office opening in that region. If local governments want to encourage venture capital investing, our results suggest that they should consider supporting the efforts of funds such as Village Ventures, which is based in Williamstown, Massachusetts and focuses on new ventures outside of the leading venture areas, or Draper Fisher Jurvetson, which has a network of smaller affiliated firms located in diverse geographies such as Houston, Texas and Pittsburgh, Pennsylvania. Alternately, concentrating on a single industry may increase second-order agglomeration externalities and build a track record of success to attract venture capitalists.

Finally, since we find evidence that a venture capital firm's existing investments in a region affect the hurdle rate for that firm's other deals in that region, bringing first-time venture capital investors to a region may be more effective than subsidizing existing investors. This is particularly important since more experienced firms' investments are more likely to be based in the venture capital centers. While some of this success may be due to superior selection, to the extent that these venture capitalists have superior skills to grow new companies, attracting their interest to different geographies would result in higher success rates in those geographies.

VIII. Conclusion

We document the geographic concentration of venture capital firms in three areas, San Francisco, New York, and Boston. We find the success rate of venture capital investments in a region is an important determinant of venture capital firms' decisions to open new branches. While venture capital firms located in these three cities outperform, that outperformance is not driven by local investments. Interestingly, some of the performance disparity between local and

non-local investments disappears when the venture firm does more than one investment in a region, suggesting that as the marginal monitoring cost falls, venture capital firms may reduce their expected success rate for investment in a distant geography. Our findings are informative both to researchers in economic geography, and to policy makers who seek to attract venture capital.

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Table I. Geography of Venture Capital Firm Offices

CSA	*Year*					*Share of Offices*				
	1985	*1990*	*1995*	*2000*	*2005*	*1985*	*1990*	*1995*	*2000*	*2005*
San Jose-San Francisco, CA - Main Offices	**65**	**78**	**97**	**234**	**230**	**15.0%**	**15.1%**	**15.9%**	**17.6%**	**21.6%**
San Jose-San Francisco, CA - Branch Offices	17	32	36	44	33	4.0%	5.9%	6.7%	6.3%	2.8%
New York, NY - Main Offices	**91**	**96**	**96**	**205**	**196**	**21.4%**	**16.9%**	**15.7%**	**16.1%**	**18.4%**
New York, NY - Branch Offices	4	9	13	15	14	0.4%	1.1%	1.7%	1.3%	1.2%
Boston, MA - Main Offices	**44**	**54**	**52**	**93**	**83**	**10.1%**	**10.1%**	**9.3%**	**8.6%**	**7.4%**
Boston, MA - Branch Offices	5	11	13	15	10	0.9%	1.6%	2.1%	2.0%	1.1%
Washington, DC - Main Offices	**12**	**16**	**17**	**54**	**51**	**3.1%**	**3.0%**	**2.4%**	**2.9%**	**4.8%**
Washington, DC - Branch Offices	0	5	5	13	7	0.0%	0.7%	0.7%	1.3%	0.5%
Chicago, IL - Main Offices	**13**	**23**	**26**	**41**	**35**	**2.9%**	**3.9%**	**4.5%**	**4.6%**	**3.3%**
Chicago, IL - Branch Offices	1	4	6	7	2	0.2%	0.7%	1.2%	0.9%	0.2%
Dallas, TX - Main Offices	**11**	**8**	**12**	**27**	**34**	**4.8%**	**4.6%**	**2.8%**	**3.0%**	**3.1%**
Dallas, TX - Branch Offices	6	7	5	5	5	0.2%	1.2%	1.2%	1.2%	0.3%
Los Angeles, CA - Main Offices	**21**	**23**	**13**	**37**	**34**	**2.4%**	**1.2%**	**1.7%**	**1.3%**	**2.8%**
Los Angeles, CA - Branch Offices	1	7	6	8	3	1.1%	1.1%	0.7%	0.3%	0.4%
Seattle, WA - Main Offices	**6**	**8**	**9**	**29**	**28**	**1.3%**	**1.4%**	**1.2%**	**1.3%**	**2.3%**
Seattle, WA - Branch Offices	1	4	5	1	1	0.2%	0.7%	0.7%	0.0%	0.1%
Atlanta, GA - Main Offices	**7**	**12**	**10**	**23**	**23**	**1.8%**	**1.8%**	**1.6%**	**1.4%**	**2.0%**
Atlanta, GA - Branch Offices	1	3	4	5	0	0.0%	0.5%	0.5%	0.3%	0.3%
Other - Main Offices	**115**	**138**	**141**	**298**	**273**	**27.1%**	**25.2%**	**23.0%**	**22.9%**	**23.8%**
Other - Branch Offices	16	20	34	52	47	3.1%	3.2%	6.2%	6.8%	3.6%
Total Main Offices	**385**	**456**	**473**	**1041**	**987**	**88.1%**	**81.7%**	**78.8%**	**86.3%**	**89.0%**
Total Branch Offices	52	102	127	165	122	11.9%	18.3%	21.2%	13.7%	11.0%

