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Community and Capital in Entrepreneurship and Economic Growth

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Abstract

We argue that social integration—in the sense of within-community interconnectedness—and venture capital have a complementary relationship in fostering innovation, entrepreneurship, and economic growth. Using panel data on metropolitan areas in the United States from 1993 to 2002, our analyses reveal that racial integration—in the microgeography of residential patterns—moderates the effect of venture capital, with more ethnically-integrated places benefiting more from venture capital. We provide evidence for the underlying mechanisms by demonstrating that communities with higher levels of racial integration foster the discovery of more novel and more valuable inventions and the emergence of more ethnically-diverse entrepreneurial groups.

Keywords

segregation, microgeography, venture capital, innovation, entrepreneurship

Does the social structure of a community—its patterns of internal interactions—influence its rate of economic development? At the level of the individual actor, a vast sociological literature demonstrates that patterns of exchange and of information flow structure access to opportunities (e.g., Burt 1992; Fernandez, Castilla, and Moore 2000; Podolny 1993). These studies, however, do not necessarily imply that these patterns of connections influence economic growth at the societal level. Social structure may act more as an engine of stratification, determining who receives what, than as an engine of growth, raising or lowering the overall levels of wealth in society. Some notable case studies nevertheless suggest that the structure of communities might matter to societal-level well-being. Saxenian (1994), for example, in her study of Silicon Valley, points to the movement of employees across organizations, and the cross-organization information channels those moves created, as critical to the success of the region. Safford (2008), comparing the economic trajectories of two Rust Belt cities, similarly argues that interconnections (or the lack thereof) between academic, business, and political leaders determined whether communities could recover from the demise of their local industries.

Two factors, however, have made it difficult to study this relationship between community social structure and economic vitality. Conceptually, social connectedness undoubtedly influences economic growth through a manifold of paths. These mechanisms may even have countervailing effects: structures

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that allow for coordination, for example, might simultaneously stymie innovation (Ruef 2002). Practically, the data required seem daunting. Assembling information on the relationships connecting a large number of individuals—even within a single city at a single point in time—can prove time-consuming. The difficulty of collecting such data over time and across communities strains the imagination.

We address the first issue by focusing on a more specific question: rather than attempting to capture all the ways in which social structure might promote or impede economic growth, we explore the extent to which it influences the efficient allocation of venture capital. Because the fledgling firms in which venture capitalists invest have little in the way of a performance record, venture capitalists rely on their social connections to assess the credibility of entrepreneurs and the promise of their ideas (Sorenson and Stuart 2001). The supply of venture capital, moreover, has large effects on regional rates of entrepreneurship and economic growth (Samila and Sorenson 2011). It therefore seems plausible that the structure of social relationships within a community might shape the effectiveness of venture capital, and through it influence economic growth.

We propose a practical solution to the second issue. Instead of attempting to enumerate social relationships themselves, we exploit information on opportunities for social interaction. Building on the well-established fact that spatial proximity—even within small areal units, such as neighborhoods and buildings—shapes who interacts with whom (e.g., Bossard 1932; Grannis 2009; Sorenson and Stuart 2001), we use detailed information on where people live to assess their spatially-based opportunities for interaction across groups—what one might call a "microgeographic" approach based on residential segregation.

Although residential segregation could and does occur along many dimensions, such as class and religion, race has been the most salient one in the United States (Massey and Denton 1987, 1993). Even among Asians, the most integrated minority group, individuals have much higher odds of living near other Asians than one would expect by chance, constraining their ability to form social connections with people in other racial groups (Reardon et al. 2009). But degrees of ethnic segregation differ dramatically from one community to the next (Ananat 2011; Massey and Denton 1987). More integrated residential patterns should promote connections that crosscut social circles in a community (Blau 1977), facilitating the flow of information and resources across individuals, and therefore stimulating innovation and entrepreneurship.

Our empirical analyses examine the extent to which venture capital varied in its effectiveness in engendering entrepreneurship and economic growth, as a function of the level of residential racial integration in a community. Integration strongly moderated these relationships: more integrated communities benefited more from venture capital, in terms of having higher rates of patenting, entrepreneurship, job creation, and economic growth. Given that a one standard deviation increase in racial integration in a region increased the positive outcomes associated with the supply of venture capital by 30 to 100 percent, these effects appear not just statistically significant but also economically meaningful. These associations hold even after controlling for a wide variety of regional characteristics, and even when using instruments to address potential endogeneity in the supply of venture capital and in the level of residential racial integration. We also provide some direct evidence of the underlying pathways through which this effect occurs by showing that the novelty of inventions and the ethnic diversity of entrepreneurial groups rise with regional racial integration.

STUDYING SOCIAL STRUCTURE

Despite the numerous reasons for expecting that patterns of relationships within communities might matter to regional economic outcomes, research on this topic has been scarce. Three factors have stymied scholars wishing to study it more systematically. First and foremost is the difficulty of assembling the data. Although certain sorts of relationships, particularly those based on contracts, leave archival records, the vast majority of social connections remain informal and unrecorded. The usual approach to enumerating them is to survey individuals, asking them with whom they interact. Although this method has enabled a wealth of research—primarily at the individual or inter-firm level—it does not scale well to studying structures across communities and over time.

A second factor stems from the endogeneity of social relationships. To the extent that social connections emerge, in part, from strategic actions at the individual level, estimates of the effects of social connectedness may confound the consequences of a community's composition with those of its social structure (Manski 1993). Even with the right data, researchers would still find it difficult to interpret any association between social structure and organizational or regional outcomes. Finally, even if one could solve the data problem and untangle the causal connections, research based on observed patterns of informal relationships usually cannot inform policy. The difficulty here resides in the (in)ability of a manager or regional planner to shape these relationships. Friendships may matter, but no one can force two particular individuals to become friends.

Microgeography

Researchers can address all these issues, however, with a relatively simple solution: rather than gathering data on realized relationships—the ties that actually occur—they can focus on the opportunities for such social connections embedded in the microgeography of a place. Recent research provides many examples of such an approach: consider the seating arrangements of the Senate floor (Chown and Liu 2015), the dorm rooms in which students live (Hasan and Bagde 2013; Sacerdote 2001), the offices in which people work (Liu 2014), and the exact street addresses of individuals and organizations (Grannis 2009; Grigoryeva and Ruef 2015).

Research consistently demonstrates that the probability of interaction occurring and of relationships being maintained declines dramatically with distance (e.g., Bossard 1932; Grannis 2009; Sorenson and Stuart 2001). People shop, attend school, and run errands near their homes (Feld 1981). They therefore more commonly have chance encounters with others who live near them (Grannis 2009; Small 2009). Once a relationship forms, the cost of maintaining it rises with distance (Zipf 1949). Even among friends and relatives, people interact more frequently with those who live and work near them. Location therefore strongly structures interaction.

This approach has at least three advantages. First, it costs less. Fine-grained information on the locations of individuals has often already been collected, across places and over time. Second, these opportunity structures seem far less susceptible to the endogeneity issues plaguing realized relationships. People choose residences for a variety of reasons, including the cost of housing, the availability of amenities nearby, the quality of the schools, and the places available at the time they move into the community (Grannis 2009). Very few people choose such places primarily with an eye to how they might forward their careers or economic outcomes (Dahl and Sorenson 2009, 2012; Young et al. 2016). Finally, these opportunity structures better lend themselves to policy intervention: community leaders can draw school districts; planners can divide cities into zones; and managers can assign individuals to offices.

Community Integration

Two additional issues emerge in using this approach to study the effects of community-level social structure. First, even with individual-level information on opportunities for interaction, one must aggregate that information. Research on social structure has generally been at the level of the individual. But, from the perspective of an organization or community, that research tells us about the distribution of rewards across members of the group, not about the ideal internal structure for an organization or a community. Second, at the community level, one often does not have sufficiently fine-grained information to locate each person at a unique point in space. Instead, researchers might have more coarse-grained data on the people employed in a particular building or residing in a certain neighborhood.

Measures of residential segregation offer a solution to both these issues. These measures, which require only that one can sort communities and their members into meaningful categories and a set of geographic subunits, summarize the extent to which the diversity of spatial subunits mimics that of the region as a whole. Blau (1977) referred to this neighborhood-level diversity as "penetrating differentiation" and argued that it contributes crucially to integration across social groups because it shapes opportunities for interaction.

