Venture capital, entrepreneurship and economic growth*

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Abstract: Using a panel of US metropolitan areas from 1993 to 2002, we find that an increase in the local supply of venture capital (VC) positively affects (i) the number of firm starts, (ii) employment, and (iii) aggregate income. Our results remain robust to specifications that address potential endogeneity in the supply of venture capital by using endowment returns as an instrumental variable. The magnitudes of the effects moreover imply that venture capital stimulates the creation of more firms than it directly funds. That result appears consistent with either of two mechanisms: One, would-be entrepreneurs that anticipate a future need for financing more likely start firms when the supply of capital expands. Two, VC-funded companies may transfer tacit knowledge to their own employees enabling spinoffs, and may encourage both their employees and others to become entrepreneurs through demonstration effects.

Keywords: Venture capital, financial intermediaries, entry, employment, wage bill

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1 Introduction

Analysts, bureaucrats, business leaders, politicians and pundits have widely pointed to venture capital (VC) as an important factor underlying the economic growth both of certain regions within the United States, such as Silicon Valley, as well as of the country as a whole (Bottazzi and Rin 2002). These commentators have similarly attributed slow growth to the relative scarcity of venture capital in states from Alaska to Florida, and in nearly every country aside from the United States. Several governments, including those of Canada, Chile, Germany and Israel, in the interest of stimulating their economies, have even sought to expand their local supplies of venture capital by way of public policy (Gilson 2003; Cumming and MacIntosh 2007).

Despite the widespread interest in venture capital as a stimulus for economic growth, however, little empirical research has examined the validity of these claims (for an exception, see Hasan and Wang 2006). At first blush, positive relationships between venture capital, entrepreneurship and economic growth might appear a foregone conclusion, but these relationships, in fact, rest on two (potentially inaccurate) assumptions. First is a presumption that VC-funded firms would not have come into being without venture capital, and second is a belief that those employed at these VC-funded firms generate substantially more value for the economy than they would have in other firms. Although firm-level studies have found that VC-funded companies enjoy higher employment and sales growth rates than the average startup (Jain and Kini 1995; Engel and Keilbach 2007), one cannot easily extrapolate from these firm-level relationships to the implications of venture capital for the economy as a whole. It is quite possible, for example, that VC firms simply select the more promising startups and substitute for other sources of financing that those ventures would have received had venture capital not been available. The macro-level relationships between the supply of venture capital, entrepreneurship and economic growth therefore remain open questions.

To determine whether the availability of venture capital stimulates the formation of new firms, and in turn contributes positively to economic growth, we exploited both cross-sectional and longitudinal variation in the supply of venture capital across and within Metropolitan Statistical Areas (MSAs). We estimated the local effects of venture capital activity – measured in terms of (i) the number of companies funded, (ii) the number of investments made, and (iii) the aggregate dollars invested – on the number of new firms established, and on employment and aggregate income. Since the supply of venture capital itself may depend in part on the demand for it – that is, on the availability of high potential businesses in which to invest – we also used endowment returns as an instrument to identify the supply of venture capital. Our results remained robust to these specifications.

Our findings imply that venture capital stimulates startup activity. A doubling in the supply of venture capital in a region results in the establishment of 0.49% to 2.6% more new establishments on average (depending on how one measures the supply of venture capital). For the average MSA, a doubling in investments means moving from having four firms funded per year to having eight firms funded per year. Our estimates therefore imply that an additional investment would stimulate the entry of 7 to 36.7 establishments—in other words, more new firms than actually funded. A doubling in the supply of venture capital also results in a 0% to 1.0% expansion in the number of jobs, and a 1.4% to 6.4% increase in aggregate income. These results appear consistent with either of two potential mechanisms. First, nascent entrepreneurs may recognize the need for capital in the future and only establish firms when they perceive reasonable odds of obtaining that funding. Second, VC-funded firms may encourage others to engage in entrepreneurship either through a demonstration effect or by training future firm founders.

By providing evidence that the supply of venture capital positively stimulates entrepreneurship and aggregate regional income, our findings contribute to the literature that has been attempting to explain cross-regional differences in economic outcomes (e.g., Glaeser et al. 1992; Rosenthal and Strange 2003). Whereas the existing literature has focused primarily on agglomeration externalities, either within or across industries, however, our results – similar to many cross-national studies of economic growth (e.g., Rodrik et al. 2004) – suggest that heterogeneity in economic institutions also contribute to regional differences in growth. In particular, consistent with the theoretical literature, an expansion in the availability of financial intermediaries, in this case venture capitalists, stimulates economic development (Greenwood and Jovanovic 1990; Keuschnigg 2004). Dynamic regions, such as Silicon Valley, have benefited not just from technological shocks and inter-firm spillovers, but also from the fact that they have had the financial infrastructure necessary to help transform these ideas into productive firms.

2 Venture capital and economic growth

Venture capital, the funding of high-potential companies through equity investments by professional financial intermediaries, has existed in the United States for more than 60 years. Despite some prominent early success stories, these intermediaries played only a minor role in the financing of early-stage companies prior to the 1980s (Gompers and Lerner 1998). Since then, however, their prominence has been rising rapidly; according to the National Venture Capital Association (NCVA), from 1978 to 2007, the total funds raised by venture capital firms in the United States grew from $549 million (in 2007 dollars) to $35.9 billion.

In the United States, venture capital firms have evolved toward a common organizational form. Each firm consists of one or more limited partnerships, called funds, with lifespans of 10 to 12 years. The capital in these funds comes from passive limited partners, primarily wealthy individuals and institutional investors, such as college endowments, insurance companies and pension funds. The general partners, often referred to as venture capitalists, actively manage this capital—identifying attractive investments and then monitoring and advising the companies in which they invest to maximize their returns. In exchange for their services, venture capitalists receive both some fixed compensation and a potentially sizable portion of the capital gains earned on these investments. They therefore have strong incentives to choose their portfolio companies wisely and to nurture them as effectively as possible.

Evidence from firm-level studies generally suggests that venture capitalists produce value through their pre- and post-investment roles (i.e through the selection and advising of portfolio companies). Jain and Kini (1995), for example, found that firms financed by venture capital grew faster in sales and in employment. Analyses of the financial returns to venture capital investments paint a similar picture (Chen et al. 2002; Cochrane 2005). But the interest in venture capital reflects not only its value to those investing in it, but also its potential to contribute to the economy as a whole by promoting the development of high growth companies that create jobs and generate wealth.

2.1 Selection and substitution

Although firm- and investment-level studies find evidence consistent with the idea that venture capital firms create value for their investors, at least two important issues arise in attempting to move from these studies to the potential benefits of venture capital to the economy as a whole: (1) Would these companies have received funding from other sources in the absence of venture capital? (2) How much of the value of venture capital at the firm-level stems from pre-investment activities (i.e. selection)? If these companies would have found other sources of funding, then venture capitalists may do little more than help their limited partners to find these investments (and, perhaps, to reduce slightly the cost of capital by intensifying competition in the financing of fledgling firms). Even if venture capital firms do alleviate entrepreneurs' capital constraints, firm- and investment-level studies could overestimate the benefits of this capital to the economy as a whole if venture capitalists cherry-pick the best investments. Venture capital may therefore have little or no net effect on the economy as a whole.