Sample consists of 2,039 unique venture capital firms in existence between 1975 and 2005. Geographic locations are assigned at the Combined Statistical Area (CSA) level. In cases where a city is not located in a CSA, we assign venture capital offices in the city to the appropriate Metropolitan Statistical Area (MSA). Main Offices are defined as the first office opened by the investing venture capital firm. If the firm was established with multiple offices, the CSA in which the firm made the most investments in its first five years of existence is classified as the main office. Branch Offices are defined as any location in which the firm has an office, other than the main office. Share of offices is defined as the percentage of total venture capital offices located in the CSA.

Table II. Localization Measures for the Venture Capital industry, 2005

CSA	*Location quotient, VC partners*	*Location quotient, VC offices*
San Jose-San Francisco, CA	10.591	7.397
New York, NY	2.124	2.094
Boston, MA	5.126	3.655
Washington, DC	3.887	1.871
Chicago, IL	0.868	0.901
Dallas, TX	0.898	1.397
Los Angeles, CA	0.693	2.247
Seattle, WA	2.059	1.333
Atlanta, GA	0.730	0.406

Location quotient of VC partners is equal to the percentage of overall venture capital partners based in the CSA in 2005 divided by the percentage of overall financial services employees based in the CSA in 2005. Location quotient of VC offices is equal to the percentage of overall venture capital offices located in the CSA in 2005 divided by the percentage of overall financial services GDP dollars generated in the CSA in 2005.

Table III. Venture Capital Firm Office Lifespans

	Average Lifespan (Years)			*Average Lifespan (% of Potential Years)*			*Number*	
CSA	***Main***	***Branch***	***Statistical Difference***	***Main***	***Branch***	***Statistical Difference***	***Main***	***Branch***
San Francisco/San Jose, CA	7.95	7.08		0.805	0.598	***	400	93
New York, NY	7.73	6.44		0.684	0.622		417	32
Boston, MA	8.05	5.10	**	0.681	0.506	**	180	42
All venture capital centers	7.88	6.46	***	0.732	0.580	***	997	167
All other cities	6.87	4.35	***	0.671	0.408	***	1,042	267
Total	7.36	5.16	***	0.701	0.473	***	2,039	434

Sample consists of 2,039 unique venture capital firms in existence between 1975 and 2005. Lifespan is defined as the number of years between the office opening and closing. In cases where the office remains open through the end of our sample in 2005, we calculate the number of years between the office opening and 2005. Potential lifespan is equal to lifespan divided by the number of potential years the office could have been open. Potential years are defined as the number of years between office opening and 2005. Geographic locations are assigned at the Combined Statistical Area (CSA) level. In cases where a city is not located in a CSA, we assign venture capital offices in the city to the appropriate Metropolitan Statistical Area (MSA). Main Offices are defined as the first office opened by the investing venture capital firm. If the firm was established with multiple offices, the CSA in which the firm made the most investments in its first five years of existence is classified as the main office. Branch Offices are defined as any location in which the firm has an office, other than the main office. Venture capital centers are defined as San Francisco/San Jose, New York, and Boston.

There also exist statistically significant differences at the 1% level in lifespan and potential lifespan between main offices located inside and outside the elite cities and between branch offices located inside and outside the venture capital centers.