Although one could use these measures to study any social categories that segregate communities, in terms of where people live or work, our study focuses on racial residential patterns. Communities in the United States have been most meaningfully segregated along racial lines. African Americans, in particular, have historically been excluded from white neighborhoods and streets through both intimidation and active discrimination (Grigoryeva and Ruef 2015; Massey and Denton 1993). But Asians, Hispanics, and whites also live in neighborhoods with above-average proportions of others from their own ethnic groups (Iceland, Weinberg, and Hughes 2014; Reardon et al. 2009). Residential segregation by race, moreover, tends to reinforce the patterns of interaction produced by homophily and familial relations, creating concentric social spheres (Blau 1977).

INTEGRATION AND ENTREPRENEURSHIP

Residential segregation along ethnic lines has been a topic of long-standing interest, but relatively little research has attempted to connect these patterns to regional economic outcomes. The more typical approach explores how living in communities with high concentrations of minorities or immigrants affects the individual. The spatial mismatch hypothesis, for example, suggests that minorities, particularly African Americans, suffer high unemployment rates and underemployment because firms do not locate factories and other places of employment near the neighborhoods in which they live (e.g., Kain 1968; Mouw 2000). The literature on ethnic enclaves, which studies communities of immigrants, points to a positive side to segregation. Neighborhoods such as Korea Town in Los Angeles and Little Havana in Miami appear to provide a social infrastructure for entrepreneurship and may allow immigrants living and working in them to earn more (Portes and Zhou 1996; Zhou 2004; Zhou and Logan 1989).

Although these lines of research usefully inform our understanding of stratification processes—the extent to which some in a region do better economically than others—they do not answer the question of whether this segregation invigorates or saps the vitality of the economy as a whole. Our research therefore departs from the prior literature by considering the effects of segregation on aggregate economic activity.

Our investigation also differs from the prior literature in another respect. By connecting residential geography to opportunities for interaction, we connect segregation to a novel mechanism: the fact that it prevents or slows the movement of information and resources through a community. Segregation—along any dimension—effectively increases the average path length, or the number of social steps, between those with information or resources and those able to use it (Watts 1999). Both the speed and the veracity of communication decay with geodesic distance (Davis 1969); each node in a chain connecting two individuals represents an opportunity to color the message, to get it a little bit wrong, or simply to fail to pass it along. Scarce resources also tend to move only through close connections (Ingram and Roberts 2000; Shane and Stuart 2002). Segregation thus effectively traps information and resources inside social circles. Because fledgling firms with uncertain prospects depend crucially on access to this flow of information and resources, we focus on the firms, jobs, and income created by high-tech and high-potential businesses.

Venture Capital

Startups must hire people and invest in research and development and in promoting products and services before they begin to bring in revenue, so entrepreneurs often need substantial financial resources to found their firms. In some cases, individuals have the luxury of relying on personal assets. But, more commonly, these resources come from friends and family, banks, angel investors (individuals, often successful entrepreneurs, who support startups), and venture capital firms.

Regardless of the source, financing for startups usually comes from the local community. Venture capitalists, for example, exhibit a high degree of home bias, rarely investing in companies more than an hour's drive away (Sorenson and Stuart 2001). Both pre- and post-investment forces lead to this localization. When assessing the abilities and creditworthiness of entrepreneurs, venture capitalists rely heavily on their friends and professional acquaintances for information and opinions not readily found online or elsewhere (Sorenson and Stuart 2001). And, once an investment has been made, proximity reduces the cost and increases the effectiveness of mentoring and monitoring these entrepreneurs (Bernstein, Giroud, and Townsend 2016; Sorenson and Stuart 2001).

Given the importance of financial resources and the local nature of investing in entrepreneurial ventures, one might expect that regions rich in venture capital would foster entrepreneurship. Indeed, they do. Samila and Sorenson (2011) found that rates of entrepreneurship, employment, and economic growth rose with the number of venture capital investments that a region received. These investments also had spillovers, fostering the creation of many more companies than had received investments and numerous jobs in incumbent firms as well as in startups.

The value of these investments appears to vary from one place to the next. Figure 1 combines information from ThomsonOne with figures from the Census Bureau to plot the number of venture capital investments, from 1993 to 2002, against the number of startups for that same period. Each point represents one metropolitan statistical area (MSA) in the United States. Although the correlation between the two appears strong, it also exhibits a high degree of dispersion. Consider, for instance, that regions with roughly 1,000 investments over the decade varied in their numbers of startups from 5,500 to 180,000.

What might account for such variation? Here, we explore the importance of racial integration—the social connectedness of a community across ethnic groups—to the effectiveness of venture capital. We see three primary reasons why this connectedness might matter. First, it could enhance a region's capacity for innovation and therefore its supply of high-quality entrepreneurial ideas available for investment. Second, it might ease the process of resource mobilization, allowing entrepreneurs, particularly minorities, to more readily convince investors to fund, and employees to join, their ventures. Third, it may allow information about entrepreneurial success to spread more rapidly and widely, perhaps encouraging others to become entrepreneurs. Let us consider each of these mechanisms in turn.

Innovation

New inventions, ideas, and developments often come from recombinations of existing ideas and, in particular, from combinations of dissimilar ideas. These innovative combinations more commonly arise in settings that connect diverse individuals, an insight that dates at least to John Stuart Mill ([1848] 1987:581):

> [I]t is hardly possible to overrate the value . . . of placing human beings in contact with persons dissimilar to themselves, and with modes of thought and action unlike those

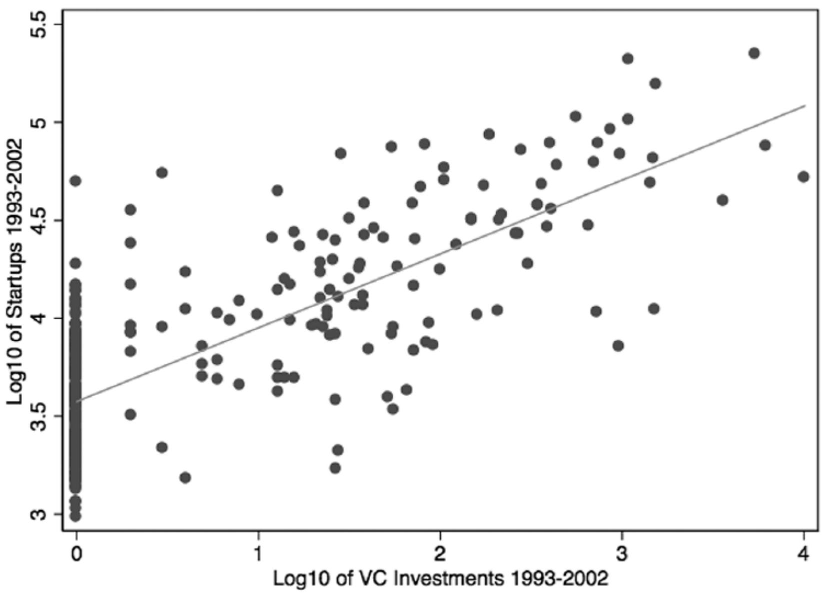

Figure 1. Startups and VC Investments in MSAs

> with which they are familiar. . . . Such communication has always been, and is peculiarly in the present age, one of the primary sources of progress.

Diversity, of course, has a downside. It can create friction, as individuals with divergent ideas struggle to communicate and coordinate. Indeed, experimental research often finds a negative relationship between diversity and performance (van Knippenberg and Schippers 2007; Williams and O'Reilly 1998). But, in cases where performance depends not just on efficiency but also on innovation, studies generally find a positive relationship between ethnic diversity and performance. Herring (2009), for example, found positive correlations between ethnic diversity and the sales, number of customers, market share, and profitability of a cross-section of firms, even after controlling for a wide variety of other factors. In a study focused on banking, Richard and colleagues (2004) demonstrate that the degree to which a firm pursues an innovation-based strategy strongly moderates these relationships, with ethnic diversity improving performance most in organizations trying to innovate.

The primary explanation for these effects has been in terms of the diversity of information and ideas available for recombination. Some of this diversity presumably stems from the fact that people from different ethnic communities bring different perspectives to the table. But diversity may also influence the nature of interactions. Phillips, Northcraft, and Neale (2006), for instance, found that teams randomly assigned an ethnically diverse set of members learned more from each other, and therefore correctly solved the problems presented to them at higher rates. Interestingly, this effect appeared even though all groups had been given precisely the same relevant information. In the absence of surface differences, such as race, team members searched less to explore what others knew.