Although research has not directly investigated the first issue, the literature on wealth and entrepreneurship suggests that insufficient financial resources may prevent many from starting their own businesses. Evans and Jovanovic (1989) and Blanchflower and Oswald (1998), for example, have found that the odds of becoming an entrepreneur rise with household wealth. This relationship suggests that entrepreneurs cannot always find substitute funds for good ideas. To the extent that access to financial resources forms a binding constraint on the ability of individuals to engage in entrepreneurship, one might then expect venture capital – as well as other institutions that alleviate these constraints – to stimulate growth by ensuring that good ideas receive funding (Keuschnigg 2004).

With respect to the second issue – the degree to which venture capitalists add value through their pre-investment activities – at least two recent studies suggest that selection accounts for a substantial portion of the returns to venture capital investing. In a sample of German companies, Engel and Keilbach (2007) found that, companies receiving venture capital had more patents at the time of funding than the average startup. But once they controlled for this difference (through matching), these companies proved no more innovative after receiving VC funding. Using a structural model to identify pre- versus post-investment processes, Sorensen (2007) has estimated that roughly two-thirds of the variation across venture capital firms in the probability that their portfolio companies would go public stems from pre-investment sorting processes (i.e. selection). Hence, even if venture capital does alleviate capital constraints, selection could still lead extrapolations from firm-level studies to overestimate the effect of venture capital on the economy.

2.2 Expectations and spinoffs

Two other factors, expectations and spinoffs, however, suggest that venture capital may encourage the founding of even more companies than it funds directly. Firm- and investment-level studies therefore could also understate the economic value of venture capital. Let us consider expectations first. If entrepreneurs assess their odds of success before attempting entry, then the availability of venture capital should positively affect the evaluations of a number of these would-be entrepreneurs. Without capital infusions, many capital-constrained entrepreneurs would find it impossible to develop their businesses. Their anticipated odds of success therefore depend on their expectations of gaining venture capital funding.[1] Though one might expect entrepreneurs to secure this funding prior to entry – thereby limiting the effects of venture capital to the companies it actually funds – entrepreneurs often enter first and pursue financing later for two reasons.[2] One, beginning operations before pursuing financing allows the founder to retain a larger share of the equity. The entrepreneur therefore has a financial incentive to found the firm – if possible – before receiving funding. Two, because of the information asymmetries inherent between entrepreneurs and investors, many venture capital firms avoid investing in companies that have not already achieved

[1]Even in the absence of capital constraints, entrepreneurs might value the advice and connections that venture capitalists can provide to their portfolio companies and therefore still see value in these financing relationships.

[2]Consistent with this expectation, the median company in our data does not receive its first round of venture capital investment until 1.6 years after being established.

rudimentary milestones—perhaps filing for a patent or creating a prototype of a product.

A second mechanism through which venture capital may engender entrepreneurship is through spinoffs—that is, through one or more employee(s) in some incumbent firm starting their own company. Venture capital can encourage spinoffs in at least two ways. The first is a demonstration effect. When interviewed, entrepreneurs often say that they first thought of starting a company when they saw someone else do it, potentially even in a different industry (Sorenson and Audia 2000). Seeing others engage in entrepreneurship can encourage other would-be entrepreneurs to start firms. The second is a training effect. Small, entrepreneurial firms operate differently from larger, more bureaucratic organizations. Prior experience in small (VC-backed) companies allows would-be entrepreneurs to absorb tacit knowledge on how to design and manage effective entrepreneurial ventures.

Because both the expectations and spinoffs mechanisms imply effects external to the companies that actually receive venture capital funding, their influence would not appear in firm- or investment-level studies. We must move to a more macro level of analysis. Research at that level has been more scarce. Some evidence exists for a positive relationship between venture capital and patenting (Kortum and Lerner 2000; Hasan and Wang 2006), though those results may reflect compositional differences in which industries attract venture capital (Gans and Stern 2003). Venture capital activity also correlates positively with regional GDP growth (Hasan and Wang 2006), though high growth regions might attract venture capital. Our understanding of these relationships nonetheless remains limited. We therefore investigated the degree to which venture capital stimulates the production of new firms, jobs and income growth.

3 Empirical evidence

To assess these issues, we constructed an unbalanced panel covering all 329 Metropolitan Statistical Areas (MSAs) in the United States from 1993 to 2002. Our data comprise information from a variety of publicly available and proprietary sources. The data on regional economic activity came from the Office of Advocacy of the Small Business Administration (SBA), which reports information collected by the Census Bureau.[3] Our information on venture capital has been derived from Thomson Reuters' VentureXpert database, and our measures of endowment returns came from *The Chronicle of Higher Education*.

We chose MSAs as our geographic unit of analysis because they offered the finest-grained regions that one might reasonably consider independent with respect to economic activity. The U.S. Office of Management and Budget (OMB) defines each MSA in terms of a core urban area, of at least 50,000 inhabitants. It also includes in each MSA any surrounding counties with a high degree of social and economic integration with the urban core.[4] In practice, the OMB assesses social and economic integration by observing commuting patterns. If more than 25% of a county's residents commute to the urban core for work, then the OMB includes the county in the MSA. Because a few regions only became classified as MSAs after 1993, our panel includes a total of 3,280 MSA-years.

We limited our analyses to a ten-year window, from 1993 to 2002, because the construction of the panel requires consistent definitions of the regional units of analysis across years. Roughly three years after each decennial census, the OMB redefines the statistical areas for

[3]The Census Bureau polls the country each March. The firm birth data, therefore, count the number of new firms from the beginning of April of a given year to the end of March in the next year. We have used the exact dates of investments from the venture capital data to align the timing of investments to the Census Bureau calendar.

[4]In contrast to the rest of the country, the Census Bureau uses townships, instead of counties, in New England to determine the boundaries of MSAs.

the next ten years on the basis of the decennial data. The 1993 redefinition governed the reporting of most government statistics from 1993 to 2002. Developing consistent regions across these redefinitions would require a host of assumptions regarding the distribution of activity within each MSA.