***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table IV. Factors Associated with the Geographic Concentration of Venture Capital Firm Offices

	Log Number of Offices in Year		Log Number of Main Offices in Year		Log Number of Branch Offices in Year	
	OLS		OLS		OLS	
	[1]	[2]	[3]	[4]	[5]	[6]
Success rate of all VCs in CSA, past five years	3.117	3.108	1.626	1.618	0.539	0.530
	[5.86]***	[5.86]***	[5.17]***	[5.16]***	[3.89]***	[3.88]***
Log GDP per Capita	1.461	1.455	0.727	0.724	0.204	0.200
	[3.30]***	[3.22]***	[2.57]**	[2.48]**	[1.74]*	[1.66]*
Percent of population with college degree or higher	0.017	0.018	0.021	0.022	0.014	0.015
	[0.62]	[0.66]	[1.49]	[1.55]	[2.06]**	[2.22]**
Log patents per capita	0.347	0.349	0.169	0.172	0.055	0.058
	[2.64]***	[2.63]***	[2.25]**	[2.25]**	[1.74]*	[1.76]*
State long-term capital gains tax rate	0.331		0.599		0.618	
	[0.11]		[0.34]		[0.65]	
State income tax rate		-0.275		0.058		0.002
		[0.10]		[0.04]		[0.00]
Includes year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,256	2,256	2,256	2,256	2,256	2,256
R-squared	0.26	0.26	0.28	0.28	0.13	0.12

Sample consists of 2,256 CSA-Year observations for 197 CSAs where at least one venture capital office existed between 1975 and 2005. The dependent variable is the natural logarithm of the number of venture capital offices plus one in the CSA-Year in columns 1 and 2, the natural logarithm of the number of main offices plus one in the CSA-Year in columns 3 and 4, and the natural logarithm of the number of branch offices plus one in the CSA-Year in columns 5 and 6. Geographic locations are assigned at the Combined Statistical Area (CSA) level. In cases where a city is not located in a CSA, we assign venture capital offices in the city to the appropriate Metropolitan Statistical Area (MSA). Main Offices are defined as the first office opened by the investing venture capital firm. If the firm was established with multiple offices, the CSA in which the firm made the most investments in its first five years of existence is classified as the main office. Branch Offices are defined as any location in which the firm has an office, other than the main office. *Success rate of all VCs in CSA, past five years* measures the percentage of all venture capital investments in the CSA over the past five years that led to an Initial Public Offering. *Log GSP per Capita* is the natural logarithm of the state's gross product per capita plus one in the previous year. *Percent of population with college degree or higher* is the share of the state population that has graduated from college. *Log patents per capita* is the number of patents per capita plus one issued in the state in the previous year. *State long-term capital gains tax rate* and *state income tax rate* are average state marginal tax rates in the previous year.

Standard errors are clustered at the CSA-level. Robust t-statistics are in parentheses below coefficient estimates.

***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table V. Geography of Venture Capital-Backed Portfolio Companies

	Portfolio Company Location		Main Office Investment Location		Branch Office Investment Location		Outside Investment Location		Share of Investments in CSA		
CSA	*Number*	*% Share of Total*	*Number*	*% Share of Total*	*Number*	*% Share of Total*	*Number*	*% Share of Total*	*Main Office*	*Branch Office*	*Outside*
San Jose-San Francisco, CA	4,063	29.01	5,462	53.91	1,584	71.13	2,612	16.25	56.55	16.40	27.04
Boston, MA	1,634	11.67	1,511	14.91	288	12.93	1,770	11.01	42.34	8.07	49.59
New York, NY	1,224	8.74	1,012	9.99	50	2.25	1,049	6.53	47.94	2.37	49.69
Los Angeles, CA	851	6.08	184	1.82	39	1.75	1,319	8.20	11.93	2.53	85.54
Washington, DC	584	4.17	214	2.11	65	2.92	742	4.62	20.96	6.37	72.67
San Diego, CA	494	3.53	77	0.76	43	1.93	1,028	6.39	6.71	3.75	89.55
Dallas, TX	411	2.93	129	1.27	70	3.14	558	3.47	17.04	9.25	73.71
Seattle, WA	383	2.73	138	1.36	2	0.09	653	4.06	17.40	0.25	82.35
Denver, CO	369	2.63	166	1.64	4	0.18	562	3.50	22.68	0.55	76.78
Atlanta, GA	348	2.48	123	1.21	2	0.09	475	2.95	20.50	0.33	79.17
Chicago, IL	303	2.16	144	1.42	4	0.18	321	2.00	30.70	0.85	68.44
Philadelphia, PA	302	2.16	71	0.70	11	0.49	468	2.91	12.91	2.00	85.09
Other	3,040	21.70	900	8.88	65	3.01	4,519	28.11	16.41	1.19	82.40
Total	14,006	100.00	10,131	100.00	2,227	100.00	16,076	100.00	35.63	7.83	56.54