The friction that arises from residing at the nexus of intersecting social spheres fosters fertile ground for innovation (Vedres and Stark 2010). The tension created by competing perspectives pulls people outside their normal mental frames, allowing them to see new possibilities (Stark 2009). Empirical studies in settings from Hungarian firms to academic inventors have found that the most novel innovations emerge from these social intersections (Forti, Franzoni, and Sobrero 2013; Vedres and Stark 2010).

The degree of connectedness, particularly in crosscutting racial patterns, should therefore promote innovation. Relationships concentrate locally not only in geographic terms but also in social space (Blau 1977; Lazarsfeld and Merton 1954). This clustering isolates individuals from diverse points of view and distant ideas. Crosscutting connections, therefore, play an important role in ensuring that interactions do not become parochial, and that the types of conversations and collaborations that engender novel recombination actually occur. To the extent that these innovations provide more and better investment opportunities to early-stage investors, one would expect more racially-integrated regions to enjoy higher social returns to venture capital.

Resource Mobilization

Moving from an idea to an organization requires an entrepreneur to assemble a range of resources, from financial capital to employees to suppliers and distributors. Family and close friends frequently serve as the first sources of these resources (Ruef 2010; Ruef, Aldrich, and Carter 2003). But relying only on personal connections can prove limiting—family and friends rarely represent the best possible employees or have sufficient financial resources to sustain a startup. Entrepreneurs must eventually recruit resources from further afield. Because no central system exists to connect entrepreneurs to these resources, the raising of financial capital and the recruitment of employees occurs primarily through informal relationships, acquaintances, and friends-of-friends (Ruef 2010; Sorenson and Stuart 2001).

Entrepreneurs have more extensive connections to potential employees and financiers from their own ethnic groups. Recent research, for example, has found that venture capitalists tend to invest in and with others of the same ethnicity (Bengtsson and Hsu 2015; Gompers, Mukharlyamov, and Xuan 2016; Hegde and Tumlinson 2014). These homophilous connections prove limiting to both sides (Sorenson and Waguespack 2006). The entrepreneur may end up excluded from access to capital or talent. And investors and employees may commit to firms less well-matched to their interests and abilities than they would have had they been exposed to a more diverse set of entrepreneurs. Consistent with the idea that this homophilous matching reflects constrained opportunities, investments in and with co-ethnics perform worse (Bengtsson and Hsu 2015; Gompers et al. 2016).

In segregated communities, the average path lengths between any two individuals become longer; hence, the odds increase that an entrepreneur might not have the social connections necessary to recruit a particularly talented individual or to gain access to an angel investor or venture capitalist. Connections across ethnic groups can therefore catalyze the construction of high-quality companies by facilitating this matching of entrepreneurs to resources. The logic here stems not so much from the idea that people of different ethnicities have different abilities and attributes—as with innovation—but rather from the assumption that profitable ideas and high-potential entrepreneurs exist in all social groups.

Role Models

Social connectedness may also influence the degree to which investments in startups generate multiplier effects, promoting the creation of more firms than are funded by venture capital. When interviewed, entrepreneurs often report that they first thought of starting a company when they saw someone else do it. The observation of others engaged in entrepreneurship can influence individuals in a variety of ways: it can raise their awareness of entrepreneurship as an option (Sorenson and Audia 2000); it can promote the perception that entrepreneurship represents a socially acceptable career path (Stuart and Ding 2006); and it can diffuse information about how to found a firm (Nanda and Sørensen 2010). Indeed, research consistently finds that being exposed to entrepreneurial peers increases the odds of someone becoming an entrepreneur, whether one defines peers as classmates (Falck, Heblich, and Luedemann 2012; Kacperczyk 2013), coworkers (Nanda and Sørensen 2010; Stuart and Ding 2006), or neighbors (Giannetti and Simonov 2009).

Racial integration may magnify these peer effects. Because crosscutting patterns of relationships accelerate the spread of information through a community, the odds of hearing about others becoming entrepreneurs increases with these connections. Integration may also increase the influence of these peers in a second way. Individuals primarily consider as role models others similar to them on one or more demographic dimensions (Marx, Ko, and Friedman 2009). To the extent that integration decreases the salience of race as a demographic dimension (e.g., Moody 2001), it may extend the peer effects associated with entrepreneurship beyond others of the same ethnicity. Venture capital, therefore, may have even stronger spillover effects in more racially-integrated regions.

EMPIRICAL ANALYSIS

We begin by assessing the extent to which various indicators of innovation and economic growth appear associated with the amount of venture capital in a region and the extent to which that relationship depends on the region's degree of racial integration.

We chose MSAs as our unit of analysis because they offer the finest-grained regions that one might reasonably consider independent with respect to economic activity.[1] For each MSA, we assembled information from a wide variety of public and commercial data sources: the Census Bureau, the Office of Advocacy of the Small Business Administration (SBA), the United States Patent and Trademark Office (USPTO), Thomson Reuters' ThomsonOne database, CrunchBase, and *The Chronicle of Higher Education*. We use these data to examine the influence of two independent variables—venture capital and ethnic integration—on four outcomes: innovation, entrepreneurship, employment levels, and regional income.

Venture capital. We measured venture capital activity by counting, for each year, the number of firms in an MSA newly funded by venture capitalists (plus one to avoid zeros in the logarithm). We limited the investments included to those categorized by Thomson Reuters as seed stage, early stage, later stage, expansion, or development, and to those from funds with limited partners (LPs). This criterion excludes angel investors, corporate venture capital, and direct investments by university endowments. Although these investors also stimulate the local economy, the logic of our instrumental variable for venture capital constrains us to assessing the importance of financial capital raised through limited partnerships.

We assigned each investment to an MSA based on the location of the investing fund, even if the target company resided in a different region. Thus, if a venture capital firm based in New York City invested in a company in Boston, we would increment the count for New York City by one. Because venture capital firms invest locally (Sorenson and Stuart 2001), assigning investments to the location of the target company produced equivalent results. For syndicated investments, we counted each investing firm as having made an investment.

Ethnic integration. We used the Theil Index, available from the Census Bureau, to measure residential integration by ethnicity (Iceland 2004). The Theil Index has a number of desirable properties (Theil and Finizza 1971); most notably, it provides the only multigroup segregation measure with the transfer property, meaning it always declines when an individual moves from an area with a higher proportion of members from the same group to an area with a lower proportion (Reardon and Firebaugh 2002). Because the Census Bureau calculates these measures only at each decennial census, we used the values from the 1990 Census.

To calculate this measure, we first divided the population into N mutually exclusive and exhaustive categories. The Bureau uses six categories for ethnicity: Caucasian or white, African American or black, Asians and Pacific Islanders, American Indians and Alaska Natives, Hispanics, and other. We calculate the diversity of an MSA as follows:

$$E = \sum_{r=1}^{N} \pi_r ln(1/\pi_r)$$

where π_r denotes the proportion of group r in the MSA.[2] We then split the MSA into M subunits, indexed by i, and calculate the same entropy index for each (E_i). Census tracts, which are designed to represent neighborhoods and generally have 2,000 to 8,000 residents, serve as the geographic subunits here.

To determine the degree of geographic segregation in a population, the entropy measure then considers how far each subunit deviates from the diversity of the region, weighting each subunit by its population:

$$H = \sum_{i=1}^{M} \frac{t_i\left(E - E_i\right)}{ET}$$

where T represents the population of the MSA and t_i that of each tract i, and where E and E_i, defined earlier, denote the diversity indices for the entire area and for subunit i, respectively. For ease of interpretation, we converted the segregation score into a racial integration score I, defined as $I = 1 - H$. It can range from zero, if no individual lives in the same neighborhood as anyone from another ethnic group, to one, if every neighborhood has precisely the same ethnic mix as the metropolitan area as a whole.

Economic outcomes. We estimated the importance of ethnic integration and the supply of venture capital to four economic outcomes. To assess innovation, we used a count of patents. Many kinds of innovation do not qualify for patenting, but patents nevertheless offer one of the few means of measuring innovation across a broad spectrum of industries and over time. To create our measure, we assigned each patent to an MSA based on the inventor's home address and to a year using the date of application. If a patent had multiple inventors, we assumed they all participated equally in the invention, allocating equal shares of the patent to each inventor's address. We counted the number of patents in each MSA-year and transformed this count using the natural logarithm.