3.1 Cross-sectional estimates

We began our analysis by estimating effects from cross-sectional variation across MSAs. In particular, we examined the effects of venture capital on three different outcomes: the number of establishments in the region, overall employment in the region, and aggregate income for the region.[5] Our measure of employment includes both full-time employees and (the full-time equivalent of) part-time employees. Aggregate income includes all forms of compensation: wages, salary, bonuses and benefits. For each of these outcomes, we estimated the effects using the following partial linear adjustment model:

$$\ln Y_{i,t2} = \beta_1 \ln F_{i,t1} + \beta_2 \ln E_{i,t1} + \beta_3 \ln W_{i,t1} + \beta_4 \ln \sum_{s=t_1-5}^{t_1-1} I_{i,s} + \beta_5 \ln \sum_{s=t_1-5}^{t_1-1} VC_{i,s} + \epsilon_i, \quad (1)$$

where i indexes the MSA observed at two points in time, $t1$ and $t2$. $Y_{i,t2}$ denotes the dependent variable (i.e. establishments, employment, and total payroll). $F_{i,t1}$, $E_{i,t1}$ and $W_{i,t1}$ are the number of firms, employees, and the aggregate wages in the region respectively. In each model, one of these measures serves as a lagged dependent variable. $I_{i,t1}$ controls for innovation in the region (through patent counts); $VC_{i,t}$ measures the supply of venture

[5] Alternatively, one might focus only on those establishments started in the industries most relevant to venture capital. Restricting the range of industries included would nevertheless have two disadvantages. From a practical point of view, venture capital firms have invested in nearly every 2-digit SIC code, so we would have little ability to discriminate across industries in their potential for receiving venture capital. But also, from a theoretical perspective, to the extent that venture capital stimulates the founding and growth of companies not directly funded by it, excluding some industries from the analyses would result in downward bias in the effects of venture capital on the economy.

capital, and ϵ_i represents a normally distributed error term.

The opportunities to create firms and to invest in venture capital might both depend on the arrival of new technological opportunities ($I_{i,t1}$). To control for these opportunities, we used the count of patent applications (eventually approved) made by inventors located in an MSA over the preceding five years. If a patent application had multiple inventors listed (n), we assigned $1/n$ patents to the MSA of each inventor.

As a measure of venture capital activity, we counted the number of firms funded over the preceding five years by VC firms located in a particular MSA. Because some regions have no activity, we added one to this count before logging it. To focus on the number of companies funded, we counted only initial investments in target companies (other measures are examined below).[6] We included all target companies in this count regardless of whether those companies resided in the same MSA as the VC firm.[7] So, for example, if a San Diego target company received three rounds of capital infusions from a venture capital firm located in Orange Country, we would increment this measure by one in Orange County in the year of the first investment. Although VC firms tend to invest in close proximity to their offices and therefore in firms located in the same MSA (Sorenson and Stuart 2001), they sometimes do invest further away.

In counting venture capital investments, we restricted the VentureXpert data to limited partnerships with a stated focus on seed stage, early stage, later stage, expansion, development, or balanced stage investing.[8] The VentureXpert database includes information on

[6]In cases that involved multiple VC firms investing in a single target, we counted each VC firm as having made one investment.

[7]Alternatively, one might locate investments according to the headquarters of the companies funded (rather than by the location of the VC firms). We dismissed this alternative because the logic of our instrumental variable allows us to identify the local supply of venture capital (rather than its deployment). To the extent that VC firms invest outside of their MSAs, however, our estimates should err on the side of being conservative.

[8]An examination of the actual investments made by these funds confirmed that venture capital firms

many private equity partnerships that do not invest in early stage companies, such as LBO, real estate and distressed debt funds, and funds of funds. The fund focus information allowed us to remove these non-VC private equity investors from the data. Restricting the analyses to limited partnerships also effectively eliminated investments by angel investors and corporate venture capital arms, as well as direct investments by university endowments and other institutional investors. Although these other forms of financing early stage companies may also have important effects on entrepreneurship, the validity of the instrument introduced below depends on limited partners' demand for private equity investments. We therefore restricted our analyses to funds with limited partners.

Table 2 presents the results of two sets of cross-sectional analyses. The first three columns report estimates with a five-year lag between the outcome measures and the predictors—in other words, for an analysis using the attributes of MSAs in 1995 to predict the number of firms, employment, and aggregate income in 2000. The next three columns present the estimates from a set of models using a nine-year lag, using 1993 values to predict 2002 outcomes. The controls suggest that regions with more innovation in the five years leading up to $t1$ experienced faster growth over the next five years in the number of firms, employment and aggregate income in the region. Venture capital, by comparison, had no apparent effect on the number of firms in the region using either the five- or nine-year lag. That does not imply that venture capital does not increase entrepreneurship, but it does suggest that either these new firms displace existing firms in the region or they do not survive long on average.

The local supply of venture capital does, on the other hand, appear to increase both employment and aggregate income in the region. The magnitude of these effects are substantial.

almost uniformly made investments consistent with their stated scopes. We nevertheless restricted the individual investments used in constructing our count and amount variables to those that fell into these stages.

A doubling in the amount of venture capital invested over the five years leading up to $t1$ implies a 0.6% increase in employment and a 2.7% rise in aggregate income in the region five years later. The larger marginal effect of venture capital on income relative to employment suggests either that venture capital produces particularly well paying jobs or (more likely) that the greater availability of entrepreneurship and small-firm employment as an outside option places upward pressure on the wages paid by existing employers. Longer lags, such as the nine-year lag reported in columns (4) through (6), yield results of almost identical magnitude. Most of the economic benefit of venture capital to the regional economy, therefore, appears to accrue in the first few years following funding.

These cross-sectional estimates may nonetheless confound the effects of venture capital with a wide range of other factors that vary from one region to the next. To investigate these issues further, let us turn to analyses that use longitudinal variation within regions to identify the effects of venture capital on the economy.

3.2 Fixed effects estimates

Our fixed effects specifications included region fixed effects, to control for time-invariant characteristics of MSAs that might both attract venture capital and influence entrepreneurship and economic growth. We also included dummy variables for each calendar year to control for macro-economic factors that might influence the availability of venture capital, entrepreneurship and economic performance across the country as a whole. The tables below also report estimates with and without region-specific trends, to capture regional differences in the average growth rates in entrepreneurship, employment and aggregate income over time. In particular, we estimated a logged form of a standard production function:

$$\ln Y_{i,t} = \beta_1 \ln I_{i,t-1} + \beta_2 \ln P_{i,t} + \beta_3 \ln VC_{i,t} + \phi_t + \eta_i + \nu_i t + \epsilon_{i,t}, \tag{2}$$

where i and t index the MSA and the year, respectively. As above, $Y_{i,t}$ denotes the various outcome measures, $I_{i,t-1}$ indicates innovation (patent applications), and $VC_{i,t}$ represents venture capital activity. The fixed effects models also included a control for regional growth in the population ($P_{i,t}$), a series of indicator variables for each year (ϕ_t), MSA fixed effects (η_i, partialed out), and (in some models) an MSA-specific growth trend ($\nu_i t$). We clustered the standard errors on MSAs to allow for correlation in the errors within regions across years. Descriptive statistics for the variables used in the panel analyses appear in Table 1.

We considered three measures of the supply of venture capital: (1) As in the cross-sectional models, we counted first investments in firms by venture capital firms in the MSA organized as limited partnerships. (2) Our second measure counted *all* investments made during the year by VC firms located in the MSA (again regardless of the location of the investment target). This measure should also capture the effects of continuing support for companies that have already received venture capital. (3) We calculated the total amount of money invested each year by venture capital funds headquartered in each metropolitan area.[9] In essence, this measure weights the investments in the second measure by their size in dollars to determine whether larger investments have larger effects. Because all three measures include some regions with no venture capital activity in a year, we added one to each measure before logging it.

[9] Although VentureXpert includes relatively complete information on the size of investment rounds (95% of our cases), it does not contain information on the proportion of these rounds contributed by each investor. In the absence of more detailed information, we allocated the total funds invested in a round equally across all investors in that round.