Sample consists of 28,434 venture capital investments in 14,006 portfolio companies for 2,039 venture capital firms between 1975 and 2005. Geographic locations are assigned at the Combined Statistical Area (CSA) level. In cases where a city is not located in a CSA, we assign portfolio companies in the city to the appropriate Metropolitan Statistical Area (MSA). Main office investment is defined as a portfolio company investment in a CSA in which the investing venture capital firm has its main office. Branch office investment is defined as a portfolio company investment in a CSA in which the investing venture capital firm has a branch office. Outside investment is defined as a portfolio company investment in a CSA in which the investing venture capital firm does not have its main office or a branch office. % Share of Total equals the percentage of portfolio companies or investment type located in the CSA. Share of investments in CSA is defined as the percentage of portfolio company investments in the CSA that are main office investments, branch office investments, or outside investments.

Table VI. Factors Associated with the Geographic Concentration of Venture Capital-Backed Portfolio Companies

	Log Number of Portfolio Companies receiving initial investment in year					
	OLS					
	[1]	[2]	[3]	[4]	[5]	[6]
Log Number of VC firms in CSA	0.740	0.740	0.696	0.696	0.1321	0.1323
	[14.43]***	[14.25]***	[18.90]***	[18.98]***	[2.51]**	[2.62]***
Success rate of all VCs in CSA, past five years	1.110	1.101	1.148	1.144	0.5166	0.5179
	[6.85]***	[6.78]***	[7.21]***	[7.24]***	[4.39]***	[4.48]***
Log GSP per Capita	-0.306	-0.312	-0.281	-0.29	0.0501	0.0311
	[2.02]**	[2.07]**	[1.84]*	[1.90]*	[0.26]	[0.15]
Percent of population with college degree or higher	0.038	0.039	0.039	0.04	0.0375	0.0369
	[3.98]***	[3.97]***	[3.98]***	[3.96]***	[1.92]*	[1.87]*
Log patents per capita	-0.025	-0.023	-0.028	-0.027	0.0507	0.0602
	[0.58]	[0.53]	[0.64]	[0.62]	[0.76]	[0.91]
State long-term capital gains tax rate	0.344		-0.401		-0.4888	
	[0.23]		[0.29]		[0.42]	1.1986
State income tax rate		-0.252		-0.736		[0.93]
		[0.18]		[0.54]		0.1323
CSA is San Francisco/San Jose			1.242	1.243		
			[7.31]***	[7.88]***		
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
CSA fixed effects	No	No	No	No	Yes	Yes
Observations	2,256	2,256	2,256	2,256	2,256	2,256
R-squared	0.74	0.74	0.75	0.75	0.86	0.86

Sample consists of 2,256 CSA-Year observations for 197 CSAs where at least one venture capital investment has been made between 1975 and 2005. The dependent variable is the natural logarithm of the number of venture capital–backed portfolio companies in the CSA plus one receiving an initial investment in the current year. Geographic locations are assigned at the Combined Statistical Area (CSA) level. In cases where a city is not located in a CSA, we assign venture capital offices in the city to the appropriate Metropolitan Statistical Area (MSA). *Log Number of VC firms in CSA* is the natural logarithm of the number of venture capital firm offices in the CSA in the current year. *Success rate of all VCs in CSA, past five years* measures the percentage of all venture capital investments in the CSA over the past five years that led to an Initial Public Offering. *Log GSP per Capita* is the natural logarithm of the state's gross product per capita plus one in the previous year. *Percent of population with college degree or higher* is the share of the state population that has graduated from college. *Log patents per capita* is the number of patents per capita plus one issued in the state in the previous year. *State long-term capital gains tax rate* and *state income tax rate* are average state marginal tax rates in the previous year.

Standard errors are clustered at the CSA-level. Robust t-statistics are in parentheses below coefficient estimates.