As a measure of entrepreneurship (firm births), we counted the number of new business establishments. The Census Bureau defines business establishments as single physical locations in which business occurs and for which employment records are maintained. A firm may have more than one establishment, but every firm has at least one. The Bureau records an establishment birth when a location had no employees in the pay period covering March 12 in one year but has employees on that date in the following year. Relocations and expansions of existing businesses, however, also meet this criterion. We therefore used the overall size of a firm to isolate entrepreneurship, counting only establishments started by firms with fewer than 20 employees.[3] Our measure transforms, by the natural logarithm, the total number of establishments opened by firms with 0 to 19 employees.

To assess changes in the strength of the regional economy, we used two MSA-level variables: employment and aggregate income. Our measure of employment includes full-time employees and (the full-time equivalent of) part-time employees. Aggregate income—labeled "payroll" in the tables—includes all forms of compensation: wages, salary, bonuses, and benefits. Table 1 reports descriptive statistics for the variables used in the analyses.

Short-Term Effects

Due to data constraints, we limited our panel estimates to a 10-year window, from 1993 to 2002. Roughly three years after each decennial census, the OMB redefines the statistical areas for the next 10 years on the basis of the decennial data; developing consistent regions across these redefinitions would require a host of assumptions. The 1993 definitions governed the reporting of most government data from 1993 to 2002. Because some regions became classified as MSAs only after 1993, our panel includes a total of 3,213 MSA-years.

Table 1. Summary Statistics

Variable	Mean	Std. Dev.	Min.	Max.	*N*
Panel A: MSA Characteristics in 1990					
MSA Integration	.78	.11	.45	.97	318
MSA Diversity	.57	.26	.10	1.24	318
MSA % Foreign-Born	5.26	6.04	.39	45.15	318
MSA % College-Educated	19.87	6.37	9.49	43.99	318
MSA Colleges	7.69	15.65	.00	158.00	318
MSA % Voted for President 1988	49.84	7.84	17.16	68.40	318
MSA % Census Response	66.82	6.75	45.54	82.66	318
MSA Bus.-Prof. Associations	43.34	74.56	1.49	610.00	318
MSA Labor Associations	47.56	73.76	.00	610.00	318
MSA Other Associations	390.70	508.17	28.16	3567.00	318
MSA Economic HHI	.03	.04	.01	.32	318
MSA Population (thousands)	602.50	1019.53	56.74	8854.20	318
Panel B: Short-Term Venture Capital Regressions					
VC Investment Count	4.20	26.04	.00	684.00	3,213
Patents	249.03	563.56	.00	7536.28	3,213
Startups	1433.70	2541.97	81.00	23517.00	3,213
Employment (thousands)	279.43	481.72	18.76	3950.36	3,209
Payroll (millions)	8857.11	18467.73	335.61	226421.00	3,209
Population (thousands)	660.08	1098.56	36.49	9663.09	3,213
Panel C: Long-Term Venture Capital Regressions					
VC Investment Count 1980 to 1990	21.40	107.33	.00	1310.00	318
Patents 2000	289.03	674.38	.00	7386.39	318
Establishments 2000 (thousands)	17.35	29.19	1.04	245.79	318
Employment 2000 (thousands)	292.77	507.14	14.11	3950.36	318
Payroll 2000 (millions)	10422.23	21907.08	372.95	216985.33	318
Patents 1990	149.59	295.83	1.50	2358.25	318
Establishments 1990 (thousands)	15.11	26.08	.96	225.64	318
Employment 1990 (thousands)	240.38	443.21	12.77	3847.92	318
Payroll 1990 (millions)	5598.50	11964.50	248.71	115177.67	318
Panel D: Patent Outcome Variables					
Forward Citations (7 years)	6.80	12.43	.00	527.00	1,531,422
HJT Generality Index	.73	.25	.00	1.00	1,138,356
HJT Originality Index	.73	.22	.00	1.00	1,467,503
Panel E: CrunchBase Ethnicities					
Ethnicities among Founders	1.27	.46	1.00	3.00	14,467
Ethnicities among Executives	1.42	.61	1.00	4.00	40,336
Ethnicities among Board Members	1.40	.58	1.00	4.00	10,773

We estimated the short-term effects of financial capital and racial integration on the various outcomes—innovation, entrepreneurship, employment, and income—in terms of elasticities. Rather than attempting to specify the wide range of other factors that might influence these outcomes, we approached the estimation conservatively and began by including region and year fixed effects and a set of region-specific trends. We estimated the following:

$$\ln Y_{it} = \alpha + \beta_1 \ln P_{i,t-1} + \beta_2 \ln VC_{it} + \beta_3 I_i \ln VC_{it} + \varphi_t + \eta_i + \tau_i t + \varepsilon_{it},$$

where i indexes the MSA and t the year, Y_{it} denotes the dependent variable (patents, establishment births, employment, or payroll), $P_{i,t-1}$

measures the population, VC_{it} represents venture capital activity, I_i denotes racial integration, φ_t and η_i represent sets of year and MSA fixed effects, $\tau_i t$ denotes a set of MSA-specific growth trends, and ε_{it} represents the residual error.[4] Note that because our information on integration does not vary within regions over time, the MSA fixed effects absorb its main effect. For the interaction, we first mean-centered the variables. A statistically significant value for β_3 would indicate that integration moderates the effect of venture capital; a positive coefficient would suggest that social relations that crosscut ethnic groups enhance the productivity of venture capital.

Note that our specification effectively captures only outcomes associated with venture capital in the year in which an investment occurred. But startups may continue to produce jobs as they grow. Indeed, Samila and Sorenson (2011) found almost as strong effects in the year following an investment as they did in the year in which the investment occurred.[5] These models, therefore, likely provide conservative estimates of the effects of venture capital.

Although these short-term models do not include any control variables other than population, the fixed effects account for a wide range of possible confounds. The MSA fixed effects control for factors, such as the local infrastructure and the presence of colleges and universities, that either do not vary across regions over time or that change at very slow rates (and therefore effectively remain constant over the decade). The year fixed effects control for national-level factors, such as the prevailing interest rates, that could influence outcomes in all regions. The region-specific time trends adjust for differences in the average growth rates of these regions, capturing the fact that some places have better economic trajectories than others.

Table 2 presents the results. Panel A considers the basic panel regression with year and MSA fixed effects. The results show complementarity between venture capital and microgeographic ethnic integration. This complementarity, moreover, seems strikingly strong. Consider first the relationship to patenting: moving one standard deviation (.1 units) above the mean in integration predicts a 68 percent increase in the effect of venture capital, whereas moving one standard deviation below it leads the amount of venture capital to have almost no effect on patenting. In terms of entrepreneurship, moving one standard deviation above the mean in integration increases the value of venture capital by roughly 40 percent. Not only does microgeographic ethnic integration increase the strength of the association between venture capital and patents and startups, but this complementarity also appears to translate into more and better paying jobs: moving one standard deviation higher in residential integration increases the predicted effects of venture capital on employment and regional income by roughly 30 to 40 percent.

Panel B adds MSA-specific growth trends. Controlling for MSA trends should remove any effect that ethnic integration might have on economic growth in general—in other words, growth unrelated to venture capital. Although these trends reduce the average effect of venture capital as well as the magnitude of the coefficient for the interaction between venture capital and racial integration, the introduction of region-specific trends has a greater impact on the average estimated effect than on the interaction with integration. On a percentage basis, therefore, the importance of racial integration to the efficacy of venture capital appears even larger in these models, ranging from roughly 45 percent for payroll to over 100 percent for patents (the size of the interaction effect on employment, however, falls below the normal thresholds used to reject the null of no effect).