Entrepreneurship: We first examined the effects of venture capital on the births of new establishments. The Census Bureau defines a business establishment as a single physical location where business occurs and for which a firm maintains payroll and employment records. All firms have at least one establishment, but many firms have more than one. We used the natural log of establishment births as our measure of entrepreneurship.

Table 3 reports the results of these analyses. The first three columns do not include a region-specific trend, while the last three do. All of the measures of venture capital have positive effects on entrepreneurship on the models without controls for region-specific growth rates. The results nevertheless suggest that first investments have a larger stimulative effect on entrepreneurship than later investments. A doubling in the number of firms funded implied a 0.78% increase in the number of new establishments. [10] Since the average MSA-year had four VC-funded companies (and 1839 establishment births in the 0-19 category), the funding of one additional company appeared to generate roughly three-and-one-half new establishments. By comparison, a doubling in the number of overall investments corresponded to a 0.55% increase in new establishments. Larger investments also seemed inefficient in promoting entrepreneurship; a doubling in the dollars invested implied an increase of only 0.05% in the number of companies. After including MSA-specific trends, moreover, the effects associated with the total number of investments and with the aggregate amount of these investments falls substantially, to a level below statistical significance.

In addition to counting the foundings of new firms, however, the new establishments measure also captures both relocations by existing businesses across MSAs and the opening of new plants and places of business by existing firms. To distinguish these activities from

[10] Although one could interpret the log-log coefficients directly as elasticities, we chose not to do so because one cannot meaningfully consider small percentage changes in the number of companies funded (only 11 of the 329 regions had more than 100 companies funded in any single year).

entrepreneurship, we used information on the size of the firm at the time of entry. Based on the total employment of organizations (i.e. across all business locations), the SBA splits establishment births into three categories: 0-19 employees, 20-499 employees, and over 500 employees. A large firm establishing a small local branch would appear in the 500+ category regardless of the number of individuals employed at the local branch. New firms meanwhile should only appear in the 0-19 employee category (though this category might still include some relocations or expansions of small existing firms). Once again, we logged the variable before using it in the regressions.

Table 4 details these analyses. Both the pattern of the results and the magnitude of the coefficients are essentially the same as those in the previous table. Since births of small firms account for 75% to 80% of all births in most regions, however, that result is not surprising. Because small establishment births more clearly capture startups, we nonetheless focus on these births of small firms as our measure of entrepreneurship for the remainder of the paper.

Although most MSAs have at least one local venture capital firm and therefore contribute to our estimates, one might worry that outliers account for our results. Notably, California, Massachusetts and Texas, together, account for a little over half of all venture capital during the period being analyzed. Table 5, therefore, reports the effect of the number of firms funded on the number of small firm establishment births for a series of models that systematically remove MSAs in each of these states – and in the final column, all of them – from the analysis. The size of the effect appears insensitive to the exclusion of those regions with the highest volumes of venture capital activity.[11]

Table 6 explores the temporal structure of the relationship between the supply of venture capital and the births of small establishments. We began by regressing the number of births

[11] Similar robustness checks using employment and aggregate income as dependent variables also revealed no sensitivity of the results to the inclusion of specific regions.

in the region on the number of firms funded in that year, in the previous year, and in the year before the previous one. As one would expect, the size of the relationship declines steadily as the lag grows longer. Although some (unreported) models find a significant relationship with a one-year lag between venture capital investment and births, the effect always falls to zero with a two-year lag. In terms of magnitude, these estimates suggest that the VC funding of an additional firm in the typical MSA would result in the opening of roughly 2.4 firms (including the one funded) in the first year and an additional 1.5 firms in the next year. At least in terms of the temporal structure, reverse causality does not appear a concern.

Employment: Next, we examined the effects of venture capital on overall employment in the region (Table 7). Once again the first three columns report the models without region-specific trends and the last three columns report them with the trends. In the models without region-specific trends, both the number of firms funded and the number of investments had positive relationships with employment in the region. A doubling in the number of firms funded in a region implied a 0.51% increase in total employment in the region, while a doubling in the number of total investments corresponded to a 0.35% rise in employment. These effects nevertheless decline substantially in magnitude once region-specific trends have been included in the models. In those models, for example, a doubling in the number of firms funded implied a 0.24% increase in total employment. As in the entrepreneurship models, follow-on investments and larger investments appear inefficient in promoting employment relative to first investments in firms.

Translating those effect sizes into absolute numbers, one would expect the funding of one additional firm by venture capitalists to result in roughly 157 more full-time-equivalent jobs for the typical region. In the parallel model of firm births with region-specific time trends (Table 4, model 4), this same funding of an additional firm implies 2.4 new establishments.

If all of these jobs appeared in the firms stimulated by venture capital, therefore, the typical new venture would employ more than 60 people. Since that number far exceeds the average size of these ventures, it suggests that at least some of the gains in employment must accrue to existing firms in the region.

Aggregate income: Finally, we considered the effects of venture capital on the total wage bill for the region (Table 8). In these models, venture capital has positive and significant effects across all six models—using all three measures of venture capital and both with and without controls for region-specific trends. The coefficients from the models with MSA trends nevertheless suggest must weaker relationships between the supply of venture capital and aggregate income. Although first investments and subsequent investments have similar size effects, larger investments appear less efficient in producing wage growth. Whereas a doubling in the number of firms funded or the total number of investments imply a 0.69% or 0.62% rise, respectively, in the total payroll in the region, a doubling in the dollars invested would correspond to a 0.033% gain in income (in the models including region-specific trends).

In dollar terms, the funding of an additional firm by venture capital would correspond to an increase of $14.3 million in the wage bill for the region. Since the average venture capital investment deploys only $2.5 million in capital, this income effect suggests that venture capital investments produce a high social return. If all of this income growth stemmed from the incomes associated with the 157 jobs created – either directly or indirectly – by that investment, then it would imply that the average job produced by venture capital had a total compensation of about $91,000.

3.3 Fixed effects IV estimates

Though the fixed effects estimates also suggest that venture capital promotes entrepreneurship, employment and income growth, their validity nonetheless rests on an assumption that the supply of venture capital does not itself depend on entrepreneurship. As noted above, however, that seems unlikely. Venture capitalists choosing a region in which to locate their offices would presumably find places with more entrepreneurial activity more attractive, and even if venture capitalists tend to emerge out of local communities, their interest in raising – and ability to raise – funds may well depend on perceptions of the degree to which the region offers attractive investment opportunities. This endogeneity would bias our OLS estimates.

