Journal of Economics & Management Strategy

High-Technology Entrepreneurship in Silicon Valley

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The economic expansion of the late 1990s created many opportunities for business creation in Silicon Valley, but the opportunity cost of starting a business was also high during this period because of the exceptionally tight labor market. A new measure of entrepreneurship derived from matching files from the Current Population Survey (CPS) is used to provide the first test of the hypothesis that business creation rates were high in Silicon Valley during the "Roaring 90s." Unlike previous measures of firm births based on large, nationally representative datasets, the new measure captures business creation at the individual-owner level, includes both employer and nonemployer business starts, and focuses on only hi-tech industries. Estimates indicate that hi-tech entrepreneurship rates were lower in Silicon Valley than the rest of the United States during the period from January 1996 to February 2000. Examining the post-boom period, we find that entrepreneurship rates in Silicon Valley increased from the late 1990s to the early 2000s. Although Silicon Valley may be an entrepreneurial location overall, we provide the first evidence that the extremely tight labor market of the late 1990s, especially in hi-tech industries, may have suppressed business creation during this period.

1. Introduction

The late 1990s were characterized by rapidly rising stock prices and lucrative stock options, a spate of IPOs, an increase in venture capital deals, and exceptionally tight labor markets. The NASDAQ rose from 1,059 on January 2, 1996 to 5,049 on March 10, 2000. Perhaps even more remarkably, the national unemployment rate dropped below 4% in April 2000. The late 1990s were also characterized by a marked increase in the use of computers and the Internet by individuals and firms (International Telecommunications Union, 2005). Silicon Valley, California played a major role in the expansion of information and communications technologies (ICTs) in the 1990s, one of the "frequently

This research was funded by the U.S. Small Business Administration and Kauffman Foundation. The views expressed here are those of the authors and not necessarily those of the SBA or Kauffman Foundation. We would like to thank the seminar participants at the Small Business Administration and West Coast Entrepreneurship Research Symposium at Stanford University for helpful comments and suggestions. Oded Gurantz and Aparna Venkataraman provided excellent research assistance.

cited miracles of industrialization in the information technology (IT) era" (Saxenian and Hsu, 2001: 893). The large concentration of hi-tech industries in the corridor between San Francisco and San Jose became well known, and much emphasis was placed on the role of entrepreneurs and high technology startups in Silicon Valley in contributing to the amazing economic growth of the 1990s. The media dubbed it the "dot com" boom. Conventional wisdom suggested that most people were interested in becoming an entrepreneur or involved in some type of startup.[1]

Surprisingly, although the prevailing view is that entrepreneurship was extremely high during the late 1990s in hi-tech locations such as Silicon Valley, there is no evidence in the academic literature from large-scale nationally representative data supporting this claim. The economic expansion of the 1990s undoubtedly created many opportunities for entrepreneurship and startups, but there also existed several factors that may have actually suppressed business creation during this period. The late 1990s represented a period in which the unemployment rate was falling rapidly, wage and salary earnings were rising, stock options and signing bonuses were becoming increasingly common, and investing in the stock market paid substantial returns. In short, the opportunity costs to business creation may have been unusually high during this period. Therefore, it is an open question as to whether this was a period of heightened entrepreneurship or one in which the returns to working at firms were too great.

The limited evidence on the question appears to primarily be due to the lack of large, nationally representative panel data with information on hi-tech entrepreneurship. To address this limitation, we use a new measure of entrepreneurial activity to study business creation from 1996 to 2005 in Silicon Valley. Microdata from matched monthly files from the Current Population Survey (CPS) are used to estimate the rate of entrepreneurship. Although the cross-sectional CPS data are commonly used to estimate static rates of business ownership, the matched data allow for the creation of a dynamic measure of entrepreneurship that captures the rate of business formation at the individual owner level. A major advantage of these data is that all new business owners are captured, including those who own incorporated or unincorporated businesses, and those who are employers or nonemployers. Recent measures of entrepreneurial activity or firm formation typically include only larger, employer firm births, but these firms represent only 25% of all existing firms (U.S. Small Business Administration, 2001; Headd, 2005), and a significant number of new employer firms start as nonemployer firms (Davis et al., 2006). An additional advantage is that unlike most business-level datasets that include limited information on the owner and no information on nonowners, the CPS includes detailed demographic information for the entire population allowing for an empirical analysis of the determinants of entrepreneurship. Although the data allow us to focus on hi-tech industries, we cannot examine separate patterns for venture-capital backed startups and employer firms, and cannot capture entrepreneurs moving to Silicon Valley with existing businesses or to immediately start businesses.

Using panel data from the matched CPS and drawing from the prior literature in economics and management, several important hypotheses regarding entrepreneurship in Silicon Valley are tested. First, was business creation higher in Silicon Valley than the rest of the United States in the economic expansion of the late 1990s? The rapidly growing economy may have created many opportunities for startups, but wage and

1. See "Understanding Silicon Valley: The Anatomy of an Entrepreneurial Region" Kenney, 2000. "The Silicon Valley Edge: A Habitat for Innovation and Entrepreneurship" Lee et al. 2000, and "The Soul of a New Economy," New York Times, December 29, 1997 for a few examples.

salary earnings and the opportunity cost of capital were also rising rapidly during this period. Second, Silicon Valley has a highly educated population, which is associated with higher rates of entrepreneurship. Silicon Valley also has a large concentration of immigrants, which is associated with higher levels of overall entrepreneurship, while the effects for hi-tech entrepreneurship are unknown. Taken together, were entrepreneurship rates higher in Silicon Valley than the rest of the United States after controlling for these differences in education, immigration, and other demographic and work characteristics? Finally, did the downturn of the early 2000s reverse an upward trend in business creation or did business creation actually rise in Silicon Valley after the bubble burst? Interestingly, the comparison to the post-boom period may shed light on whether entrepreneurship was dampened in Silicon Valley in the late 1990s by the unusually tight labor market.

We find that business creation rates were 10–20% lower in Silicon Valley than the rest of the United States during the period from January 1996 to February 2000 based on estimates that control and do not control for the highly-educated workforce and other characteristics of the population. In the post boom period, we find that entrepreneurship rates in Silicon Valley increased while the national rate stayed essentially constant. These entrepreneurship patterns are robust to alternative definitions of business formation that are less inclusive and focus on more successful types of businesses. Taken together, these results appear to challenge the conventional wisdom about Silicon Valley in the late 1990s—entrepreneurship was relatively low in the late 1990s compared to both the rest of the United States and the post-boom period in Silicon Valley. We provide some preliminary evidence that the negative influence of high opportunity costs through a very tight labor market may have outweighed the positive influence of expanded entrepreneurial opportunities during the roaring 90s.

2. Theoretical Perspectives on Entrepreneurial Opportunities

This paper begins with the observation that numerous entrepreneurial opportunities were said to have existed in Silicon Valley during the late 1990s, but we have little robust empirical evidence that these opportunities were being exploited at a high rate. In fact, entrepreneurship may have been suppressed by the exceptionally tight labor market.

In the economics literature, a theoretical analysis of the choice to become a business owner has generally been based upon the relative earnings that a worker could obtain there in comparison with his or her earnings at a wage and salary job. The standard theoretical model of the entrepreneurial decision in the economics literature posits that two major opportunity costs to starting a business are wages in the labor market and returns to investing unspent capital (Evans and Jovanovic, 1989). There is also some empirical evidence that opportunity costs are an important factor in the decision to become an entrepreneur (Evans and Leighton, 1989), and that it is often weighed against the expected size of the new venture (Cassar, 2006) or the expected returns (Bhide, 2000). Evans and Leighton (1989) find that low wages are associated with entry into entrepreneurship. Other research has emphasized that technological change can create variation in the number of entrepreneurial opportunities which are available (Shane, 2000).