As a robustness check, Panel C reports a set of models in which we removed California, Massachusetts, and Texas from the sample, as they have the largest concentrations of venture capital activity. Although the effect sizes appear slightly smaller in these models, the pattern of effects remains the same. Additional models, reported in the Appendix, introduce a large number of additional interaction terms—between the supply of venture

Table 2. Short-Term Effects

	(1) Patents	(2) Startups	(3) Employment	(4) Payroll
Panel A: Panel Regression				
VC (log)	.048**	.019**	.011**	.027**
	(.013)	(.005)	(.002)	(.005)
VC (log) x MSA Integration	.324**	.079*	.045**	.078*
	(.079)	(.035)	(.013)	(.034)
MSA Population (t–1) (log)	1.338**	.811**	.816**	1.121**
	(.300)	(.079)	(.039)	(.064)
Year Fixed Effects	Y	Y	Y	Y
MSA Fixed Effects	Y	Y	Y	Y
MSAs	322	322	322	322
MSA-Year Observations	3,213	3,213	3,209	3,209
Panel B: Panel Regression with MSA Trends				
VC (log)	.014	.016**	.005*	.012**
	(.010)	(.006)	(.002)	(.003)
VC (log) x MSA Integration	.155*	.096*	.014	.052*
	(.061)	(.042)	(.015)	(.022)
MSA Population (t–1) (log)	–.424	–.085	.120	.361**
	(.626)	(.163)	(.103)	(.121)
Year Fixed Effects	Y	Y	Y	Y
MSA Fixed Effects	Y	Y	Y	Y
MSA Trends	Y	Y	Y	Y
MSAs	322	322	322	322
MSA-Year Observations	3,213	3,213	3,209	3,209
Panel C: Panel Regression with MSA Trends, Excluding CA, MA, and TX				
VC (log)	.011	.015**	.003	.009*
	(.013)	(.005)	(.002)	(.004)
VC (log) x MSA Integration	.145*	.069*	.009	.045
	(.068)	(.034)	(.015)	(.023)
MSA Population (t–1) (log)	–.435	–.004	.138	.377*
	(.739)	(.198)	(.129)	(.151)
Year Fixed Effects	Y	Y	Y	Y
MSA Fixed Effects	Y	Y	Y	Y
MSA Trends	Y	Y	Y	Y
MSAs	260	260	260	260
MSA-Year Observations	2,593	2,593	2,590	2,590

Note: Names in the header refer to the dependent variables. Standard errors, clustered by MSA, are in parentheses.
*$p < .05$; **$p < .01$ (two-tailed tests).

capital and characteristics of the region—to rule out a variety of alternative mechanisms as possibly accounting for the apparent effects of integration.

Considered together, these panel estimates paint a consistent picture. Venture capital, on average, increases innovation, entrepreneurship, and economic growth. Yet, in integrated communities, this effect appears considerably stronger. A metropolitan region one standard deviation above the mean in residential racial integration enjoys at least a 30 percent larger stimulus in response to an increase in the supply of venture capital on each outcome.

Endogeneity. Despite the robustness of these estimates, one might still have concerns about endogeneity. Important innovations, for example, might attract venture capitalists to a region, and hence causality may run opposite to the hypothesized direction. Additional variables, even unobserved ones, might co-occur with integration and also moderate how venture capital influences the various outcomes. To address these potential issues, we estimated the short-term effects using instrumental variables for the number of venture capital investments and the degree of ethnic integration.

As an instrument for venture capital, we used Limited Partner (LP) Returns (Samila and Sorenson 2010, 2011), an estimate of the investment gains that institutional investors in a region experienced and hence of the amount of funds available for investment in venture capital. Whereas one might worry that venture capital firms have a tendency to raise funds and invest in regions that have a rich supply of opportunities (and possibly strong future growth prospects), this instrument stems from institutional investors' interests in diversifying their portfolios. It therefore appears plausibly exogenous. Our construction of the variable followed Samila and Sorenson (2011), multiplying the national average returns to college and university endowments by the number of limited partners in each region that had invested in private equity by 1990 (prior to our observation window).[6]

As an instrument for the level of ethnic integration, we used the Railroad Division Index developed by Ananat (2011), based on the nineteenth-century distribution of railroads within cities.[7] Using maps from the mid-1800s, Ananat (2011) measured the extent to which railroads divided the city into discrete segments. She focused on a 4-km radius around the historical center of the city and defined the index as the Simpson Index of the areas of the regions defined by the railroads.[8] Cities divided into fewer and larger spaces have smaller scores on this metric (and less potential for segregation). To the extent that these tracks impede the movement of people across them and create clear demarcations of regions, they segment cities into neighborhoods with sharper boundaries and therefore facilitate residential segregation.

Table 3 reports the results of these models. Although the models instrumenting for the supply of venture capital and for the degree of ethnic integration sometimes produced coefficients where one could not reject the null of no effect at $p < .05$—in large part because Ananat collected her index for less than a third of the regions in our data, leaving us with less statistical power—one cannot reject the null hypothesis that these models yield equivalent effects to the panel estimates above. These results further bolster the evidence for residential racial integration moderating the effectiveness of venture capital in producing innovation, entrepreneurship, and economic growth.

Long-Term Effects

The panel estimates allowed us to assess whether social integration has a causal interaction with venture capital, but they only captured the influence of these factors in the very short term, in the year of an investment. Startups, however, may require time to create jobs and wealth. We therefore would like a sense of the longer-run implications of the complementarity between social integration and financial capital. To explore these longer-term effects, we turned to cross-sectional analyses. In particular, we examined the effects of venture capital in 1990 on overall employment and aggregate income in 2000. For each outcome, we estimated the effects using the following partial linear adjustment model:

$$\ln Y_{i,2000} = \alpha + \beta_1 \ln \sum_{s=1980}^{1990} VC_{is} + \beta_2 I_i + \beta_3 I_i$$
$$\ln \sum_{s=1980}^{1990} VC_{is} + \sum_j \beta_j X_{ij} + \varepsilon_i,$$

where i indexes the MSA, $Y_{i,2000}$ denotes the dependent variable (patents, establishment births, employment, and payroll), VC_{is} measures the supply of venture capital, I_i denotes

Table 3. Instrumental Variables Estimates of Short-Term Effects

	1st Stage		2nd Stage			
	(1) VC	(2) VC x Int.	(3) Patents	(4) Startups	(5) Employment	(6) Payroll
Panel A: LP Returns as Instrument for VC						
LP Returns	.009*	–.006**				
	(.004)	(.001)				
LP Returns x MSA Integration	.000	.008**				
	(.005)	(.001)				
VC (log)			.143**	.071**	.048*	.076**
			(.048)	(.022)	(.019)	(.015)
VC (log) x MSA Integration			.707**	.316**	.101	.165*
			(.229)	(.112)	(.075)	(.078)
MSA Population (t–1) (log)	–2.213**	.050	–.109	.051	.217*	.535**
	(.838)	(.073)	(.603)	(.166)	(.110)	(.126)
Year Fixed Effects	Y	Y	Y	Y	Y	Y
MSA Fixed Effects	Y	Y	Y	Y	Y	Y
MSA Trends	Y	Y	Y	Y	Y	Y
Sanderson-Windmeijer F-Stat	58.077	66.484				
MSAs	322	322	322	322	322	322
MSA-Year Observations	3,220	3,220	3,213	3,213	3,209	3,209
Panel B: LP Returns as Instrument for VC and Railroad DI as Instrument for Integration						
LP Returns	.008**	–.001**				
	(.002)	(.000)				
LP Returns x Railroad DI	–.002	–.005**				
	(.007)	(.002)				
VC (log)			.118	.130	.079*	.095**
			(.099)	(.075)	(.039)	(.033)
VC (log) x MSA Integration			.796*	.833*	.176	.192
			(.397)	(.411)	(.120)	(.143)
MSA Population (t–1) (log)	–4.735*	.115	.156	–.107	.730**	1.349**
	(1.849)	(.207)	(1.040)	(.505)	(.245)	(.296)
Year Fixed Effects	Y	Y	Y	Y	Y	Y
MSA Fixed Effects	Y	Y	Y	Y	Y	Y
MSA Trends	Y	Y	Y	Y	Y	Y
Sanderson-Windmeijer F-Stat	7.215	7.897				
MSAs	109	109	109	109	109	109
MSA-Year Observations	1,090	1,090	1,090	1,090	1,089	1,089

Note: Names in the header refer to the dependent variables. Standard errors, clustered by MSA, are in parentheses.
$^{*}p < .05$; $^{**}p < .01$ (two-tailed tests).

racial integration in 1990, X_{ij} indicates a set of control variables, and ε_i represents a normally distributed error term. For these models, our measure of venture capital activity counted the number of investments made between 1980 and 1990 by venture capital firms located in a particular MSA.[9] As in the panel models, we included all target companies in this count regardless of whether those companies resided in the same MSA as the investor.

Because we only have a single observation per region in these models, we could not include MSA fixed effects. We therefore incorporated several control variables. To some extent, the measures of ethnic integration depend on a region's ethnic diversity. A region with no minorities, for example, would have no segregation. We therefore included a region's ethnic diversity, in essence the MSA-level entropy that our integration measure uses as a baseline (the E above), as a control. Because minorities have more frequently immigrated to the United States and may integrate better into more-educated communities, our models also adjust for the proportion foreign-born, the proportion college-educated, and the number of colleges and universities (all from the American Communities Project data).