To address these potential endogeneity problems, we also identified the effect using an instrumental variable (IV).[12] Our specification of the IV models follows that described in equation (2), except that we instrument the supply of venture capital. In the IV models reported, we focus on the number of firms funded as our measure of venture capital activity because it has provided the most consistent effects in the cross-sectional and OLS longitudinal models. We used the LIML estimator for these models because of its greater robustness over 2SLS in terms of removing the OLS bias from the estimates (Stock and Yogo 2005).[13]

Our instrument, *LP Returns*, relies on the demand for alternative assets by limited partners. Institutional investors generally have an investing strategy that depends in part on an optimal allocation of assets across classes (e.g., 60% equity, 30% fixed income, and 10% alternative assets). The managers of these funds regularly rebalance their portfolios to maintain allocations close to these optimal mixes. When the endowments they manage earn high

[12] Although we do not report these models, we also estimated a set of models using the instrument suggested by Gompers and Lerner (2000): Inflows into LBO funds in an MSA. Estimates with that instrument yielded substantively equivalent results. We nonetheless prefer LP Returns as an instrument because it predicts more of the variation in the supply of venture capital and because it is more plausibly exogenous to regional economic activity.

[13] We estimated all IV models using the `xtivreg2` module in Stata 10 (Schaffer 2005).

returns, they need to shift assets to venture capital to maintain their asset allocations.[14] Investments in VC funds should therefore correlate highly with lagged endowment returns.[15] But these institutional investors rarely invest directly in startups, so their returns should not have a direct effect on entrepreneurship.

Although this relationship should hold at the national level, the usefulness of the instrument as a source of exogenous variation in the regional supply of venture capital depends also on an assumption that institutional investors have a tendency to invest in locally-headquartered private equity funds. Such a home bias might exist for a variety of reasons: Institutional investors might feel more comfortable investing near to home and they more probably have had prior interactions with the managers of local funds. Regardless of the reasons, this assumption appears to hold. In our sample, the unconditional probability of an LP investing in a fund located in the same MSA is roughly double the probability of it investing in a fund located in an adjacent area and more than six times the probability of it investing in one further away.

To estimate the effect that rebalancing might have on the local availability of venture capital, we obtained average annual returns data for college and university endowments, an important class of limited partners, from *The Chronicle of Higher Education*. We then weighted that measure for each region by multiplying these average national returns by the logged count of institutional investors in the region that had invested in venture capital at least ten years prior to the focal year (adding one to avoid zeros). The ten-year lag should remove endogeneity that might result from institutional investors initiating investment in

[14]Due to the finite maturity of VC investments, the flow of assets to venture capital increases with portfolio returns, even when VC investments outperform other assets in the portfolio.

[15]Though one might worry that attractive venture capital investments could drive these returns, because venture capital accounts for only a very small portion of institutional investors' portfolios – less than 1% on average (Blumenstyk 2008) – reverse causality is not an issue here.

venture capital in response to a change in local economic conditions. We then used this information to construct our instrument:

$$LPR_{it} = \sum_{j} \sum_{s=t-1}^{t-3} \frac{ER_s \ln LPC_{js}}{1 + dist_{ij}}, \tag{3}$$

where LPR_{it} is our measure of LP Returns for MSA i in year t, ER_s is the national average return for college endowments in year s, LPC_{js} is the count of limited partners in MSA j that had made private equity investments at least ten years prior to year s, with one added to avoid zeros, and $dist_{ij}$ is the distance in miles between the centroid of MSA i and the centroid of MSA j. Distance weighting accounts for the fact that limited partners have a higher propensity to invest in funds headquartered near to them.

We cumulate three years of lagged returns because the funds committed to venture capital firms by limited partners are not invested immediately. The venture capital available in a region therefore depends not just on the funds that VC firms raised in the prior year, but also on their fundraising activities for several earlier years. On average, VC firms begin investing in companies roughly one year after closing a fund (Sorenson and Stuart 2001, p. 1566). Over the first three years of the life of a partnership, the average fund invests roughly 80% of its committed capital. We therefore cumulated the one to three years lags in LP returns to form our instrument.[16]

Entrepreneurship: Table 9 reports our fixed effects IV estimates of establishment births, both with and without region-specific trends. In the first-stages of both models, the instrument strongly predicts the number of firms funded, as expected. The Kleibergen-Paap

[16] In unreported models, we also entered five years of lags individually as instruments. Three or four of these lags would have significant coefficients in the first stage equations, and the second stage estimates did not differ substantively from those we report.

rk Wald statistic (Kleibergen and Paap 2006) – reported as "KP Wald" with the second-stage estimates in the IV tables – tests directly whether our instrument predicts a sufficient amount of the variance in the endogenous variables to identify our equations. For LIML estimation with one instrument and one endogenous variable, Stock and Yogo (2005) report a critical value of 16.38 for the IV estimates to have no more than 10% of the bias of the OLS estimates.[17] For both models, the KP Wald statistic far exceeds this critical value.

Assessing the results, in both models, the supply of venture capital has a positive relationship to the number of new establishments. The point estimate of this effect has increased in the IV estimation—nearly tripling in magnitude in the model without region-specific trends and nearly quadrupling in magnitude in the model with them. Because of the larger standard errors, the OLS estimates nevertheless are within the 95% confidence intervals of the IV estimates. In the model with the region-specific trends, the IV estimates suggest that a doubling in the number of firms funded would result in a 2.2% increase in the number of new establishments by organizations with 0-19 employees (roughly seven new establishments per company funded in an MSA with an average supply of venture capital and the mean number of new establishments).

Employment: Table 10 reports parallel results of fixed effects IV estimates of employment. Once again, the instrument appears well behaved. The Kleibergen-Paap Wald statistics again suggest that the first stages have sufficient strength to identify VC investment counts (though the statistic suggests that the instrument becomes much weaker in the model that includes region-specific trends).

In the model without region-specific trends, the IV point estimate is nearly identical

[17] Although we do not report it, the LM version of the Kleibergen-Paap test yielded equivalent results. We should also note that though the Kleibergen-Paap Wald statistic is robust to within-cluster correlation in the errors, Stock and Yogo (2005) only tabulated critical values for the case of uncorrelated errors.

to that obtained in the OLS fixed effects model. In the model with region-specific trends, however, the point estimate of the effect of venture capital on employment increases almost by an order of magnitude (from a doubling in firms funded implying a 0.24% increase in employment to it implying a 1.4% rise in employment). In both cases, however, the OLS point estimates again fall within the 95% confidence intervals of the IV estimates. Given the smaller Kleibergen-Paap Wald statistic in this model and this enormous increase in the magnitude of the estimated effect, we nonetheless worry that the effect size in the model with region-specific trends may reflect the weakness of the instrument in that specification.

Aggregate income: Table 11 finally reports estimates of the effects of venture capital on the overall compensation in a region using an instrument to identify the supply of venture capital. The instrument again appears well behaved in both models. Again, the IV estimation produced significantly larger estimates of the effect than the fixed effects regressions—roughly triple the size in the models without region-specific trends and fives times the size in the ones with them. If all of the increase in aggregate income resulted from the jobs predicted in model 10-2, then the average employee in one of these jobs created by venture capital would need to receive compensation on the order of $83,000 per year. As with the OLS estimates, that number seems reasonable in magnitude, thus the employment and aggregate income results appear consistent in the magnitude of the effects that they suggest.