While it is empirically difficult to measure the availability of entrepreneurial opportunities and opportunity costs, this logic provides several insights that are useful for thinking about entrepreneurship in the late 1990s. First, the economic boom of the 1990s provided strong consumer and firm demand for products and services provided by

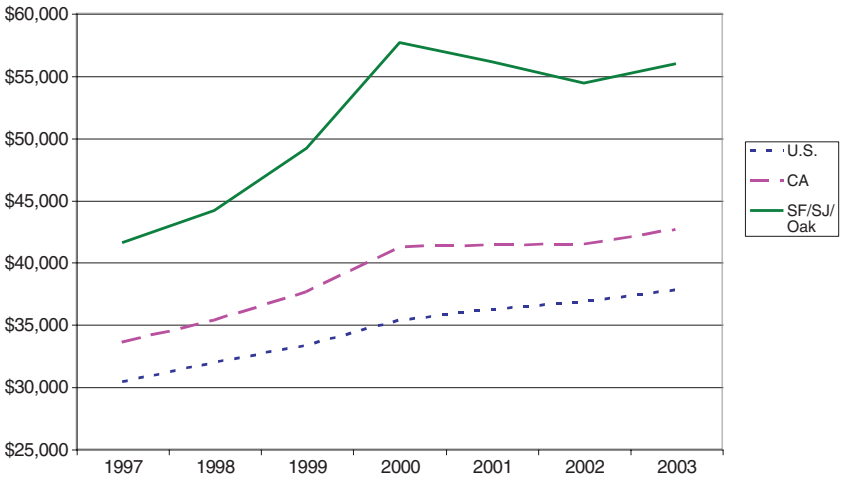

FIGURE 1. ANNUAL EARNINGS

Source: BLS Quarterly Census of Employment and Wages (QCEW).

startups, thus increasing entrepreneurial earnings and associated opportunities. Although economic growth may have increased the returns to entrepreneurship nationally, Silicon Valley entrepreneurs may have gained even more because of the especially strong local economic conditions during this period.

Second, the increased use of the personal computer and Internet in the late 1990s may have also altered the classic production function, and the rapidly falling price of technology may have decreased the price of physical capital. Previous research indicates that high levels of investment in personal computers by small businesses during the late 1990s. More than 75% of small businesses used computers (Bitler et al., 2001; Bitler, 2002), and self-employed business owners had high rates of computer ownership (U.S. Small Business Administration, 2003). Small- and medium-sized businesses also made relatively large investments in computers and communication equipment (Buckley and Montes, 2002) and 25–45% of total capital expenditures among relatively young employer firms are for computers (Haltiwanger, 2004). There is also direct evidence that access to personal computers increases entrepreneurship (Fairlie, 2005), possibly by making it easier to complete tasks needed to run a business such as accounting, inventory, communications, and advertising (Bitler, 2002).

On the other hand, earnings in the wage and salary sector were increasing very rapidly during the late 1990s placing downward pressure on entrepreneurship. Figure 1 displays average annual earnings in the San Francisco/San Jose/Oakland metropolitan area, California and the United States. In the San Francisco Bay Area, mean earnings rose from $42,000 to more than $58,000, which was far higher than mean earnings in California or the United States. The unemployment rate also dropped rapidly over this period of time (see Figure 2). The unemployment rate in the San Francisco Bay Area fell to a remarkable low of 2.2% in December 2000. Overall, the late 1990s were a period when the returns to the wage and salary sector were at unprecedented levels.[2]

2. There is also evidence of high levels of job mobility among hi-tech workers in Silicon Valley suggesting a dynamic labor market (i.e., Fallick et al., 2006). On the other hand, high levels of job mobility might also result in a higher chance of starting a business.

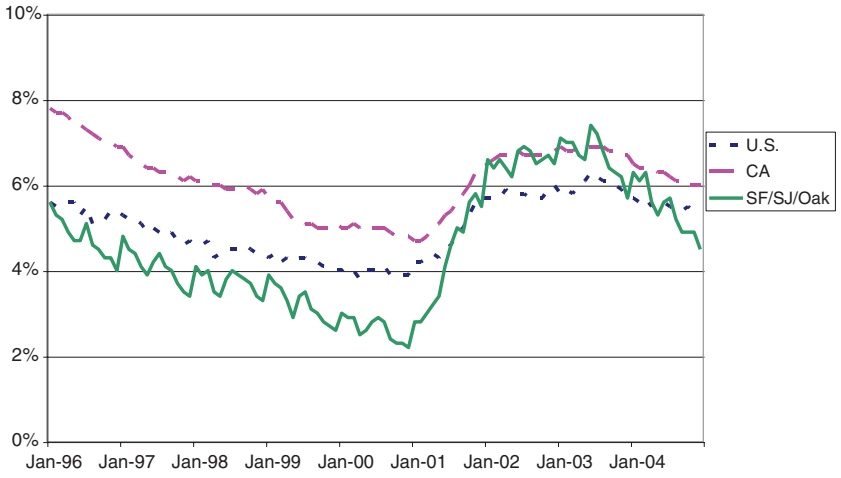

FIGURE 2. UNEMPLOYMENT RATES

Source: BLS Quarterly Census of Employment and Wages (QCEW).

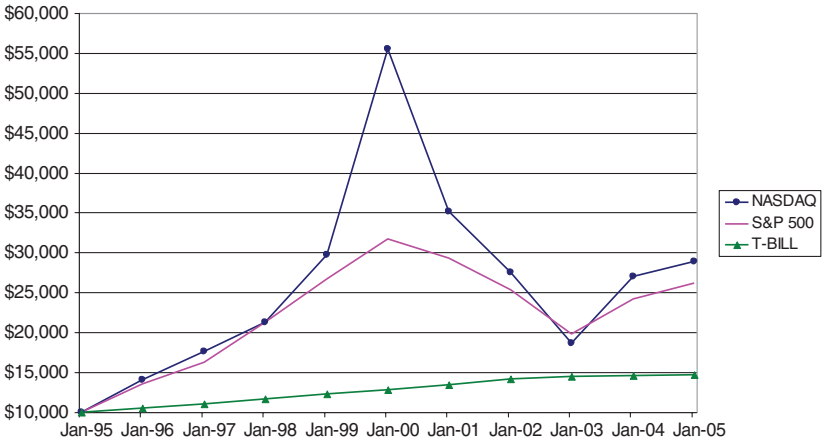

FIGURE 3. RETURNS TO INVESTING $10,000 IN JANUARY 1995

Source: Yahoo! Finance Historical Data.

Another factor creating downward pressure on entrepreneurship was the opportunity cost of capital. The returns to investing in the stock market were extremely high during this time period. Figure 3 displays the returns to investing in a few different assets over the 1996 to 2004 period. Investing $10,000 in the NASDAQ in 1995 would have grown to $45,000 from 1996 to 2000, and investing $10,000 in the SP 500 would have grown to nearly $22,000. Of course, investing in a less risky asset would have paid smaller returns, but many investors were placing a lot of money in the stock market at this point in time, and investing this money in a startup meant missing out on those returns.

The booming stock market, however, also increased personal wealth. In the presence of liquidity constraints, higher levels of wealth may have made it easier for entrepreneurs to find the required startup capital to launch new ventures. Startup capital

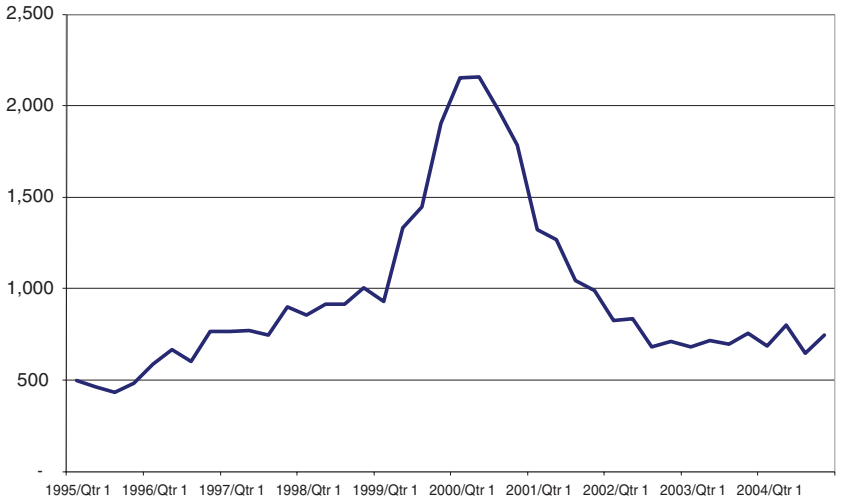

FIGURE 4. VENTURE CAPITAL DEALS

Note: Venture Capital Deals Measure Cash-for-Equity Investments by the Professional Venture Capital Community in Private Emerging Companies.
Source: PWC Money Tree Survey.

may have been much easier to find during the late 1990s, especially in hi-tech areas such as Silicon Valley. Figure 4 displays the number of venture capital deals made in the United States over time. The number of deals rose from less than 500 per quarter in 1995 to more than 2,000 per quarter in the early 2000s.