One might also worry that regions with high levels of integration have more civic-minded citizens. Indeed, a large literature in economics suggests that ethnic diversity impedes spending on important public goods (e.g., Alesina, Baqir, and Easterly 1999). We therefore included controls for the percentage of people who voted in the presidential election in 1988 and the response rate to the 1990 Census—proxies for civil engagement. We also accounted for the general associational activity of the region (Putnam 1996) with 1990 counts of the business and professional associations, labor associations, and other associations (from the County Business Patterns data). Finally, the models adjust for the economic diversity of the region, which might correlate with racial integration, using a Herfindahl-Hirschman Index (HHI) of the distribution of establishments across SIC codes in the 1990 County Business Patterns (Economic HHI).

Table 4 presents results of the long-term regressions. Because they do not include MSA fixed effects, these regressions allow us to estimate the overall effect of integration on the economy. Racial integration appears positively related to the innovativeness of a region, in terms of the number of patents it receives and the number of companies created there. But that innovation appears to translate into economic growth only in regions that have a supply of venture capital. Venture capital, therefore, may play a crucial role in commercializing ideas, bringing them from the lab or the mind of an inventor to the consumer (Samila and Sorenson 2010).

In terms of the control variables, a few relationships appear worthy of mention. Measures of civic and social capital have mixed effects with respect to economic growth. MSAs with higher voter participation and census response rates appear little different from those with lower levels of civic participation. Only business associations appear positively associated with business starts and growth.

In terms of the primary variable of interest, the interaction between venture capital investments and ethnic integration, the models reveal positive and significant long-term relationships across three of the four outcomes: patents, employment, and payroll. A city one standard deviation more integrated than the average gained roughly six more patents, 2,100 more jobs, and an additional \$180 million in payroll with a doubling in venture capital. If this increase in payroll had come entirely from the added jobs, workers' annual salaries would have averaged approximately \$86,000—well-paid positions.

Exploring the Mechanisms

Although the models above appear consistent with our theoretical expectations for the relationship between racial integration and the efficacious allocation of venture capital, these models remain at a macro level. Even though the panel models with additional interaction terms and the instrumental variables models should address most of the concerns related to

Table 4. Long-Term Effects

	(1) Patents 2000	(2) Establishments 2000	(3) Employment 2000	(4) Payroll 2000
1980 to 1990 VC (log)	–.005	.007	.009	.030**
	(.028)	(.005)	(.007)	(.010)
1990 MSA Integration	1.183**	.125	.029	.036
	(.362)	(.067)	(.099)	(.113)
1980 to 1990 VC (log) x MSA Integration	.264*	.033	.094**	.157**
	(.128)	(.024)	(.031)	(.050)
1990 MSA Diversity	.023	–.065*	–.008	–.008
	(.160)	(.029)	(.039)	(.048)
1990 MSA % Foreign-Born	–.006	–.005**	–.007**	–.007**
	(.006)	(.001)	(.001)	(.002)
1990 MSA % College-Educated	.031**	.003*	.002	.007**
	(.007)	(.001)	(.001)	(.002)
1990 MSA Colleges (log)	–.060	–.017	–.015	–.017
	(.068)	(.010)	(.013)	(.016)
1990 MSA % Voted for Pres. 1988	–.002	–.001	–.002	–.002
	(.005)	(.001)	(.001)	(.001)
1990 MSA % Census Response 1990	.009	–.001	.000	.002
	(.007)	(.001)	(.001)	(.002)
1990 MSA Bus. Assoc. (log)	.032	.041**	.060**	.060**
	(.082)	(.012)	(.016)	(.021)
1990 MSA Labor Assoc. (log)	–.035	–.031*	–.024	–.046**
	(.066)	(.012)	(.014)	(.017)
1990 MSA Other Assoc. (log)	–.474**	–.106**	–.129**	–.184**
	(.154)	(.036)	(.044)	(.049)
1990 MSA Economic HHI	.381	–.018	.006	.020
	(.715)	(.120)	(.150)	(.210)
1990 MSA Patents (log)	.775**	.002	–.004	–.010
	(.060)	(.010)	(.012)	(.015)
1990 MSA Establishments (log)	.064	1.008**	.071	.076
	(.285)	(.049)	(.059)	(.075)
1990 MSA Employment (log)	.714	.313**	1.392**	.482**
	(.528)	(.093)	(.102)	(.125)
1990 MSA Payroll (log)	.011	–.203**	–.342**	.643**
	(.386)	(.065)	(.073)	(.098)
Constant	–8.719**	–.010	.706	.429
	(1.572)	(.298)	(.406)	(.486)
R^2	.918	.994	.992	.990
Observations	318	318	318	318

Note: Names in the header refer to the dependent variables. Standard errors, clustered by MSA, are in parentheses.
$^{*}p < .05$; $^{**}p < .01$ (two-tailed tests).

potential confounds, some evidence of the micro-level processes would increase our confidence that the relationship operates through the mechanisms suggested. We therefore explored the effects of racial integration on two more-micro outcomes: the kinds of inventions coming out of a region, and the diversity of the people involved in high-tech startups.

Inventions. Under our first mechanism, more integrated regions should produce more novel inventions. We therefore gathered data on individual patents to determine whether inventions from racially-integrated regions differed qualitatively from those arising elsewhere. We included all available utility patents with an application date between 1991 and 2005 and assigned patents to regions based on the addresses listed for their inventors. If a patent had inventors in multiple MSAs, we included the patent in each of them, meaning the patent-MSA became our unit of analysis.

We used three measures to assess the importance and novelty of patents in a region: forward citations, and the generality and originality measures proposed by Hall, Jaffe, and Trajtenberg (2001). Citations from future patents are frequently considered an indicator of the value of a patent (Reitzig 2004; Trajtenberg 1990). We counted the number of citations received by a patent in the seven years following the filing of its application. Those seven years of forward citations allowed us to calculate the generality index, the extent to which the citations came from a wide range of future technologies. Hall and colleagues (2001) define generality as the Blau index (one minus the Herfindahl index) of technology classes of the citing patents, the idea being that more general ideas have greater value than the simple count of citations would suggest.

The originality index examines the citations of the focal patent to earlier patents, under the notion that more novel inventions combine elements from a wider range of technologies. Hall and colleagues (2001) define this measure as the probability that any two patents cited belong to different classes (the Blau index of the primary classes of the patents cited by the focal patent).[10]

We regressed each variable of interest on our measure of racial integration, as well as on the control variables used in our models of the long-term effects of venture capital. We also introduced technology-year fixed effects into these models, a set of more than 500 intercepts. These intercepts account for the fact that technologies differ, on average, in their number and patterns of citations, and these differences also vary over time. They effectively absorb any differences across regions in the compositions of the kinds of inventions. The primary coefficient of interest estimates whether two patents, within the same technology and applied for in the same year, vary in their citation characteristics as a function of the degree of ethnic integration in the region in which the inventors resided.

Table 5 presents the results of these models. Interestingly, relatively few of the control variables have significant relationships with the number of citations and the generality and originality measures. Common measures of civic and social capital appear nearly irrelevant to invention. The presence of educational institutions and a better educated population nevertheless correlate positively with all three measures. Educated regions appear to produce more novel and more valuable inventions.

But the most interesting results appear in the coefficients for ethnic integration. Patents with inventors located in integrated MSAs received more forward citations, from a more diverse set of technologies (generality). These patents also combined more diverse technologies (originality). These positive effects do not come from racial diversity itself; they appear only in regions in which members of different ethnic groups come in more regular contact with one another. These effects held even in (unreported) models in which we instrumented for ethnic integration. One can therefore interpret these results as being causal effects of racial residential integration on innovation.