4 Discussion

We find that increases in the supply of venture capital in an MSA stimulate the production of new firms in the region. This effect appears consistent with either of two mechanisms. One, would-be entrepreneurs in need of capital may incorporate the availability of such capital into their calculations when trying to decide whether to start their firms. Two, the firms that VC firms finance may serve as inspiration and training grounds for future entrepreneurs. We further find that an expanded supply of venture capital appears to raise employment and aggregate income in a region. At least some of these employment and income effects probably stem from the fact that venture capital allows entrepreneurs to create value by pursuing ideas that they otherwise could not. Our results remain robust to estimation with an instrumental variable.

Our results seem quite consistent with the general notion that an expansion in financial intermediation improves the allocation of capital and therefore can stimulate growth (Greenwood and Jovanovic 1990). Venture capital firms fill a niche that allows the necessary capital to reach some of the least developed and most uncertain ideas. Hence, alternative forms of financing, such as banks, cannot easily substitute for venture capital in its absence. Individual investors ("angels"), moreover, may lack the requisite skills and experience to choose and incubate these young companies effectively (though the relative efficiency of angel investments versus venture capital falls outside the scope of this analysis and deserves greater research attention).

But our results do not imply that regions would benefit from an unlimited supply of venture capital. Because we find an elasticity of less than one, our results imply decreasing returns to the availability of venture capital. We can moreover use the estimates from the dollars invested on the wage bill (model 8-3) to place a minimum on the optimal supply of venture capital. Although the wage bill does not incorporate all capital gains, the point at which an additional dollar of venture capital would yield less than an additional dollar in wages at least provides a lower bound on the optimal supply of venture capital. In other words, we calculate the point at which the change in the wages equals the change in investment ($\Delta Wage = \Delta VCInvestAmt$). For the average MSA, this calculation yields a sum of roughly \$7 million dollars (with a 90% confidence interval ranging from \$400,000 to \$14 million dollars).

When one adjusts for the fact that smaller regions would require less venture capital and larger regions would require more, our estimates suggest that only 195 of the 329 MSAs in our analysis ever exceed this minimum bound. Only 15 of the areas – Atlanta, Bergen-Passaic (NJ), Boston, Boulder, Bridgeport (CT), Dallas, Lowell (MA), Middlesex (NJ), Oakland, Orange County, San Diego, San Francisco, San Jose, Seattle and Stamford (CT) – exceed it for every year in our window. Our findings therefore suggest that most metropolitan regions in the United States could benefit from an expansion in venture capital.

Given this inadequate supply, several questions naturally arise. First, why do some regions have an undersupply of venture capital? Does it stem from an unwillingness to invest in venture capital among local institutions or from a shortage of experienced venture capitalists? Second, can public policy correct this situation, and if so, how? Obviously, the answers to the second question depend in large part on those to the first.

Another interesting line of inquiry would consider whether the efficiency of venture capital depends on other factors. For example, to the extent that our results stem from the expectations of capital constrained entrepreneurs, then the supply of venture capital should have the largest effect in regions (or at times) in which alternative forms of financing are dear. This question also has clear policy relevance. Government programs to expand the supply of venture capital have met with mixed success. At one extreme, the Israeli model has almost uniformly been praised and offered as an example of best practices. At the other, both the Canadian and German models appear to have had limited success and may have even stunted the development of venture capital in those regions. Although the focus to date has primarily been on the internal design of these programs, variation across countries in the success of these programs may also stem from differences in complementary factors within these jurisdictions.

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Table 1: Summary Statistics

Variable	**Mean**	**Std. Dev.**	**N**
Patents(t-1)	235.4	534.1	3270
Population (1000s)	659.4	1104.9	3270
Births, All	1839.1	3201.9	3270
Births, Small	1415.2	2523.6	3270
Employment (1000s)	275.5	478.6	3264
Payroll (millions)	8725.4	18339.1	3264
VC Count First	4.2	27.5	3270
VC Count All	15.9	106.4	3270
VC Amount (millions)	39.8	340.1	3270

Notes: Observations of U.S. metropolitan statistical areas (MSAs) from 1993 to 2002. See text for details of variable construction.

Table 2: Cross-sectional Analysis of the Impact of Venture Capital Investments.

	(1)	(2)	(3)	(4)	(5)	(6)
	$t_1 = 1995; t_2 = 2000$			$t_1 = 1993; t_2 = 2002$		
	Estblmnts(t_2)	Emplmnt(t_2)	Payroll(t_2)	Estblmnts(t_2)	Emplmnt(t_2)	Payroll(t_2)
Estblmnts(t_1)	1.019***	0.0727***	0.1250***	1.023***	0.1890***	0.239***
	(.01696)	(.02251)	(.03562)	(.02939)	(.03426)	(.04646)
Emplmnt(t_1)	0.0635*	1.037***	-0.0204	0.2150***	1.078***	0.1370
	(.03362)	(.04465)	(.07064)	(.05933)	(.06915)	(.09377)
Payroll(t_1)	-0.0897***	-0.1080***	0.8810***	-0.2430***	-0.259***	0.6300***
	(.02566)	(.03407)	(.05391)	(.04528)	(.05278)	(.07156)
$\sum_{t_1-5}^{t_1-1}$ Patents	0.0173***	0.0144***	0.0347***	0.0267***	0.0241***	0.0392***
	(.00406)	(.00539)	(.00853)	(.00696)	(.00811)	(.01100)
$\sum_{t_1-5}^{t_1-1}$ VC Cnt First	0.0045	0.0087**	0.0389***	0.0080	0.00824	0.0306***
	(.00312)	(.00415)	(.00656)	(.00514)	(.00600)	(.00813)
R^2	1.00	1.00	0.99	0.99	0.99	0.99
Observations	323	323	323	323	323	323

Notes: OLS regression results. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ The unit of observation is the MSA and the data covers the MSAs defined in 1993 in the 48 contiguous US states. The dependent variables measure the number of all business establishments with non-zero employment in the first quarter of year t_2, the total full- and part-time employment in the MSA in the pay period including Mar 12 of year t_2, and the total payroll including all forms of compensation during the calendar year t_2, respectively, where $t_2 =$ 2000 for models 1-3 and $t_2 = 2002$ for models 4-6. The explanatory variables measure the number of all business establishments with non-zero employment in the first quarter of year t_1, the total full- and part-time employment in the MSA in the pay period including Mar 12 of year t_1, and the total payroll including all forms of compensation during the calendar year t_1, the total number of patents applied from April of year $t_1 - 5$ to March of year $t_1 - 1$, and the total number of first VC investments from April of year $t_1 - 5$ to March of year $t_1 - 1$, respectively, where $t_1 = 1995$ for models 1-3 and $t_1 = 1993$ for models 4-6. See the text for more details on variable construction.