Although the late 1990s in Silicon Valley, California and the rest of the United States may have provided many opportunities for entrepreneurship, the increasing returns to entrepreneurship may have been offset by increasing returns to working for a firm and investing wealth. In the end, there is no clear theoretical prediction regarding whether the boom of the 1990s was a time of heightened entrepreneurship.

2.1 The Special Case of Silicon Valley

Several scholars have identified particular characteristics of entrepreneurship in Silicon Valley that are very difficult to measure empirically. One common argument is that the entire environment or "habitat" in the region appears to be favorable for innovation and entrepreneurship (Saxenian, 1994). Various studies have emphasized the role of a highly educated and mobile workforce, a risk taking and failure tolerant culture, an open business environment that encourages creative thinking, leading research universities and institutes, extensive complementary services in law and venture capital, quality of life, and other factors that contribute to an unusually entrepreneurial environment in Silicon Valley (Lee et al., 2000).

Likewise, other work has posited that new venture creation is more common in "clusters" co-located with valuable resources (Stuart and Sorenson, 2003). Stuart and Sorenson argue that "the local nature of social capital suggests that new ventures will more likely begin in regions that offer ample supplies of the necessary resources." Since incipient entrepreneurs require social connections with potential resource providers, and resources are geographically concentrated, some areas, such as Silicon Valley,

are predicted to have higher founding rates than others (Sorenson and Audia, 2000). However, these sociological drivers of clustering are difficult to separate from the economic spillovers that result from agglomeration (Krugman, 1991). Industry agglomeration can also lead to the related phenomenon of entrepreneurial spawning (Chatterji, 2009), where former employees of incumbent firms start new ventures in the same industry often located near the original parent firm, adding to the agglomeration effects in regions such as Silicon Valley.

Although there are many reasons to suspect that Silicon Valley differs from the rest of the United States in the creation of hi-tech businesses, these factors are notoriously difficult to measure. These unobservable factors make it difficult to infer causes for any differences in entrepreneurship rates found between Silicon Valley and the rest of the country. To implicitly control for these difficult-to-measure factors, we take the empirical strategy of comparing business creation in Silicon Valley in the pre period (late 1990s) to business creation in Silicon Valley in the post period (early 2000s). Although the factors listed above did not change much during our sample period, economic conditions declined sharply, reducing the opportunity cost of entering entrepreneurship and also likely reducing potential entrepreneurial opportunities.

We use these changes to assess the level of high-technology entrepreneurship in Silicon Valley from 1996 to 2005. We provide the first formal test of the conventional wisdom that there was more high-technology entrepreneurship in Silicon Valley during the "bubble" period of the late 1990s, and our finding suggests that the higher opportunity cost of entering entrepreneurship in Silicon Valley may have actually resulted in lower business creation rates than previously asserted, especially after controlling for demographics. Additionally, another test of the importance of opportunity costs comes from examining the post boom period. Specifically, as opportunity costs decreased in the post boom period, we might find that entrepreneurship in Silicon Valley increased even as entrepreneurial opportunities were declining due to worsening economic conditions.

3. Data

Although research on entrepreneurship is growing rapidly, there are very few national datasets that provide information on recent trends in business formation. Using matched data from the 1996 to 2005 CPS, we create a new measure of entrepreneurship. The new measure of entrepreneurship captures the rate of business creation at the individual owner level (Fairlie, 2010). The underlying datasets that are used to create the entrepreneurship measure are the basic monthly files to the CPS. By linking the CPS files over time, longitudinal data can be created, which allows for the examination of business creations. These surveys, conducted monthly by the U.S. Bureau of the Census and the U.S. Bureau of Labor Statistics, are representative of the entire U.S. population and contain observations for more than 130,000 people. Combining the 1996–2005 monthly data creates a sample size of more than 8 million adult observations.

Households in the CPS are interviewed each month over a 4-month period. Eight months later they are re-interviewed in each month of a second 4-month period. The rotation pattern of the CPS, thus allows for matching information on individuals from month to month for 75% of all respondents to each survey. To match these data, we use the household and individual identifiers provided by the CPS and remove false matches by comparing race, sex, and age codes from the 2 months. Monthly match

rates are generally between 94% and 96%, and false positive rates are very low. Because match rates are so high for month to month matches, self-employment rates and the demographic characteristics of matched individuals do not differ substantially from the original representative CPS sample.

3.1 Measuring Entrepreneurship

Potential measures of the number of existing business owners or businesses are readily available from several nationally representative government datasets, such as the Survey of Business Owners and the American Community Survey. Typical measures of business ownership based on these data, however, do not capture the dynamic nature that is generally implied when defining entrepreneurship. In particular, they do not measure business formation at the time the business is created.[3]

To estimate the entrepreneurship rate, we first identify all individuals who do not own a business as their main job in the first survey month. By matching CPS files, we then identify whether they own a business as their main job with 15 or more usual hours worked in the following survey month. The entrepreneurship rate is thus defined as the percentage of the population of nonbusiness owners that start a business each month.[4] To identify whether they are business owners in each month we use information on their main job defined as the one with the most hours worked. Thus, individuals who start side or casual businesses will not be counted if they are working more hours on a wage and salary job, and the hours worked restriction rules out the possibility of business ownership as "disguised unemployment" (Carter and Sutch, 1994). Tax record data on business ownership, such as the Survey of Business Owners and nonemployer business statistics, include a large share of businesses that are very small scale and do not represent the primary work activity of the owner (e.g., consultants).

A measure of business starts that has been commonly used in the previous literature is employer firm births from the Statistics of U.S. Businesses (SUSB) created by the U.S. Census Bureau and SBA (2010) and used in recent studies of geographical variation in business formation rates (Advanced Research Technologies, LLC, 2005; Burton: Center for American Progress, 2005). The exclusion of nonemployer firms, however, is likely to lead to a substantial undercount of the rate of entrepreneurship because nonemployer firms represent 75% of all firms (U.S. Small Business Administration, 2001; Headd, 2005) and a significant number of new employer firms start as nonemployer firms (Davis et al., 2006). Estimates of business formation from the CPS do not suffer from this problem because they include all new employer and nonemployer firms.

One difference between estimates of business creation in the CPS and those from business-level sources is caused by the difference between business owners and businesses. Multiple businesses owned by one individual count only once in individual-level data and businesses with multiple owners count only once in business-level

3. The Total Entrepreneurial Activity (TEA) index used in the Global Entrepreneurship Monitor captures individuals who are involved in either the startup phase or managing a business that is less than 42 months old (Reynolds et al., 2003).

4. Exit rates from business ownership can also be estimated, but the sample sizes become substantially smaller when conditioning on business ownership in the first survey month. The CPS does not provide any information on the reason for exit, and many exits can be considered successful and do not represent business closures (Headd, 2003). We report some estimates for business exit rates below.

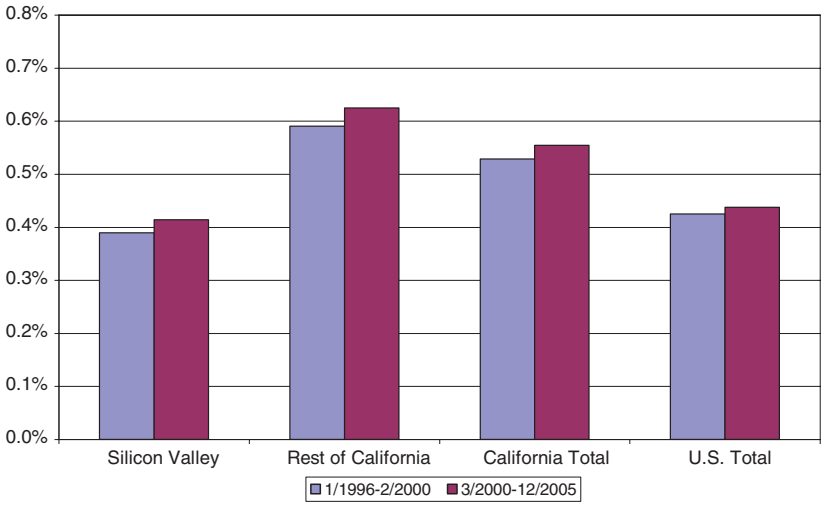

FIGURE 5. ENTREPRENEURSHIP RATES FOR HI-TECH INDUSTRIES BY GEOGRAPHICAL AREA (1996–2005)

data. These discrepancies are relatively minor, however, estimates from the 1992 CBO indicate that the total number of business owners is only 12% larger than the total number of businesses (U.S. Census Bureau, 1997). Similarly, Boden and Nucci (1997) find that less than 3% of small business records in the CBO pertain to owners of multiple businesses.