Founding teams. With our second mechanism, more integrated regions should produce more ethnically-diverse groups of founders and employees and configurations of resource providers. We therefore gathered data on the composition of a number of groups associated with recent startups, their founding teams, their executives, and their board members. The ThomsonOne database has limited information on these individuals, but CrunchBase, an online database, has

Table 5. Effects of Integration on Patenting

	(1) Forward Cites 7-year	(2) Generality	(3) Originality
MSA Integration	.372**	.040**	.060**
	(.075)	(.015)	(.014)
MSA Diversity	.051	.010	.008
	(.037)	(.009)	(.007)
MSA % Foreign-Born	.001	.000	.000
	(.002)	(.000)	(.000)
MSA % College-Educated	.006**	.001**	.001*
	(.001)	(.000)	(.000)
MSA Colleges (log)	.036**	.004	.006*
	(.013)	(.003)	(.002)
MSA % Voted for Pres. 1988	.002	.000	.000
	(.002)	(.000)	(.000)
MSA % Census Response	.000	−.001	.000
	(.002)	(.000)	(.000)
MSA Bus.-Prof. Assoc. (log)	−.035	.000	−.002
	(.018)	(.005)	(.004)
MSA Labor Assoc. (log)	.033*	.005	.004
	(.016)	(.003)	(.003)
MSA Other Assoc. (log)	−.043	−.003	.002
	(.042)	(.008)	(.007)
MSA Economic HHI	.017	.046	.058*
	(.191)	(.028)	(.023)
MSA Population (log)	.022	−.005	−.007
	(.034)	(.005)	(.005)
Tech Subcategory – Year FEs	Y	Y	Y
R^2	.294	.071	.064
MSAs	318	318	318
Patent-MSA Observations	1,531,422	1,138,356	1,467,503

Note: Names in the header refer to the dependent variables. Standard errors, clustered by MSA, are in parentheses.
$^*p < .05$; $^{**}p < .01$ (two-tailed tests).

become an important repository for information on (mostly high-tech) companies soliciting or receiving venture capital.

To assess whether startups in more racially-integrated regions had more diverse sets of individuals associated with them, we used the surnames of the founders, executives, and board members to assign individuals to ethnic categories based on the ethnic composition of people with the same surname, according to the Census Bureau (Flynn 2016). This algorithm allowed us to assign 86 percent of individuals in the database to one of four ethnic groups—African American, Asian, Caucasian, or Hispanic—with 90 percent confidence.[11] We excluded the remaining 14 percent of individuals from our analysis. We used this information to calculate the number of different ethnicities represented in each organization in the sets of (1) founders, (2) executives, and (3) board members. For example, if a group of founders had two Caucasians and one Asian member, this measure would increment to two ethnic categories. For each group, we calculated these measures for startups that had at least two members in the set (and therefore that conceivably could have some degree of diversity).

We regressed each of these counts on our measure of racial integration, as well as on the

Table 6. Effects of Integration on the Entrepreneurial Group

	(1) Founders	(2) Executives	(3) Advisors
MSA Integration	−.013	.175*	.279**
	(.088)	(.075)	(.099)
MSA Diversity	.069	.176**	.114*
	(.053)	(.049)	(.046)
MSA % Foreign-Born	.002	.004**	.002
	(.001)	(.001)	(.002)
MSA % College-Educated	.006**	.004*	.004*
	(.002)	(.001)	(.002)
MSA Colleges (log)	−.018	−.006	.002
	(.017)	(.016)	(.022)
MSA % Voted for Pres. 1988	−.001	−.002	−.003
	(.001)	(.001)	(.002)
MSA % Census Response	−.001	.002	.003
	(.002)	(.002)	(.002)
MSA Bus.-Prof. Assoc. (log)	−.047**	−.034	−.040
	(.017)	(.017)	(.023)
MSA Labor Assoc. (log)	.029*	.023	.053**
	(.014)	(.014)	(.020)
MSA Other Assoc. (log)	.004	.003	−.038
	(.039)	(.035)	(.049)
MSA Economic HHI	−.053	−.002	.179
	(.108)	(.095)	(.116)
MSA Population (log)	.033	.010	.009
	(.024)	(.025)	(.028)
Dummies for Count of Persons	Y	Y	Y
R^2	.052	.267	.200
MSAs	225	296	209
Startup Observations	14,334	39,876	10,680

Note: For each group named in the header, the dependent variable counts the number of ethnicities represented in that group. Standard errors, clustered by MSA, are in parentheses.
*p < .05; **p < .01 (two-tailed tests).

control variables used in our models of the long-term effects of venture capital. We also included indicator variables for every possible group size (e.g., two individuals, three, four). These variables flexibly capture any baseline relationship between group size and diversity.

Table 6 presents the results of these regressions.[12] Among the control variables, business associations appear associated with less diversity at the startup level, whereas labor associations—such as labor unions—have a positive association with diversity within startups, even net of the ethnic composition of the region. More educated regions also appear to foster more diverse startup teams.

With respect to our variable of interest, higher levels of ethnic integration predicted more ethnically-diverse teams of executives and boards of advisors. This latter result is particularly interesting. Boards of advisors of startups usually include representatives of the angel investors and venture capitalists who financed the firm. The fact that these boards have greater diversity therefore suggests that more cross-ethnic investments may occur in more integrated regions. Teams of founders, themselves, by contrast, did not appear more diverse in integrated regions. These effects also held—in fact, even became stronger—in (unreported) models in which we instrumented for ethnic integration. Micro-level evidence, therefore, supports the mechanisms discussed earlier for why ethnic integration would enhance the effectiveness of venture capital in stimulating economic growth.

DISCUSSION

Case studies suggest that patterns of social connections within a community matter to its economic health (e.g., Safford 2008; Saxenian 1994). It has nevertheless been difficult to do large-scale quantitative analyses on the extent and magnitude of these effects, due to the paucity of data on social relationships across communities and over time. We circumvented this challenge by gathering data, not on relationships themselves, but on the opportunities for interaction embedded in the geography of where people live.

We examined whether residential segregation, in terms of race, influenced the extent to which venture capital stimulated the local economy. Although research shows that venture capital engenders entrepreneurship and economic growth (Samila and Sorenson 2011), not all regions appear to benefit equally from it. Examining MSAs in the United States from 1993 to 2002, we found that more racially-integrated regions benefited more from venture capital in terms of promoting innovation and entrepreneurship and creating jobs and wealth. A city one standard deviation more racially-integrated than the average enjoyed at least 30 percent larger effects of venture capital on innovation, entrepreneurship, and economic growth. These results seem consistent with the positive effects of racial integration found elsewhere. At the firm level, for example, organizations that embrace racial diversity and therefore promote interaction across ethnic groups appear to perform better than those that do not (Herring 2009; Pager 2016).

At least three factors could account for the complementarity between social integration and financial capital. First, more integrated regions may produce more and better ideas in which venture capitalists can invest. Innovation frequently involves the novel recombination of existing ideas. To the extent that individuals of different ethnicities have distinct perspectives and information, regions in which individuals tend to mix across racial lines may prove more fertile ground for innovation, and therefore offer better investment opportunities for venture capitalists. Consistent with this mechanism, our analysis of patent data found that more racially-integrated regions produced ideas that combined a wider range of inputs and had greater value and range of application.

Second, social connectedness could ease the resource mobilization process, allowing entrepreneurs to more readily recruit the people and funding that they need for their ventures. Because the process of finding employees and financiers for startups typically relies heavily on social relationships, segregated communities may produce suboptimal matches. Instead of finding the best employees overall for their needs, entrepreneurs must settle for the best available in their segment of the community; instead of investing in the most promising startups, venture capitalists constrain themselves to financing the best available from within their own ethnic group. Consistent with this channel, our analysis of entrepreneurial groups found that more racially-integrated regions had startups with more ethnically-diverse executives and boards of advisors.

Third, higher levels of integration may magnify the spillover effects associated with entrepreneurship. Research repeatedly finds that being exposed to others who have started their own businesses increases the likelihood that individuals will attempt to become entrepreneurs themselves (Nanda and Sørensen 2010; Stuart and Ding 2006). To the extent that information regarding venture capital investments travels more widely or seems salient to a broader segment of the community in racially integrated communities, one might expect larger follow-on effects in them as well.

Although our analyses examined the effects of venture capital only on local economies, one might expect similar differences across communities in the value of other forms of entrepreneurial finance. The magnitude of these differences, however, might well depend on the nature of the businesses being funded. High-growth businesses, whether financed by venture capitalists or angel investors, generally depend on both the innovative capacity of the region and entrepreneurs' ability to assemble resources. But more day-to-day businesses, such as a shop or restaurant, depend mostly on whether the entrepreneur can attract investors and hire employees. One therefore might expect racial integration to prove less valuable to entrepreneurial finance outside the high-technology, high-growth industries typically favored by venture capitalists.

Many forms of entrepreneurship, moreover, do not require access to resources in the extended community. Individuals acting as independent contractors or operating a business funded and staffed by their family need not rely on social connections to found their firms. It therefore remains an open question as to how residential racial segregation might affect the value of these firms to the economy, although the research on ethnic enclaves suggests such segregation could actually increase their value (Zhou 2004).