***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table VII. Comparison of Venture Capital Investment Success Rates by Type of Investment and Portfolio Company Location

	All investments:			*Companies in* VC Centers*:*			*Companies outside VC Centers:*		
	VC Center based VC	All Other	Significance of Difference	VC Center based VC	All Other	Significance of Difference	VC Center based VC	All Other	Significance of Difference
Main Office Investment									
Success Rate	0.154	0.115	***	0.154	--	--	--	0.115	--
% Deals	41.31	21.55		64.92	--		--	33.04	
Branch Office Investment									
Success Rate	0.212	0.152	***	0.225	0.160	***	0.151	0.124	
% Deals	10.20	17.41		13.11	38.13		5.11	6.36	
Outside Investment									
Success Rate	0.193	0.137	***	0.197	0.131	***	0.192	0.140	***
% Deals	48.50	61.04		21.98	61.87		94.89	60.60	
All Deals									
Success Rate	0.179	0.135	***	0.173	0.142	***	0.190	0.131	***
Number	18,888	9,546		12,018	3,320		6,870	6,226	

	Early Stage investments:			*Late Stage investments:*		
	VC Center based VC	All Other	Significance of Difference	VC Center based VC	All Other	Significance of Difference
Main Office Investment						
Success Rate	0.136	0.103	***	0.177	0.133	***
% Deals	46.39	26.46		36.07	16.72	
Branch Office Investment						
Success Rate	0.196	0.129	***	0.227	0.175	***
% Deals	9.76	17.69		10.64	17.14	
Outside Investment						
Success Rate	0.158	0.112	***	0.224	0.158	***
% Deals	43.85	55.85		53.29	66.14	
All Deals						
Success Rate	0.151	0.113	***	0.207	0.157	***
Number	9,586	4,732		9,302	4,814	

Sample consists of 28,434 venture capital investments in 14,006 portfolio companies for 2,039 venture capital firms between 1975 and 2005. *Main office investment* is defined as a portfolio company investment in a CSA in which the investing venture capital firm has its main office. *Branch office investment* is defined as a portfolio company investment in a CSA in which the investing venture capital firm has a branch office. *Outside investment* is defined as a portfolio company investment in a CSA in which the investing venture capital firm does not have its main office or a branch office. *Success Rate* equals the percentage of investments that led to an Initial Public Offering (IPO). *% Deals* equals the percentage of deals that are main office investments, branch office investments, or outside investments. VC centers are defined as San Francisco/San Jose, New York, and Boston. ***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table VIII. Summary Statistics for Factors Associated with Venture Capital Investment Success

	Investment Type						Investment Type Differences						Overall mean	
	[1] Main Office		[2] Branch Office		[3] Outside		[1] vs. [2]		[1] vs. [3]		[2] vs. [3]			
Variable	mean	s.d.	mean	s.d.	mean	s.d.	Diff.	Sig.	Diff.	Sig.	Diff.	Sig.	mean	s.d.
Success Rates														
Success	0.145	0.352	0.176	0.381	0.175	0.380	-0.030	***	-0.029	***	0.001		0.164	0.370
Firm Characteristics														
Adjusted VC firm experience	0.475	1.106	0.938	0.972	0.418	1.113	-0.463	***	0.057	***	0.520	***	0.484	1.112
Venture Capital Firm based in VC Center	0.793	0.405	0.575	0.494	0.604	0.489	0.218	***	0.189	***	-0.029	***	0.664	0.472
Investment Characteristics														
Stage														
Initial investment in first round	0.566	0.496	0.445	0.497	0.479	0.500	0.121	***	0.088	***	-0.033	***	0.507	0.500
Initial investment in second round	0.186	0.389	0.211	0.408	0.189	0.392	-0.025	***	-0.004		0.022	**	0.190	0.392
Initial investment in third round	0.099	0.298	0.147	0.354	0.119	0.324	-0.048	***	-0.020	***	0.028	***	0.114	0.318
Initial investment in fourth round or later	0.131	0.337	0.180	0.384	0.188	0.390	-0.049	***	-0.057	***	-0.008		0.167	0.373
Industry														
Computers and Internet	0.504	0.500	0.466	0.499	0.420	0.493	0.038	***	0.084	***	0.046	***	0.453	0.498
Communications	0.184	0.387	0.235	0.424	0.162	0.369	-0.051	***	0.022	***	0.073	***	0.176	0.380
Business and Industrial	0.018	0.132	0.016	0.126	0.021	0.144	0.002		-0.003	*	-0.005		0.020	0.139
Consumer	0.047	0.211	0.031	0.173	0.059	0.236	0.016	***	-0.013	***	-0.028	***	0.053	0.223
Energy	0.038	0.191	0.036	0.187	0.043	0.204	0.001		-0.006	**	-0.007		0.041	0.198
Biotech and Health Care	0.170	0.376	0.176	0.381	0.244	0.429	-0.006		-0.074	***	-0.068	***	0.213	0.409
Financial Services	0.018	0.134	0.021	0.142	0.024	0.153	-0.002		-0.006	***	-0.003		0.022	0.146
Business Services	0.012	0.109	0.011	0.103	0.015	0.122	0.001		-0.003	**	-0.004		0.014	0.116
Other	0.009	0.097	0.009	0.092	0.011	0.106	0.001		-0.002		-0.003		0.010	0.102
Number of Observations	9,948		2,227		16,076								28,434	