Using the detailed industry codes available in the CPS we narrow the sample of business starts to only hi-tech and related industries. Although total business creation is important and can also be examined, we focus on hi-tech because of the potential for revenue generation and the character of Silicon Valley. For the main analysis, we include workers in all industries related to information, computers, software, pharmaceuticals, scientific and technical services. A complete list is available in Appendix A.[5] We also check the robustness of results using alternative definitions of hi-tech and report some results for all businesses for comparison. Our main findings are not sensitive to the exclusion of specific industries.

4. Entrepreneurship in Silicon Valley

As noted earlier, there is no evidence in the previous literature from a large, nationally representative dataset on patterns of entrepreneurship in Silicon Valley. Figure 5 and Table IA report estimates of entrepreneurship rates for Silicon Valley, the rest of California, the California total, and the United States from the matched CPS data. Estimates are reported for January 1996 to February 2000, which is defined as the economic boom period, and from March 2000 to December 2005, which is defined as the post-boom

5. Hi-tech industries represent 23% of the workforce in Silicon Valley, which is more than double the percentage for the rest of the United States. Workers in these industries are also very educated with nearly 50% having at least a 4-year college degree compared with only 27% of workers in all other industries.

Table IA.
Entrepreneurship Rates for Hi-Tech Industries by Geographical Area (1996–2005)

	Silicon Valley		Rest of California		California Total		U.S. Total	
Year	Entrep. Index	Sample Size	Entrep. Index	Sample Size	Entrep. Index	Sample Size	Entrep. Index	Sample Size
1/1996–2/2000	0.39%	5,366	0.59%	15,217	0.53%	20,583	0.43%	171,376
3/2000–12/2005	0.41%	8,069	0.62%	19,820	0.55%	27,889	0.44%	265,687

Notes: (1) Estimates calculated using matched data from the CPS. (2) The entrepreneurship rate is the percent of individuals (ages 20–64) who do not own a business in the first survey month that start a business in the following month with 15 or more hours worked. (3) All observations with allocated labor force status, class of worker, and hours worked variables are excluded. (4) Silicon Valley is defintied as the San Jose, San Francisco and Oakland MSAs.

period.[6] The cutoff between time periods coincides with the highest point reached by the NASDAQ, which was on March 10, 2000.[7]

Entrepreneurship rates were lower in Silicon Valley than the national average during the boom period of the late 1990s. From January 1996 to February 2000, the business creation rate in Silicon Valley was 0.39% compared to 0.43% in the United States. The rate of entrepreneurship for Silicon Valley indicates that 390 per 100,000 hi-tech workers started a business each month during this period. Silicon Valley also had a lower business creation rate during this period than the California total. Another interesting pattern that emerges from the data is that Silicon Valley has a higher entrepreneurship rate in the 6 year period after the peak of the NASDAQ than during the economic boom of the late 1990s. The entrepreneurship rate increased from 0.39% to 0.41%. The U.S. rate also increased, but only slightly between the two periods. These findings are inconsistent with the common perception that the late 1990s were a period of unbridled entrepreneurship in Silicon Valley. The high returns to wage and salary work in Silicon Valley may have dampened the number of individuals creating new businesses.

We follow the convention of defining the Silicon Valley as the San Jose, San Francisco and Oakland MSAs (see Fallick et al., 2006, e.g.). These patterns for Silicon Valley appear to be primarily driven by the San Jose MSA.[8] We find that the hi-tech entrepreneurship rate was 0.17% in the San Jose MSA for the late 1990s, which is lower than the Silicon Valley and U.S. rates. The business creation rate increased to 0.23% in the post boom period. In contrast to these patterns the business creation rates for

6. January 1996 is chosen as the start of the strong economic growth period of the 1990s for two reasons. First, although the trough of the business cycle was officially March 1991 and the national unemployment rate reached its peak in mid 1992, real GDP growth was not consistently high until the third quarter of 1995 (it was very low in the first two quarters of 1995). Thus, 1996 is the first year in which the unemployment rate was consistently declining and real GDP growth was consistently high. Second, it is not possible to create entrepreneurship data for 1994 and 1995. In these years, the Bureau of Labor Statistics re-randomized the identification codes making it impossible to match individuals over time. December 2005 is chosen as the end date for the post period because it was the last year of available data from the BLS and provides five full years of data after the dot com bust which corresponds roughly with the length of the boom period. It also captures a period when the NASDAQ was relatively steady and before unemployment reached its low point before the recession starting in 2007. We find that the estimates of entrepreneurship rates are not sensitive to the end dates of our analysis period.

7. The NASDAQ hit its peak on March 10, 2000 and plummeted after that date. The national unemployment rate hovered around 4% in 2000, but then started rising very rapidly starting in late 2000, and real GDP growth dropped precipitously from 1999 Q4 to 2000 Q1.

8. The San Jose/Sunnyvale/Santa Clara MSA comprises 52% of the hi-tech labor force in Silicon Valley and 32% of the total adult population. The demographic characteristics of the San Jose/Sunnyvale/Santa Clara MSA do not differ substantially from those of Silicon Valley.

Table IB.
Business Exit Rates for Hi-Tech Industries by Geographical Area (1996–2005)

	Silicon Valley		Rest of California		California Total		U.S. Total	
Year	Exit Rate	Sample Size	Exit Rate	Sample Size	Exit Rate	Sample Size	Exit Rate	Sample Size
1/1996–2/2000	3.00%	498	3.58%	2,019	3.44%	2,517	2.60%	17,579
3/2000–12/2005	3.62%	592	2.66%	2,734	2.87%	3,326	2.40%	27,988

Notes: (1) Estimates calculated using matched data from the CPS. (2) The business exit rate is the percent of individuals (ages 20–64) who own a business with 15 or more hours worked in the first survey month that do not own a business in the following month. (3) All observations with allocated labor force status, class of worker, and hours worked variables are excluded. (4) Silicon Valley is defintied as the San Jose, San Francisco and Oakland MSAs.

San Francisco and Oakland MSA during the boom period were both higher than the national rate. Both rates were 0.64% for the late 1990s and their combined rate decline to 0.60 in the early 2000s.[9] Although we continue to define the Silicon Valley as the broader region encompassing the cluster of hi-tech firms, it is reassuring that the patterns of hi-tech entrepreneurship that we find for Silicon Valley are even stronger when we focus on the center of Silicon Valley—the San Jose-Sunnyvale-Santa Clara MSA.

4.1 Successful Entrepreneurship

Although the focus of our study is on overall business creation, it is also useful to examine whether there are differences between Silicon Valley and the rest of the United States in successful business creation. Ideally, business success would be gleaned from a dataset that follows new businesses or business owners over several years to determine whether they are successful. However, to our knowledge, no long-term panel datasets exist with large enough sample sizes to focus on Silicon Valley and information on owner characteristics. Entrepreneurship as measured in the CPS captures the creation of all types of businesses including nonemployer, employer, incorporated, and unincorporated businesses. To proxy for the types of businesses that might be successful we examine rates of business creation for two of these factors—incorporated businesses and employer businesses.[10] In addition, we examine patterns of business exit to capture potential geographical differences in likely success of firms. The matched CPS provides information on business exit rates and incorporated businesses.

We start by examining whether hi-tech business exit rates were higher in Silicon Valley than the rest of the United States. The matched CPS data allow us to look at monthly business exit rates. If business exit rates were considerably lower in Silicon Valley during the boom period of the late 1990s then it raises concerns that successful hi-tech entrepreneurship may have been higher in Silicon Valley even though overall hi-tech entrepreneurship was lower. We find that the monthly business exit rate is 0.030 for Silicon Valley, which is 13% higher than for the rest of the United States (see Table IB). The similarity of exit rates does not raise concerns that there is a major

9. San Francisco and Oakland are combined in the post boom period because these PMSAs are combined in the later years of our sample period.

10. Many very successful young firms, especially in hi-tech industries, are unincorporated and do not have employees (U.S. Census Bureau, 1997, 2006).