Table 3: Births of Establishments for All Firms

	(1)	(2)	(3)	(4)	(5)	(6)
Patents(t-1)	0.0209***	0.0208***	0.0214***	0.0159**	0.0160**	0.0160**
	(.00637)	(.00637)	(.00637)	(.00698)	(.00699)	(.00699)
Population	0.753***	0.753***	0.758***	0.328**	0.315**	0.311**
	(.06359)	(.06378)	(.06348)	(.15263)	(.15381)	(.15422)
VC Cnt First	0.0112***			0.0117***		
	(.00326)			(.0036)		
VC Cnt All		0.00797***			0.00408	
		(.00286)			(.00408)	
VC Amount			0.000673*			-0.0000543
			(.00036)			(.00041)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
MSA Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
MSA Trend	No	No	No	Yes	Yes	Yes
R^2	0.51	0.51	0.51	0.66	0.66	0.66
Clusters	328	328	328	328	328	328
Observations	3270	3270	3270	3270	3270	3270

Notes: OLS regression results. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ Robust standard errors in parentheses; disturbances clustered by MSA. MSA fixed effects partialed out. The unit of observation is the MSA-year and the data covers the MSAs in the 48 contiguous US states from 1993 to 2002. The dependent variable is births of new establishments for all firms. An establishment birth is registered during a year when a physical location had zero employment in the first quarter of the year, but had positive employment in the first quarter of the following year. Consequently, the VC variables measure the number of first investments, the number of all investments, and the total amount invested, respectively, from April of the focal year to March of the following year. See the text for more details on variable construction.

Table 4: Births of Establishments for Firms with 0-19 Employees.

	(1)	(2)	(3)	(4)	(5)	(6)
Patents(t-1)	0.0142**	0.0140**	0.0145**	0.00736	0.00744	0.00748
	(.00688)	(.00688)	(.00688)	(.00682)	(.00683)	(.00683)
Population	0.851***	0.849***	0.853***	0.188	0.178	0.176
	(.07509)	(.07539)	(.07516)	(.16244)	(.16316)	(.16332)
VC Cnt First	0.00953**			0.00851**		
	(.00396)			(.00391)		
VC Cnt All		0.00801**			0.00203	
		(.00333)			(.00443)	
VC Amount			0.000817**			-0.000156
			(.00038)			(.0004)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
MSA Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
MSA Trend	No	No	No	Yes	Yes	Yes
R^2	0.24	0.24	0.24	0.50	0.50	0.50
Clusters	328	328	328	328	328	328
Observations	3270	3270	3270	3270	3270	3270

Notes: OLS regression results. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ Robust standard errors in parentheses; disturbances clustered by MSA. MSA fixed effects partialed out. The unit of observation is the MSA-year and the data covers the MSAs in the 48 contiguous US states from 1993 to 2002. The dependent variable is births of new establishments for firms with 0-19 employees at the beginning of the year. For new firms, the size was determined at the end of the year. An establishment birth is registered during a year when a physical location had zero employment in the first quarter of the year, but had positive employment in the first quarter of the following year. Consequently, the VC variables measure the number of first investments, the number of all investments, and the total amount invested, respectively, from April of the focal year to March of the following year. See the text for more details on variable construction.

Table 5: High-VC-Activity States and Small Establishment Births.

	(1) All	(2) No CA	(3) No MA	(4) No TX	(5) No CA,MA,TX
Patents(t-1)	0.00736	0.00669	0.00771	0.00691	0.00645
	(.00682)	(.00705)	(.00682)	(.00743)	(.00769)
Population	0.188	0.0997	0.175	0.323*	0.223
	(.16244)	(.17489)	(.16353)	(.17651)	(.19601)
VC Cnt First	0.00851**	0.00770*	0.0108***	0.00849**	0.0104**
	(.00391)	(.00407)	(.00383)	(.00411)	(.00417)
Year Dummies	Yes	Yes	Yes	Yes	Yes
MSA Fixed Effects	Yes	Yes	Yes	Yes	Yes
MSA Trend	Yes	Yes	Yes	Yes	Yes
R^2	0.50	0.50	0.53	0.50	0.54
Clusters	328	303	317	301	265
Observations	3270	3020	3160	3000	2640

Notes: OLS regression results. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ Robust standard errors in parentheses; disturbances clustered by MSA. MSA fixed effects partialed out. The unit of observation is the MSA-year and the data covers the MSAs in the 48 contiguous US states from 1993 to 2002. The dependent variable is births of new establishments for firms with 0-19 employees at the beginning of the year. For new firms, the size was determined at the end of the year. An establishment birth is registered during a year when a physical location had zero employment in the first quarter of the year, but had positive employment in the first quarter of the following year. Consequently, the VC variable measures the number of first investments from April of the focal year to March of the following year. Model 1 includes MSAs in all states. Model 2 excludes MSAs in California. Model 3 excludes MSAs in Massachusetts. Model 4 excludes MSAs in Texas. Model 5 excludes MSAs in California, Massachusetts, and Texas. See the text for more details on variable construction.

Table 6: Temporal Structure of Small Establishment Births and VC First Investments.

	(1) Births, S	(2) Births, S	(3) Births, S	(4) VC Cnt F	(5) VC Cnt F	(6) VC Cnt F
Patents(t-1)	0.00736	0.00744	0.00745	0.0101	0.0300	0.0357*
	(.00682)	(.00683)	(.00683)	(.01926)	(.02324)	(.02114)
Population	0.188	0.176	0.176	-1.455*	-0.135	0.783
	(.16244)	(.1625)	(.16341)	(.85558)	(.88383)	(.85329)
VC Cnt First(t)	0.00851**					
	(.00391)					
VC Cnt First(t-1)		0.00637				
		(.00434)				
VC Cnt First(t-2)			-0.000294			
			(.00497)			
Births, Small(t)				0.223**		
				(.10637)		
Births, Small(t-1)					0.0211	
					(.1222)	
Births, Small(t-2)						-0.0485
						(.10543)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
MSA Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
MSA Trend	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.50	0.50	0.50	0.39	0.29	0.26
Clusters	328	328	328	328	328	328
Observations	3270	3270	3270	3270	3270	3270

Notes: OLS regression results. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ Robust standard errors in parentheses; disturbances clustered by MSA. MSA fixed effects partialed out. The unit of observation is the MSA-year and the data covers the MSAs in the 48 contiguous US states from 1993 to 2002. In models 1-3, the dependent variable is births of new establishments for firms with 0-19 employees at the beginning of the year. For new firms, the size was determined at the end of the year. An establishment birth is registered during a year when a physical location had zero employment in the first quarter of the year, but had positive employment in the first quarter of the following year. Consequently, the VC variable measures the number of first investments from April of the focal year to March of the following year. In models 4-6, the dependent variable is first VC investments. See the text for more details on variable construction.

Table 7: Level of Employment in MSA.

	(1)	(2)	(3)	(4)	(5)	(6)
Patents(t-1)	0.0102***	0.0104***	0.0109***	0.000606	0.000619	0.000644
	(.00324)	(.00326)	(.0033)	(.00257)	(.00257)	(.00258)
Population	0.808***	0.810***	0.815***	0.290***	0.286***	0.285***
	(.03683)	(.03697)	(.03751)	(.08941)	(.0895)	(.08917)
VC Cnt First	0.00738***			0.00349**		
	(.00212)			(.00166)		
VC Cnt All		0.00502**			0.00197	
		(.0021)			(.00173)	
VC Amount			0.000209			-0.0000210
			(.00031)			(.00021)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
MSA Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
MSA Trend	No	No	No	Yes	Yes	Yes
R^2	0.82	0.82	0.82	0.91	0.91	0.91
Clusters	328	328	328	328	328	328
Observations	3264	3264	3264	3264	3264	3264

Notes: OLS regression results. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ Robust standard errors in parentheses; disturbances clustered by MSA. MSA fixed effects partialed out. The unit of observation is the MSA-year and the data covers the MSAs in the 48 contiguous US states from 1993 to 2002. The dependent variable is the level of employment, including full- and part-time employees, in the MSA in the pay period including March 12 of the given year. Consequently, the VC variables measure the number of first investments, the number of all investments, and the total amount invested, respectively, from April of the previous year to March of the focal year. See the text for more details on variable construction.