Despite being focused only on the effects of venture capital, our results suggest that more racially-integrated regions enjoy faster rates of economic growth. Venture capital can account for a meaningful share of the differences between regions in their average incomes per capita (Samila and Sorenson 2011). Our estimates further suggest that some of the regions with the highest levels of venture capital and high-tech entrepreneurship, such as San Diego and San Jose, can expect greater returns to those activities, magnifying these disparities. Residential racial integration, moreover, may contribute to the economic growth of regions through other channels. Less racially-segregated cities, for example, have lower rates of poverty and higher levels of intergenerational economic mobility (Ananat 2011; Chetty et al. 2014).

The idea that racial integration would promote innovation, entrepreneurship, and job creation offers a strong counterpoint to much of the existing literature on ethnic diversity and economic growth. Ethnic diversity has often been seen as problematic. One prominent strain of literature, for example, argues that more diverse communities find it difficult to agree on the provision of public goods, such as education and infrastructure, and to build effective civil institutions (e.g., Alesina et al. 1999). But this literature misses the upside of diversity, its value to innovation. As economies shift from being agrarian or industrial to relying on the production of ideas and information, the net value of diversity—particularly when coupled with integration—may become increasingly positive.

Regions with high levels of racial segregation, however, cannot easily address these disadvantages. Patterns of residential segregation change very slowly (Reardon et al. 2009). In part, only a small fraction of the population moves in any given year. But, even among those moving, individuals may prefer to live near others of the same ethnicity despite the fact that these individual decisions have negative consequences for a community's economic health. One might therefore expect continued economic divergence between more and less racially-integrated metropolitan areas.

The implications of our results for inequality within these regions, however, appear less clear. To the extent that more residentially-integrated communities allow individuals from any ethnic group to pursue their entrepreneurial ideas, one might expect racial integration to reduce income inequality. Consistent with this idea, recent research in economics suggests that more segregated communities have higher levels of income inequality (Ananat 2011; Chetty et al. 2014). But entrepreneurship can also increase inequality in many ways. Investing in startups has the payoff structure of a lottery, where most lose but a few become exceedingly rich. Industries and regions with more startups, moreover, tend to have greater variation in what they pay employees (Sørensen and Sorenson 2007). Although a topic ripe for future research, one might imagine that residential racial integration could reduce crossrace inequality but increase within-race stratification.

Our results may also have implications for differences across countries in their economic success, particularly as innovation and entrepreneurship become more important to economic growth. In particular, our results suggest that the "melting pot" model of the United States, which integrates immigrants with the host society, might foster more robust economic growth than the multicultural "salad bowl" approach common in Canada and parts of Europe.

Although our analyses focused on social integration along racial lines, theoretically, similar processes should occur along any dimension that both structures interaction and differentiates individuals in terms of their access to information or resources. Communities more segregated along class lines, for example, might also experience a slower recombination of ideas and resources and therefore less innovation, entrepreneurship, and economic growth. Organizations that silo their employees into segmented offices and divisions might similarly suffer. Our approach—observing the opportunities for interaction rather than relationships themselves—offers a way forward in investigating all these questions empirically.

APPENDIX

Although the fixed effects and trends in the panel estimates in Table 2 control for a wide range of potential confounds, one might worry that some other factor—(1) correlated with racial integration in 1990 and (2) that also moderates the effectiveness of venture capital—accounts for these results. To explore this possibility, we introduced to our models a large number of interaction terms between the supply of venture capital and region characteristics that might influence the effectiveness of venture capital. In particular, these models interact all the controls used in the long-term models with the measure of venture capital activity.

Table A1 reports the results of these models. All these characteristics were measured at one point in time at the beginning of the period or before it. The MSA fixed effects therefore absorb the main effects of all these variables. Although the proportion college-educated appears to increase the effectiveness of venture capital somewhat—as one would probably expect—none of the other region characteristics has consistent effects across the four outcomes. The estimated effect of the interaction between the supply of venture capital and racial integration, moreover, remains largely unaffected by the inclusion of all these terms.

Table A1. Alternative Channels

	(1) Patents	(2) Startups	(3) Employment	(4) Payroll
VC (log)	.027	.015	.006*	.007
	(.016)	(.009)	(.003)	(.004)
VC (log) x MSA Integration	.490**	.068	.063**	.073*
	(.106)	(.041)	(.022)	(.034)
VC (log) x MSA Diversity	.036	–.038	.022	.019
	(.051)	(.028)	(.013)	(.022)
VC (log) x MSA % Foreign-Born	–.002	.002*	–.001**	–.001
	(.002)	(.001)	(.000)	(.001)
VC (log) x MSA % College-Educated	.004	.000	.001*	.004**
	(.002)	(.001)	(.000)	(.001)
VC (log) x MSA Colleges (log)	.073**	.005	–.000	.004
	(.024)	(.009)	(.004)	(.007)
VC (log) x MSA % Voted for Pres. 1988	–.002	–.000	–.000	.000
	(.002)	(.001)	(.000)	(.001)
VC (log) x MSA % Census Response 1990	.003	.000	.000	.000
	(.002)	(.001)	(.000)	(.001)
VC (log) x MSA Bus. Assoc. (log)	–.009	–.013	.002	–.003
	(.029)	(.009)	(.006)	(.013)
VC (log) x MSA Labor Assoc. (log)	.022	.001	–.001	.003
	(.025)	(.009)	(.005)	(.010)
VC (log) x MSA Other Assoc. (log)	–.047	.005	.005	.008
	(.037)	(.018)	(.008)	(.014)
VC (log) x MSA Economic HHI	–.080	.085	–.048	–.087
	(.166)	(.061)	(.031)	(.065)
MSA Population (t–1) (log)	1.310**	.828**	.794**	1.094**
	(.308)	(.081)	(.040)	(.061)
Year Fixed Effects	Y	Y	Y	Y
MSA Fixed Effects	Y	Y	Y	Y
MSAs	318	318	318	318
MSA-Year Observations	3,173	3,173	3,169	3,169

Note: Names in the header refer to the dependent variables. Standard errors, clustered by MSA, are in parentheses.
*$p < .05$; **$p < .01$ (two-tailed tests).

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Notes

1. 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, together with any surrounding counties—or townships in the case of New England—with a high degree of social and economic integration with the core. In practice, if

over 25 percent of a county's residents commute to the core, then the OMB includes the county in the MSA.

2. When $\pi_r = 0$, one typically sets $\ln(1/\pi_r) = 0$.
3. The Census Bureau reports establishment births by three categories of firm size: 0 to 19 employees, 20 to 499 employees, and more than 500 employees. It allocates firms to these categories based on their size across all establishments at year end. Few startups have more than 19 employees by the end of their first year.
4. Repeated observations of regions could lead to correlated errors over time. In least squares estimation, these correlations will not bias the point estimates, but they can influence the standard errors. We therefore estimated our models using standard errors robust to repeated observations of the same regions.
5. Samila and Sorenson (2011), however, found little evidence of an effect after the year following an investment, consistent with the more general finding that net job creation, on average, occurs only in the first year or two of a venture (Haltiwanger, Jarmin, and Miranda 2013).
6. Samila and Sorenson (2010) provide extensive evidence for the assumptions involved in using this variable as an instrument for the supply of venture capital. As they explain, this construction of the instrument has attractive features. Using national average returns avoids reverse causality—that some investors had better returns because they invested in regions that grew rapidly. Using only the number of institutional investors who had invested in private equity prior to the observation window prevents us from incorporating information on endogenous allocations to venture capital into the measure.
7. To address the concern that these distributions reflect some other important feature of the city, Ananat (2011) provided extensive evidence that the index appeared unrelated to ethnic segregation at the time of the measure or to a large number of other characteristics of these cities in 1910 and 1920. Three factors appear to have driven the distribution of these railroads: the topographical features of the area (hills and rivers), competition between railroad companies, and the federal government's goal, following the Civil War, to create a national railroad network.
8. Because we interacted this instrument with another one, we could not include density of tracks as a control, as Ananat did. We therefore regressed her original measure on the track length per km^2 and then used the residual of this regression as our instrumental variable. Using the data from Ananat (2011), we confirmed that the tests of the validity of this instrument held for our railroad-length-residualized version of it.
9. Because some regions had no activity, we added one to this count before logging it. We again mean-centered the variables to calculate the interaction term.
10. To correct for bias introduced by small numbers of citations, we adjusted both the generality and originality measures as suggested by Hall and colleagues (2001).
11. A manual exploration of the unmatched names suggests they primarily represent less-common European and Indian surnames.
12. Not every MSA has organizations in CrunchBase with more than two individuals associated with one of those groups. The number of MSAs therefore varies somewhat from one model to the next.

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