Table IC.
Incorporated Entrepreneurship Rates for Hi-Tech Industries by Geographical Area (1996–2005)

	Silicon Valley		Rest of California		California Total		U.S. Total	
Year	Entrep. Index	Sample Size	Entrep. Index	Sample Size	Entrep. Index	Sample Size	Entrep. Index	Sample Size
1/1996–12/1999	0.05%	5,756	0.05%	16,800	0.05%	22,556	0.08%	183,330
1/2000–12/2005	0.05%	8,466	0.08%	21,747	0.07%	30,213	0.10%	282,605

Notes: (1) Estimates calculated using matched data from the CPS. (2) The incorporated entrepreneurship rate is the percent of individuals (ages 20–64) who do not own an incorporated business in the first survey month that start an incorporated business in the following month with 15 or more hours worked. (3) All observations with allocated labor force status, class of worker, and hours worked variables are excluded. (4) Silicon Valley is definted as the San Jose, San Francisco and Oakland MSAs.

Table ID.
Annual Employer Establishment Creation Rates for All Industries by Geographical Area (1996-2005)

Year	Silicon Valley Creation Rate	Rest of California Creation Rate	California Total Creation Rate	U.S. Total Creation Rate
1/1996–12/1999	0.47%	0.53%	0.52%	0.52%
1/2000–12/2005	0.50%	0.50%	0.50%	0.50%

Notes: (1) Source: Statistics of U.S. Businesses data, U.S. Census Bureau and U.S. Small Business Administration http://www.census.gov/econ/susb/data/susb2004.html. (2) The employer establishment creation rate is the number of new employer establishments created each year divided by the adult non-business owning population estimated from the CPS. (3) Silicon Valley is defined as the San Jose, San Francisco and Oakland MSAs.

difference when comparing total hi-tech entrepreneurship and successful hi-tech entrepreneurship in Silicon Valley to the rest of the United States.

We next examine whether the creation of incorporated hi-tech businesses was higher in Silicon Valley than the rest of the United States. Owners of incorporated businesses represent roughly one-third of all business owners with these businesses often being more successful. Table IC reports rates of incorporated business creation for Silicon Valley and other areas. We find that the rate of incorporated entrepreneurship in Silicon Valley is lower than the rate for the rest of the United States. The incorporated entrepreneurship rate did not increase from the late 1990s to the early 2000s, but estimates of these rates are less precise because of much lower rates of incorporated business creation.[11]

The CPS does not provide information on whether businesses have employees. To examine patterns of employer firm creation we rely on published estimates from the Statistics of U.S. Businesses (SUSB) which is produced by the U.S. Census Bureau and U.S. Small Business Administration. We examine rates of employer business formation for Silicon Valley and make comparisons to the United States. Estimates are reported in Table ID. A major limitation of these data, however, is that they include all industries. Estimates for specific industries, such as hi-tech, are not available at the MSA-level. In Silicon Valley the annual rate of employer business formation was 0.47% in the late 1990s, which is lower than the annual rate of employer business formation of 0.52% in the

11. Even with a similar sample size, there is less relative precision for a variable with a very small proportion of ones than for a variable with a higher proportion of ones, which makes it difficult to identify statistically significant differences (see Cohen, 1988, for example).

United States. We also find that the annual employer business formation rate increased from the late 1990s to the early 2000s in Silicon Valley. Both patterns of employer business formation confirm those found above for the entrepreneurship rate using the CPS.[12]

In sum, the analysis of successful entrepreneurship does not change our conclusion regarding the two key empirical findings from the analysis of entrepreneurship rates in Silicon Valley.[13] Silicon Valley had a lower rate of hi-tech entrepreneurship in the late 1990s than the rest of the United States. In the early 2000s, entrepreneurship rates increase in Silicon Valley as the economy contracted. The results for alternative measure of entrepreneurship strengthen the confidence we have in these patterns.

5. Entrepreneurship in the Late 1990s

The initial examination of estimates from the CPS reveals that hi-tech entrepreneurship rates were lower in Silicon Valley than the rest of the country during the late 1990s. In this section, we further investigate the finding of a relatively low rate of business creation in Silicon Valley during the strong economic growth period of the late 1990s. The first question to address is how does Silicon Valley compare to other large MSAs around the country in terms of rates of business creation during the late 1990s? Table II reports estimates of entrepreneurship rates for the 20 largest MSAs for the period from January 1996 to February 2000. In the boom period of the late 1990s, the entrepreneurship rate in Silicon Valley was in the top half of the distribution of the largest MSAs in the United States. However, there were many large MSAs that had higher hi-tech entrepreneurship rates than Silicon Valley. Silicon Valley was only ranked 9th out of 20 MSAs. The comparison across MSAs reveals that Silicon Valley did not have one of the highest rates of entrepreneurship during the late 1990s possibly due to the exceptionally tight labor market in Silicon Valley during this period.[14]

5.1 Controlling for Demographic Characteristics

Differential rates of entrepreneurship in Silicon Valley than the rest of the United States during the late 1990s may be partly due to who lives there and works in hi-tech industries. For example, Silicon Valley has a very highly educated workforce, and education is found to be positively correlated with entrepreneurship (Moutray, 2007; van et al., 2004). Thus, the difference between business creation rates in Silicon Valley and the United States may be even larger once the highly educated workforce is taken into consideration. Silicon Valley also has a large concentration of immigrants, and entrepreneurship rates overall

12. Previous research also indicates similar patterns of business creation between the measure of entrepreneurship used here and the alternative employer firm measure (Stangler and Kedrosky, 2010).

13. The average number of venture capital deals obtained by startups in Silicon Valley was 53.3 per quarter in the late 1990s. This number of venture capital deals was relatively high compared to the rest of the United States (106.8 per quarter) and to the post-boom period in Silicon Valley (18.8 per quarter), but the receipt of venture capital represents only a fraction of startups and does not capture overall levels of business creation in the area. Venture capital flows over time also do not capture trends in business formation (Stangler and Kedrosky, 2010).

14. Estimates of employer business starts over a longer time period also indicate that San Francisco and San Jose do not have high rates compared to other cities (Advanced Research Technologies, 2005). The average rate of new employer firm births per 1,000 labor force from 1990 to 2001 was 3.554 in San Jose and 3.963 in San Francisco placing these cities at the 125th and 74th ranked cities out of 394 cities in the United States, respectively. These estimates, however, cover the entire 1990s and do not focus on hi-tech startups.

Table II.
Hi-Tech Entrepreneurship Rates for the Largest MSAs (1996–2000)

MSA or PMSA	Entrep. Index	Sample Size
New York, NY PMSA	1.14%	3,952
Los Angeles-Long Beach, CA PMSA	0.77%	8,143
Phoenix-Mesa, AZ MSA	0.59%	2,300
San Diego, CA MSA	0.49%	1,657
Orange County, CA PMSA	0.46%	2,016
Seattle-Bellevue-Everett, WA PMSA	0.45%	2,232
Washington, DC-MD-VA-WV PMSA	0.44%	5,254
Baltimore, MD PMSA	0.40%	1,017
Silicon Valley	0.39%	5,366
Minneapolis-St., Paul, MN-WI MSA	0.38%	2,417
Atlanta, GA MSA	0.38%	2,358
Boston, MA-NH PMSA	0.35%	4,028
Houston, TX PMSA (Chambers County not in sample)	0.34%	1,818
Riverside-San Bernardino, CA PMSA	0.32%	895
St. Louis, MO-IL MSA (Crawford County, MO [part] not in sample)	0.29%	1,003
Philadelphia, PA-NJ PMSA	0.28%	4,063
Chicago, IL PMSA (Dekalb County not in sample)	0.25%	6,943
Nassau-Suffolk, NY PMSA	0.22%	1,791
Detroit, MI PMSA	0.22%	2,622
Dallas, TX PMSA	0.22%	3,017

See notes to Table I.

are higher among immigrants than the native-born (Schuetze and Antecol, 2006).[15] But, the effect of immigration on hi-tech entrepreneurship is unknown and may be negative. If the effect is negative then having a large concentration of immigrants may explain why Silicon Valley has a lower rate of hi-tech entrepreneurship the rest of the United States. To investigate these questions further, we first compare the demographic characteristics of Silicon Valley residents to the national average.

Table III reports estimates for several demographic characteristics of the hi-tech workforce for Silicon Valley and the United States.[16] Nearly 32% of hi-tech workers living in Silicon Valley are immigrants, with 20.9% coming from Asian countries. In contrast, the U.S. hi-tech workforce is 12% immigrant with 5.3% from Asian countries. The Silicon Valley workforce also has a larger concentration of U.S. born Asians and slightly higher concentration of U.S. born Latinos, but has a lower concentration of African-Americans than the United States total. Another major difference between Silicon Valley and the rest of the United States is the education level of the hi-tech workforce. In Silicon Valley, 57.5% of the workforce has a college or graduate degree compared to the 42.9% in the United States. Controlling for highly educated workforce and other characteristics of the population in Silicon Valley may result in even lower entrepreneurship rates relative to the United States.

15. The importance of immigrants to Silicon Valley has been noted in the previous literature (Saxenian, 1999, 2000).

16. The patterns are similar when examining the total population in Silicon Valley and the United States.

Table III.
Demographic Characteristics of Silicon Valley and the United States (1996–2000)

	Silicon Valley	United States
Female	38.3%	39.1%
Black	5.0%	8.8%
U.S.-born Latino	4.5%	4.0%
U.S.-born Asian	4.5%	1.3%
Native American	0.8%	0.6%
Immigrant Latino	3.6%	2.8%
Immigrant Asian	20.9%	5.3%
Immigrant other	7.2%	4.1%
Age	38.4	38.7
Married	56.2%	61.9%
Previously married	12.3%	13.0%
High school graduate	12.6%	23.3%
Some college	27.5%	29.7%
College graduate	35.9%	30.3%
Graduate school	21.6%	12.6%
Home owner	61.3%	70.8%
Sample Size	5,366	171,376

See notes to Table IA.

5.2 An Empirical Model of Entrepreneurship

To control for differences between Silicon Valley and the rest of the United States in these and other factors, multivariate regressions for hi-tech entrepreneurship are estimated. These regressions are useful for identifying the determinants of entrepreneurship. The determinants of business creation can be explored by using the detailed demographic and employment information available in the CPS. The effects of gender, race/ethnicity, nativity, age, education, marital status, employment status, region, urban status, and home ownership on the probability of entrepreneurship are examined. The inclusion of these variables controls for geographical differences in demographic and employment characteristics and changes over time in these characteristics.[17] Although estimates of entrepreneurship rates have been created from the CPS, the determinants of entrepreneurship at the micro level have not been explored using the underlying data. Furthermore, a large literature explores the regional characteristics associated with firm formation, but these studies do not have information on the characteristics of individual business owners and focus on employer firm formation. Individual-level analyses using microdata improve on MSA-level analyses because they control directly for individual differences and implicitly for the main metropolitan area differences in detailed demographic and employment characteristics. In other words, the use of microdata accounts for MSA-level variation in the same measures.

17. Examining the entire adult population in Silicon Valley, we do not find evidence of strong trends in these individual characteristics from migration. There is some evidence of increasing shares of immigrant Latinos and Asians, but these appear to be smooth, slower moving trends over the period. We also might be concerned about individuals who are more entrepreneurial based on unobservable characteristics moving to Silicon Valley, but this would increase rates in Silicon Valley relative to the rest of the United States, making the underlying difference even larger.

Table IV.
Probit Regressions for Hi-Tech Entrepreneurship, CPS (1996–2000)

Explanatory Variables	(1)	(2)	(3)	(4)
Female	0.00026**	− 0.00086**	− 0.00084**	− 0.00080**
	(0.00002)	(0.00002)	(0.00002)	(0.00002)
Black	− 0.00162**	− 0.00178**	− 0.00170**	− 0.00166**
	(0.00004)	(0.00004)	(0.00004)	(0.00004)
U.S.-born Latino	− 0.00222**	− 0.00232**	− 0.00258**	− 0.00233**
	(0.00006)	(0.00006)	(0.00006)	(0.00006)
U.S.-born Asian	− 0.00452**	− 0.00465**	− 0.00495**	− 0.00444**
	(0.00013)	(0.00012)	(0.00012)	(0.00012)
Native American	0.00258**	0.00148**	0.00137**	0.00162**
	(0.00010)	(0.00010)	(0.00010)	(0.00010)
Immigrant Latino	− 0.00250**	− 0.00323**	− 0.00351**	− 0.00308**
	(0.00008)	(0.00008)	(0.00008)	(0.00008)
Immigrant Asian	− 0.00289**	0.04520**	0.04351**	0.03909**
	(0.00005)	(0.00066)	(0.00066)	(0.00069)
Immigrant other	− 0.00012**	− 0.05339**	− 0.05150**	− 0.04565**
	(0.00004)	(0.00079)	(0.00079)	(0.00083)
Age (00s)	− 0.02395**	0.04520**	0.04351**	0.03909**
	(0.00066)	(0.00066)	(0.00066)	(0.00069)
Age squared	0.04154**	− 0.05339**	− 0.05150**	− 0.04565**
	(0.00077)	(0.00079)	(0.00079)	(0.00083)
High School graduate	− 0.00003	0.00089**	0.00095**	0.00101**
	(0.00006)	(0.00006)	(0.00006)	(0.00007)
Some college	0.00167**	0.00244**	0.00244**	0.00261**
	(0.00006)	(0.00006)	(0.00006)	(0.00007)
College graduate	0.00326**	0.00420**	0.00424**	0.00423**
	(0.00006)	(0.00006)	(0.00006)	(0.00007)
Graduate school	0.00517**	0.00572**	0.00579**	0.00565**
	(0.00006)	(0.00006)	(0.00006)	(0.00007)
Home owner	− 0.00124**	− 0.00098**	− 0.00092**	− 0.00110**
	(0.00002)	(0.00002)	(0.00002)	(0.00002)
Unemployed		0.00814**	0.00805**	0.00808**
		(0.00003)	(0.00003)	(0.00003)
Not in the labor force		0.01417**	0.01416**	0.01393**
		(0.00002)	(0.00002)	(0.00003)
Silicon Valley	− 0.00078**	− 0.00036**	− 0.00010*	− 0.00032**
	(0.00005)	(0.00004)	(0.00004)	(0.00004)
Other California			0.00141**	
			(0.00003)	
Mean of dependent variable	0.00425	0.00425	0.00425	0.00420
Log Likelihood value	−1277838	−1059632	−1058265	−962082
Sample size	171,376	171,376	171,376	151,238

Notes: (1) The sample consists of individuals in hi-tech industries (ages 20–64) who do not own a business in the first survey month. The sample used in Specification 4 excludes individuals living in rural areas. (2) Marginal effects and their standard errors are reported. * and ** denote statistical significance at the 0.05 and 0.01 levels, respectively. (3) Additional controls include month, year, and urban status dummies.

Table IV reports marginal effects estimates from several probit regressions for the probability of entrepreneurship in hi-tech industries.[18] The base specification is

18. Marginal effects are estimated using the coefficient estimates and the full sample distribution. They provide an estimate of the effect of a 1 unit change in the explanatory variable on the probability of entrepreneurship.

reported in the first column. The probit estimates indicate that women are more likely to become hi-tech entrepreneurs than men controlling for other characteristics. Although the results changes after we include additional controls below it contrasts with the common finding of lower rates of overall entrepreneurship among women (Parker, 2004). African-Americans, U.S.-born Latinos and Asians are also less likely to start businesses in high-tech industries, and Native Americans are more likely to start hi-tech businesses, all else equal.[19] Immigrants are also less likely to start businesses controlling for other factors. Latino, Asian and other immigrants are all less likely to start hi-tech businesses, which may be the result of visa requirements focusing on employment. When all industries are included, immigrants are typically found to have higher rates of entrepreneurship (Schuetze and Antecol, 2006; Fairlie, 2006). To our knowledge, this is the first estimate of the effect of immigration on hi-tech entrepreneurship from nationally representative data.

The relationship between business creation and age is quadratic, first increasing with age and then declining with age. The strongest relationship is between education and entrepreneurship. The probability of hi-tech entrepreneurship increases sharply with each higher level of education. For example, individuals with a graduate degree are 0.15 percentage points more likely to start a business than just having a college degree. Home owners are less likely to enter self-employment.[20]

As noted earlier, for a few of these determinants of entrepreneurship, Silicon Valley differs from the rest of the United States. Two major differences are that Silicon Valley has a larger concentration of immigrants and has a more educated population than the rest of the United States. Immigrants are less likely to start hi-tech businesses, which could explain why Silicon Valley has a lower rate of entrepreneurship than the United States. On the other hand, Silicon Valley has a more educated population than the rest of the United States putting upward pressure on entrepreneurship rates. In the end, the lower rate of entrepreneurship in Silicon Valley than the United States displayed in Table I and Figure 5 may just be due to lower concentrations of the types of individuals who are likely to start businesses.