Sample consists of 28,434 venture capital investments between 1975 and 2005. *Main office investment* is defined as a portfolio company investment in a CSA in which the investing venture capital firm has its main office. *Branch office investment* is defined as a portfolio company investment in a CSA in which the investing venture capital firm has a branch office. *Outside investment* is defined as a portfolio company investment in a CSA in which the investing venture capital firm does not have its main office or a branch office. *Success* is an indicator variable that takes the value of one if the investment led to an Initial Public Offering. *Adjusted VC firm experience* is equal to the log of one plus the number of previous investments made by the venture capital firm minus the log of one plus the number of prior investments the average venture capital investor has made as of the year in question. *Venture Capital Firm based in VC Center* is an indicator variable that takes the value of one if the investing venture capital firm is based in San Francisco/San Jose, New York, or Boston and zero otherwise. *Initial investment round variables* are indicators that report the initial round in which the venture capital firm made an investment in the portfolio company. *Industry variables* are indicators that report which of the nine major industries identified by Gompers, Kovner, Lerner and Scharfstein (2008) the portfolio company is classified under.

***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table IX. Factors Associated with Venture Capital Investment Success

	Success, IPO Probit						IPO or M&A
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Portfolio company outside VC's office CSAs	0.0221	0.0222	0.0029	-0.0013	0.0004	0.0030	-0.0032
	[4.44]***	[4.44]***	[0.30]	[0.13]	[0.04]	[0.26]	[0.23]
Portfolio company in CSA of VC's branch office	0.0231	0.0232	0.0049	0.0016	0.0037	0.0068	0.0133
	[2.74]***	[2.75]***	[0.32]	[0.11]	[0.24]	[0.36]	[0.60]
Adjusted VC firm experience	0.0099	0.0091	0.0092	0.0089	0.0091	0.0117	0.0171
	[4.99]***	[2.52]**	[2.55]**	[2.45]**	[2.52]**	[2.59]**	[3.14]***
VC based in VC Center	0.0313	0.0311	0.0100	0.0069	0.0087	0.0072	0.0179
	[6.80]***	[6.66]***	[0.97]	[0.67]	[0.82]	[0.57]	[1.16]
VC based in VC Center * Adjusted VC Firm Experience		0.0012	0.0011	0.0014	0.0012	0.0005	0.0080
		[0.29]	[0.26]	[0.33]	[0.28]	[0.10]	[1.26]
VC based in VC Center * Portfolio company outside VC's office CSAs			0.0293	0.0323	0.0305	0.0353	0.0312
			[2.42]**	[2.66]***	[2.49]**	[2.37]**	[1.76]*
VC based in VC Center * Portfolio company in CSA of VC's branch office			0.0206	0.0239	0.0219	0.0199	0.0016
			[1.09]	[1.26]	[1.16]	[0.86]	[0.06]
One or more investment in the CSA in the two years before or after the date of investment				-0.0209			
				[3.05]***			
One or more local investor in syndicate					-0.0041		
					[0.66]		
Includes year controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Includes round controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Includes portfolio company location controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Includes industry controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	28,434	28,434	28,434	28,434	28,434	21,532	28,434