Table 8: Total Payroll in MSA.

	(1)	(2)	(3)	(4)	(5)	(6)
Patents(t-1)	0.0241***	0.0237***	0.0255***	0.00363	0.00359	0.00364
	(.00557)	(.00562)	(.0059)	(.00283)	(.00283)	(.00284)
Population	1.085***	1.077***	1.100***	0.616***	0.609***	0.605***
	(.0645)	(.06462)	(.06834)	(.11747)	(.11723)	(.11862)
VC Cnt First	0.0239***			0.00992***		
	(.00448)			(.00279)		
VC Cnt All		0.0210***			0.00901***	
		(.00419)			(.00262)	
VC Amount			0.000800*			0.000470*
			(.00047)			(.00025)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
MSA Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
MSA Trend	No	No	No	Yes	Yes	Yes
R^2	0.93	0.93	0.93	0.97	0.97	0.97
Clusters	328	328	328	328	328	328
Observations	3264	3264	3264	3264	3264	3264

Notes: OLS regression results. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ Robust standard errors in parentheses; disturbances clustered by MSA. MSA fixed effects partialed out. The unit of observation is the MSA-year and the data covers the MSAs in the 48 contiguous US states from 1993 to 2002. The dependent variable is the total annual payroll in the MSA, including all forms of compensation such as salaries, wages, reported tips, employee contributions to pension plans, and the value of taxable fringe benefits. Consequently, the VC variables measure the number of first investments, the number of all investments, and the total amount invested, respectively, during the focal calendar year. See the text for more details on variable construction.

Table 9: Births of Establishments for Firms with 0-19 Employees with LP Returns as Instrument.

	(1) 1st Stage	(2) Births, S	(3) 1st Stage	(4) Births, S
Patents(t-1)	0.0346	0.0130*	0.00392	0.00708
	(.02236)	(.00692)	(.01783)	(.00648)
Population	0.834***	0.835***	-0.949	0.221
	(.31662)	(.07692)	(.79332)	(.15394)
LP Returns	0.00912***		0.00842***	
	(.00085)		(.00079)	
VC Cnt First		0.0264**		0.0318**
		(.01149)		(.01313)
Year Dummies	Yes	Yes	Yes	Yes
MSA Fixed Effects	Yes	Yes	Yes	Yes
MSA Trend	No	No	Yes	Yes
R^2	0.25		0.45	
KP Wald F-stat		115.4		114.3
Clusters	328	328	328	328
Observations	3270	3270	3270	3270

Notes: LIML IV regression results. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ Robust standard errors in parentheses; disturbances clustered by MSA. MSA fixed effects partialed out. The unit of observation is the MSA-year and the data covers the MSAs in the 48 contiguous US states from 1993 to 2002. The dependent variable is births of new establishments for firms with 0-19 employees at the beginning of the year. For new firms, the size was determined at the end of the year. An establishment birth is registered during a year when a physical location had zero employment in the first quarter of the year, but had positive employment in the first quarter of the following year. Consequently, the VC variable measures the number of first investments, from April of the focal year to March of the following year. The instrument approximates the portfolio rebalancing of limited partners and is calculated by summing up three years of annual measures consisting of the product of the average return for all college endowments in a year and the logged count of limited partners located in the MSA who had invested in any form of private equity at least ten years earlier. See the text for more details on variable construction.

Table 10: Level of Employment with LP Returns as Instrument.

	(1) 1st Stage	(2) Emplmnt	(3) 1st Stage	(4) Emplmnt
Patents(t-1)	0.0533**	0.0103***	0.00786	0.000431
	(.02478)	(.00325)	(.01495)	(.00242)
Population	1.128***	0.808***	-1.071	0.311***
	(.40001)	(.03779)	(.77605)	(.08594)
LP Returns	0.00907***		0.00656***	
	(.00085)		(.00143)	
VC Cnt First		0.00719		0.0201*
		(.00618)		(.01129)
Year Dummies	Yes	Yes	Yes	Yes
MSA Fixed Effects	Yes	Yes	Yes	Yes
MSA Trend	No	No	Yes	Yes
R^2	0.28		0.53	
KP Wald F-stat		113.2		21.11
Clusters	328	328	328	328
Observations	3264	3264	3264	3264

Notes: LIML IV regression results. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ Robust standard errors in parentheses; disturbances clustered by MSA. MSA fixed effects partialed out. The unit of observation is the MSA-year and the data covers the MSAs in the 48 contiguous US states from 1993 to 2002. The dependent variable is the level of employment, including full- and part-time employees, in the MSA in the pay period including March 12 of the given year. Consequently, the VC variable measures the number of first investments, from April of the focal year to March of the following year. The instrument approximates the portfolio rebalancing of limited partners and is calculated by summing up three years of annual measures consisting of the product of the average return for all college endowments in a year and the logged count of limited partners located in the MSA who had invested in any form of private equity at least ten years earlier. See the text for more details on variable construction.

Table 11: Total Payroll with LP Returns as Instrument.

	(1) 1st Stage	(2) Payroll	(3) 1st Stage	(4) Payroll
Patents(t-1)	0.0429*	0.0201***	-0.0000592	0.00332
	(.02412)	(.00533)	(.01896)	(.00278)
Population	0.822**	1.037***	-0.580	0.658***
	(.3418)	(.06262)	(.81569)	(.11044)
LP Returns	0.00916***		0.00763***	
	(.00091)		(.00078)	
VC Cnt First		0.0759***		0.0519***
		(.0132)		(.01015)
Year Dummies	Yes	Yes	Yes	Yes
MSA Fixed Effects	Yes	Yes	Yes	Yes
MSA Trend	No	No	Yes	Yes
R^2	0.24		0.46	
KP Wald F-stat		102.0		95.54
Clusters	328	328	328	328
Observations	3264	3264	3264	3264

Notes: OLS regression results. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ Robust standard errors in parentheses; disturbances clustered by MSA. MSA fixed effects partialed out. The unit of observation is the MSA-year and the data covers the MSAs in the 48 contiguous US states from 1993 to 2002. The dependent variable is the total annual payroll in the MSA, including all forms of compensation such as salaries, wages, reported tips, employee contributions to pension plans, and the value of taxable fringe benefits. Consequently, the VC variable measures the number of first investments during the focal calendar year. The instrument approximates the portfolio rebalancing of limited partners and is calculated by summing up three years of annual measures consisting of the product of the average return for all college endowments in a year and the logged count of limited partners located in the MSA who had invested in any form of private equity at least ten years earlier. See the text for more details on variable construction.