In addition to the control variables, Specification 1 includes a dummy variable for Silicon Valley. The estimates indicate that after controlling for immigration, education and other demographic characteristics, Silicon Valley has an even lower rate of business creation than the United States. The coefficient estimate is large, negative and statistically significant. It implies that rate of entrepreneurship in Silicon Valley was 0.078 percentage points lower than the rest of the country. The actual entrepreneurship rates were 0.39% for Silicon Valley and 0.43% for the United States implying a difference of 0.035 percentage points. Thus, we find that on balance the demographic characteristics of hi-tech workers (e.g., more educated workforce) are favorable to entrepreneurship and that entrepreneurship is relatively lower in Silicon Valley than our previous estimates indicated.[21]

In Specification 2, we control for whether the individual was unemployed or not in the labor force in the first survey year. The coefficient estimates indicate that the

19. See Fairlie and Robb (2008) for more details on African-American and Asian business ownership.

20. Previous studies find that home prices, home ownership and property restitution increase the likelihood of business creation and self-employment (Black et al., 1996; Johansson, 2000; Earle and Sakova, 2000; Fairlie, 2005; Fairlie and Krashinsky, 2012). The results may differ for hi-tech industries because of higher levels of wealth and lower levels of capital needed to start businesses.

21. We also find a large negative coefficient when we include a separate dummy variable for the San Jose-Sunnyvale-Santa Clara MSA. The coefficients on San Francisco and Oakland dummies, however, are positive and small.

unemployed and those not in the labor force are more likely than wage and salary workers to start businesses in the following month.[22] The unemployed and individuals not in the labor force may face different incentives for entrepreneurship, especially if they are job losers. More specifically, they have a lower opportunity cost of starting a business because of the lost returns to tenure and experience on their jobs. More importantly, however, we find that the coefficient on Silicon Valley is smaller, although it remains negative and statistically significant. After controlling for initial employment and demographic characteristics, we find that Silicon Valley has an entrepreneurship rate that is 0.036 percentage points lower than the rest of the United States.

There are two important implications from this finding. First, lower initial unemployment rates partially capture the higher opportunity costs associated with starting a business in Silicon Valley during the boom. Once these partial opportunity costs are controlled for, the difference between entrepreneurship rates in Silicon Valley and the rest of the United States become smaller. Second, controlling for demographic characteristics and employment characteristics, which capture some of the opportunity costs, does not change the initial finding of a lower entrepreneurship rate in Silicon Valley than in the rest of the United States.

The rest of California also has a higher rate of business creation than Silicon Valley and the United States. To compare Silicon Valley to the United States outside of California, we include a dummy variable for other parts of California in Specification 3. The coefficient on Silicon Valley is now interpreted as the difference between the entrepreneurship rate in Silicon Valley and the United States outside of California. We find that entrepreneurship rates were lower in Silicon Valley than the United States outside of California. The difference is smaller in absolute values, but remains negative and statistically significant. Even removing the rest of California, we continue to find that Silicon Valley had lower business formation rates in hi-tech industries in the late 1990s than the rest of the country.

Taken together, these regression estimates clearly indicate that Silicon Valley in the "Roaring 90s" was not a place and time of exceptionally high rates of entrepreneurship. Although Silicon Valley has a larger concentration of immigrants, which places downward pressure on hi-tech entrepreneurship rates, the highly educated workforce, which is associated with higher rates of hi-tech entrepreneurship, and other factors more than offset the effect. The result is that entrepreneurship rates continue to be lower in Silicon Valley than the United States during the late 1990s. The mean differences and regression estimates indicate that entrepreneurship rates were roughly 10–20% lower in Silicon Valley.

5.3 Additional Estimates

We check the sensitivity of results to several additional specifications and samples. One concern is that we are comparing Silicon Valley partly to rural areas in the rest of the United States, which might not be appropriate. As a robustness check, we exclude individuals living in rural areas from the sample. The determinants of entrepreneurship in rural areas may also differ from the determinants in more urban areas. Specification 4 of Table IV reports estimates. The coefficients are not sensitive to the exclusion of these

22. Controlling for unemployment and NILF also changes the age function from being concave and generally negative to convex and generally positive.

observations, which represent 11.8% of the full sample of hi-tech workers. The exclusion of individuals living in rural areas from the regressions results in a slightly smaller coefficient on the Silicon Valley dummy variable (0.0032). The coefficients, however, remain large, negative and statistically significant indicating lower rates of entrepreneurship in Silicon Valley than the U.S. total. Thus, the estimates for the comparison to the rest of the United States are not sensitive to the inclusion of rural areas.

Although not reported, we also check the sensitivity of results to larger metropolitan areas. Excluding small metropolitan areas, we find a coefficient estimate of −0.000746, which is similar to what we find using the full sample (reported in Specification 1). The coefficient remains positive and statistically significant. We also check the sensitivity to hours worked. Restricting entrepreneurship to individuals with at least 30 hours worked per week, we also find similar results for the Silicon Valley coefficient. Finally, we estimate the regressions using a logit model and a linear probability model and find similar marginal effect estimates. Overall, the reported estimates are not sensitive to alternative specifications, samples and estimation techniques.

Another concern is that immigrants in Silicon Valley differ from those residing in the rest of the country. We find that immigrants from India, China, Vietnam, and the Philippines represent the highest shares of immigrant groups working in hi-tech industry in the Silicon Valley. These groups also have high concentrations in the hi-tech industry in the rest of the United States, but much lower than in Silicon Valley. When we include detailed controls for these groups and several additional immigrant groups we find similar estimates for the Silicon Valley coefficient, indicating lower rates of entrepreneurship than the rest of the country. For another check of the results we interact education with the immigrant variables and also find similar estimates for the Silicon Valley coefficient. The results do not appear to be sensitive to differences between Silicon Valley and the rest of the United States in types of immigrants as measured by home country and education.

6. Entrepreneurship in Silicon Valley in the Post-Boom Period

Entrepreneurship rates in Silicon Valley rose from 0.39% in the January 1996 to February 2000 period to 0.41% in the March 2000 to December 2005 period (see Table I). This finding is consistent with the hypothesis that large opportunity costs in terms of a very tight labor market in Silicon Valley in the late 1990s may have suppressed business creation during this period. As the labor market worsened after March 2000 in Silicon Valley, we would expect to see entrepreneurship rates rise. The change in labor market conditions was also much more pronounced in Silicon Valley than the rest of the United States, which is consistent with the finding that entrepreneurship rates remained essentially constant in the United States from the pre- to post-boom periods.

This comparison between the pre- and post boom periods is useful for testing our hypothesis regarding the importance of opportunity costs in determining entrepreneurship rates. The comparison of pre to postperiods implicitly controls for all of the factors that are unique to Silicon Valley, such as the extreme concentration of established hi-tech firms, the presence of several leading universities and research institutes, and the distinct social networks among entrepreneurs. The major change in the post boom period was a decline in the local economy, possibly resulting in a substantial drop in the opportunity costs of starting a business. At the same

Table V.
Probit Regressions for Hi-Tech Entrepreneurship, CPS (1996–2005)

Explanatory Variables	(1)	(2)	(3)	(4)
Silicon Valley	−0.00075*		−0.00039*	−0.00027*
	(0.00005)		(0.00005)	(0.00004)
Silicon Valley Post Period	0.00024*	0.00040*	0.00025*	−0.00018*
	(0.00006)	(0.00005)	(0.00006)	(0.00005)
Other California			0.00187*	
			(0.00003)	
Other California Post Period			0.00001	
			(0.00004)	
Unemployment controls	No	No	No	Yes
Mean of dependent variable	0.00433	0.00409	0.00433	0.00433
Log Likelihood value	−3,229,179	−151,561	−3,223,807	−2,715,474
Sample size	432,846	13,296	432,846	432,846

Notes: (1) The sample consists of individuals (ages 20–64) who do not own a business in the first survey month. Specification 2 only includes observations for Silicon Valley. (2) Marginal effects and their standard errors are reported. * denotes statistical significance at the 0.01 level. (3) All specifications include controls for gender, race/ethnicity, nativity, age, marital status, education level, family income, urban status, month effects and year effects.

time however, entrepreneurial opportunities may have also declined rapidly. Thus, an increase in business creation rates in Silicon Valley from the pre to postperiods provides further evidence that is consistent with entrepreneurship rates being suppressed in Silicon Valley during the "Roaring 90s" due to an exceptionally tight labor market.

To explore this question more carefully, however, we need to confirm that the increase in entrepreneurship in Silicon Valley between the two time periods was not due to changes in demographic characteristics. We estimate probit regressions that include the full sample of observations from the beginning of 1996 to the end of 2005 and interactions with time periods (see Table V). Specification 1 includes the basic set of controls for demographic characteristics. Entrepreneurship increased in Silicon Valley from the boom period to the post boom period relative to changes in the national rate of entrepreneurship. The business creation rate in Silicon Valley increased by 0.024 percentage points after controlling for demographic characteristics and changes in the U.S. entrepreneurship rate. This estimated change is identical to the actual change in the entrepreneurship rate of 0.024 percentage points.

Specification 2 reports estimates from a sample for only Silicon Valley. In this specification, the rest of the U.S. is not used as the comparison group. We are simply comparing entrepreneurship rates in Silicon Valley in the post to the pre periods after controlling for changes in demographic characteristics. The estimated change in entrepreneurship rates is positive and larger than the previous estimates. Thus, removing the implicit controls for the slight upward trend in the U.S. rate results in a larger increase in entrepreneurship rates in the post-boom period in Silicon Valley. We return to including the rest of the United States to control for changes in the macro-economy over this period.

The estimates reported in Table I indicate that other parts of California also experienced an increase in entrepreneurship rates in the post period. To control for these trends, we include a dummy variable for the rest of California and interactions with the post period (Specification 3 of Table V). The estimates on the Silicon Valley

post variable do not change relative to the main specification. Business creation rates in Silicon Valley increase in the post period, possibly because of opportunity costs declined.

Although the increase in entrepreneurship rates in the post period is consistent with the effects of declining opportunity costs outweighing the effects of declining opportunities for entrepreneurship, there may be alternative explanations for the change in entrepreneurship rates. For example, workers may have fewer incentives to create spinoffs from large hi-tech firms in a boom period not only because of higher wages, but because capital is more available to large firms in boom periods. New projects in these firms can be funded more easily. Additional possible explanations are that large firms benefit more from their scale and scope economies in economic growth periods and that the growth in IT may have allowed large firms to better manage employees and become more productive.[23] Ruling out all possible explanations is difficult, but we can provide more evidence on the importance of declining opportunity costs. In particular, we include additional controls for previous unemployment and nonlabor force participation in our regression model (Specification 4). The inclusion of these variables partially controls for opportunity costs. The inclusion of unemployment and not being in the labor force changes the sign on the post-Silicon Valley dummy from positive to negative. Thus, higher business creation rates in Silicon Valley in the post-boom period disappear when we control for different rates of unemployment. As noted earlier, the unemployment rate in Silicon Valley rose from slightly more than 2% in the beginning of 2001 to 7.4% at its peak in the middle of 2003 (see Figure 2). The U.S. unemployment rate also rose over this period, but the increase was much smaller. The U.S. unemployment rate did not become nearly as high as the unemployment rate in Silicon Valley in the early 2000s. The combination of increasing entrepreneurship rates in Silicon Valley from the pre- to post-boom periods and the decline in coefficient estimates after controlling for initial unemployment provides additional evidence supporting the hypothesis that entrepreneurship rates were suppressed in the boom of the late 1990s in Silicon Valley, possibly due to high opportunity costs.

7. Conclusions

This study provides one of the first estimates of entrepreneurship rates in Silicon Valley during the so-called "Roaring 90s." The few previous estimates of entrepreneurship in Silicon Valley from large, nationally representative datasets do not focus on the strong economic growth period of the late 1990s, do not include new firms without employees, do not focus on hi-tech industries, or cannot control for the highly educated and other demographic characteristics of the entrepreneurs. Thus, the hypothesis that Silicon Valley was and is a place with unusually high entrepreneurship has not been previously tested. To test this hypothesis a new measure of entrepreneurship that includes all types of new businesses in hi-tech industries is created by matching monthly CPS from 1996 to 2005.

Estimates from the matched CPS indicate that hi-tech entrepreneurship rates were lower in Silicon Valley than the rest of the United States during the rapid economic expansion of the late 1990s. Business creation rates were lower in Silicon Valley during

23. As noted earlier, however, entrepreneurs and small businesses also appear to have benefited from the expansion of computers, the Internet and other technologies (Fairlie, 2005; Bitler, 2002; SBA, 2003; Buckley and Montes, 2002; Haltiwanger, 2004; Bitler et al., 2001).

this period even after controlling for the large concentration of immigrants, which places downward pressure on rates of business creation in hi-tech industries. The finding of lower entrepreneurship rates is robust to less inclusive measures of business formation that focus on the types of businesses that are potentially more successful. Business creation rates in Silicon Valley may have been suppressed by the exceptionally tight labor markets during this period. Unemployment rates, for example, almost hit a low of 2%.

Interestingly, estimates from matched CPS data indicate that entrepreneurship rates increased from the boom period of the late 1990s to the early 2000s in Silicon Valley relative to the United States. The business creation rate in Silicon Valley increased by 0.02 percentage points from the late 1990s to the post boom period. This result represents an interesting new finding. Entrepreneurship was higher after the dot com bust than in the late 1990s in Silicon Valley. But, even after controlling for demographic and employment characteristics Silicon Valley continued to have lower entrepreneurship rates than the rest of the United States. The substantial returns to the labor market in Silicon Valley may have depressed business creation, especially during the strong economic growth period of the late 1990s.

Besides these novel findings that run counter to the conventional wisdom about Silicon Valley, our work provides additional insights for the academic literature on entrepreneurship. First, our results suggest that in a strong economy, the number of entrepreneurial opportunities could indeed increase without commensurate increases in actual entrepreneurship. This result is driven by higher opportunity costs to entrepreneurship that dissuade some individuals from leaving salaried labor. Future theoretical and empirical research in management and economics needs to carefully consider the role of opportunity costs in the entrepreneurial decision.

Second, many cities in the United States and around the world are trying to emulate the Silicon Valley experience. The findings from this analysis indicate that, at least in terms of potentially creating high rates of entrepreneurship, the demographic characteristics of the population and economic conditions are important. In particular, having a highly educated workforce is likely to lead to more entrepreneurial activity and not just having an environment or "habitat" favorable for innovation and entrepreneurship (Lee et al., 2000). Future research should examine these regional dimensions of entrepreneurship further, utilizing different datasets and empirical approaches, and aim to empirically assess the effects of both opportunities and opportunity costs.

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Appendix A

Hi-Tech and Related Industries

2002	Description	2002			
CENSUS CODE	NAICS CODE				
2190	Pharmaceutical and medicine manufacturing	3254			
3360	Computer and peripheral equipment manufacturing	3341			
3370	Communications, audio, and video equipment mfging	3342,	3343		
3380	Navigational, measuring, electromedical, & control instruments manufacturing	3345			
3390	Electronic component and product manufacturing, n.e.c	3344,	3346		
3580	Aircraft and parts manufacturing	336411	to	336413	
3590	Aerospace products and parts manufacturing	336414,	336415,	336419	
3960	Medical equipment and supplies manufacturing	3391			
4190	Electrical goods, merchant wholesalers	4236			
4380	Drugs, sundries, & chemical & allied products, merchant wholesalers	4242,	4246		
4585	Wholesale electronic markets, agents & broker	4251			
4790	Radio, TV, and computer stores	443112,	44312		
5590	Electronic shopping	454111			
5591	Electronic	454112			
Information					
6470	Newspaper publishers	51111			
6480	Publishing, except newspapers & software	5111	exc.	51111	
6490	Software publishing	5112			
6570	Motion pictures and video industries	5121			
6590	Sound recording industries	5122			
6670	Radio and television broadcasting and cable	5151,	5152,	5175	
6675	Internet publishing and broadcasting	5161			
6680	Wired telecommunications carriers	5171			
6690	Other telecommunications services	517	exc.	5171,	5175
6692	Internet service providers	5181			
6695	Data processing, hosting, & related services	5182			
6770	Libraries and archives	51912			
6780	Other information services	5191	exc.	51912	
7290	Architectural, engineering, and related services	5413			
7370	Specialized design services	5414			
7380	Computer systems design & related services	5415			
7390	Management, scientific, & technical consulting services	5416			
7460	Scientific research and development services	5417			
7490	Other professional, scientific, and technical services	5419	exc	54194	