Sample for all specifications except [6] consists of 28,434 venture capital investments between 1975 and 2005. Specification [6] excludes investments from 1999-200 “tech bubble. The dependent variable is *Success* an indicator variable that takes on the value of one if the portfolio company went public and zero otherwise for specifications 1-6. The dependent variable is *Success* an indicator variable that takes on the value of one if the portfolio company went public or was merged or acquired and zero otherwise for specifications 7. *Portfolio Company outside VC's office CSAs* is an indicator variable that takes the value of one if the portfolio company receiving investment is located in a CSA in which the venture capital firm does not have its main office or a branch office and zero otherwise. *Portfolio Company in CSA of VC's branch office* is an indicator variable that takes the value of one if the portfolio company receiving investment is located in a CSA in which the venture capital firm has a branch office and zero otherwise. The omitted investment type category is Portfolio Company in CSA of VC's main office. This category includes all deals in which the portfolio company receiving investment is located in a CSA in which the venture capital firm's main office is located. *Adjusted VC firm experience* is equal to the log of one plus the number of previous investments made by the venture capital firm minus the log of one plus the number of prior investments the average venture capital investor has made as of the year in question. *VC based in VC Center* is an indicator variable that takes the value of one if the investing venture capital firm is based in San Francisco/San Jose, New York, or Boston. *One or more investment in the CSA in the two years before or after the date of investment* is an indicator variable that takes the value of one if the venture capital firm has made one or more investments in the CSA in the two years before or after the date of investment. *One or more local investor in syndicate* is an indicator variable that takes the value of one if one or more of the venture capital firms investing in the portfolio company is local to the portfolio company.

Robust z-statistics are in parentheses below coefficient estimates.

***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table X. Factors Associated with Venture Capital Investment Success, Early Stage Investments

	Success, IPO Probit				
	[1]	[2]	[3]	[4]	[5]
Portfolio company outside VC's office CSAs	0.0154	0.0155	-0.0069	-0.0107	-0.0091
	[2.61]***	[2.63]***	[0.63]	[0.95]	[0.76]
Portfolio company in CSA of VC's branch office	0.0245	0.0247	-0.0125	-0.0150	-0.0142
	[2.40]**	[2.42]**	[0.71]	[0.86]	[0.81]
Adjusted VC firm experience	0.0072	0.0051	0.0064	0.0063	0.0066
	[2.82]***	[1.13]	[1.40]	[1.36]	[1.43]
VC based in VC Center	0.0144	0.0140	-0.0128	-0.0155	-0.0115
	[2.46]**	[2.37]**	[1.03]	[1.23]	[0.91]
VC based in VC Center * Adjusted VC Firm Experience		0.0030	0.0015	0.0016	0.0017
		[0.56]	[0.27]	[0.30]	[0.31]
VC based in VC Center * Portfolio company outside VC's office CSAs			0.0350	0.0381	0.0327
			[2.35]**	[2.54]**	[2.19]**
VC based in VC Center * Portfolio company in CSA of VC's branch office			0.0545	0.0583	0.0524
			[2.14]**	[2.26]**	[2.06]**
One or more investment in the CSA in the two years before or after the date of investment				-0.0169	
				[1.92]*	
One or more local investor in syndicate					0.0015
					[0.20]
Includes year controls	Yes	Yes	Yes	Yes	Yes
Includes round controls	Yes	Yes	Yes	Yes	Yes
Includes portfolio company location controls	Yes	Yes	Yes	Yes	Yes
Includes industry controls	Yes	Yes	Yes	Yes	Yes
Observations	14,043	14,043	14,043	14,043	14,043

Sample consists of 14,043 early stage venture capital investments between 1975 and 2005. Early stage investments are investments in portfolio companies that are developing their product or have begun initial marketing, manufacturing, and sales activities for their product. The dependent variable is *Success* an indicator variable that takes on the value of one if the portfolio company went public and zero otherwise. *Portfolio Company outside VC's office CSAs* is an indicator variable that takes the value of one if the portfolio company receiving investment is located in a CSA in which the venture capital firm does not have its main office or a branch office and zero otherwise. *Portfolio Company in CSA of VC's branch office* is an indicator variable that takes the value of one if the portfolio company receiving investment is located in a CSA in which the venture capital firm has a branch office and zero otherwise. The omitted investment type category is Portfolio Company in CSA of VC's main office. This category includes all deals in which the portfolio company receiving investment is located in a CSA in which the venture capital firm's main office is located. *Adjusted VC firm experience* is equal to the log of one plus the number of previous investments made by the venture capital firm minus the log of one plus the number of prior investments the average venture capital investor has made as of the year in question. *VC based in VC Center* is an indicator variable that takes the value of one if the investing venture capital firm is based in San Francisco/San Jose, New York, or Boston. *One or more investment in the CSA in the two years before or after the date of investment* is an indicator variable that takes the value of one if the venture capital firm has made one or more investments in the CSA in the two years before or after the date of investment. *One or more local investor in syndicate* is an indicator variable that takes the value of one if one or more of the venture capital firms investing in the portfolio company is local to the portfolio company.

Robust z-statistics are in parentheses below coefficient estimates.

***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively.