

High-Technology Entrepreneurship in Silicon Valley Opportunities and Opportunity Costs¹

Robert W. Fairlie²

Department of Economics
Engineering 2 Bldg.
University of California
Santa Cruz, CA 95060
rfairlie@ucsc.edu

Aaron K. Chatterji

Fuqua School of Business
Duke University
1 Towerview Drive
Durham, NC 27708
ronnie@duke.edu

July 2008

Abstract:

The economic expansion of the late 1990s undoubtedly 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 monthly files from the Current Population Survey (CPS) is used to provide the first test of the hypothesis that entrepreneurship 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 non-employer business starts, and focuses on only hi-tech industries. Estimates from the matched CPS data 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. Controlling for the large concentration of immigrants and highly-educated workforce does not change the conclusion. Examining the post-boom period, we find that entrepreneurship rates in Silicon Valley increased from the late 1990s to the early 2000s. In contrast, trends in entrepreneurship rates in the United States were constant over this period. Although Silicon Valley may be an entrepreneurial location overall, the extremely tight labor market of the late 1990s, especially in hi-tech industries, may have suppressed business creation during this period.

¹ 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 for helpful comments and suggestions. Oded Gurantz and Aparna Venkataraman provided excellent research assistance.

² Corresponding author

1. Introduction

The late 1990s were characterized by a state of rapidly rising stock prices, lucrative stock options, IPOs, 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. Remarkably, the national unemployment rate dropped below 4 percent 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. Both the number of personal computers and the number of people using the Internet increased by roughly 100 million from 1996 to 2001 in the United States (International Telecommunications Union 2005).

Silicon Valley, California played a major role in the expansion of ICTs in the 1990s. The large concentration of hi-tech industries in the corridor between San Francisco and San Jose is well known, and much emphasis was placed on the role of entrepreneurs and startups, especially in hi-tech industries and regions such as Silicon Valley in contributing to economic growth in the 1990s. The media dubbed it the "dot com" boom. There was the impression that most people were interested in becoming an entrepreneur or involved in some type of startup.³

However, although the conventional wisdom 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. While 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 entrepreneurship and business creation during this period. After all, 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 entrepreneurship may have been unusually high during this period. Therefore, it is an open

³ 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.

question as to whether this was a period of heightened entrepreneurship or one in which the returns to working at firms were too great.

To address this limitation in the literature, a new measure of entrepreneurial activity is used 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 non-employers. Recent measures of entrepreneurial activity or firm formation typically include only larger, employer firm births (see Advanced Research Technologies, LLC, 2005 and Burton: Center for American Progress 2005 for example). Employer firms represent only 25 percent of all existing firms (U.S. Small Business Administration 2001, Headd 2005), and a significant number of new employer firms start as non-employer firms (Davis, et. al. 2006). Another advantage of these data is that the analysis can focus on hi-tech industries instead of just aggregate business creation.

The large sample sizes and detailed demographic information available in the matched CPS allow for a comparison of entrepreneurship rates in Silicon Valley to the rest of the country and an empirical analysis of the determinants of entrepreneurship.⁴ Drawing from the prior literature in economics and management, several important hypotheses regarding entrepreneurship in Silicon Valley are tested. First, was entrepreneurship 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 salary earnings and the opportunity cost of capital were also rising rapidly during this period. Second, Silicon Valley has a highly-educated population and large concentration of immigrants, which are both associated with higher rates of entrepreneurship. Were entrepreneurship rates

⁴ Business-level datasets typically used to estimate firm formation include no information or only limited information on the entrepreneur.

higher in Silicon Valley than the rest of the United States after controlling for these differences in demographic characteristics and other characteristics such as previous employment status and industrial structure? Finally, did the downturn of the early 2000s reverse an upward trend in entrepreneurship or did entrepreneurship rise in Silicon Valley? 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 entrepreneurship rates were lower in Silicon Valley than the rest of the United States during the period from January 1996 to February 2000, even after controlling for the large concentration of immigrants and a highly-educated workforce. In the post boom period, we find that entrepreneurship rates in Silicon Valley increased while the national rate stayed constant. While our results challenge the conventional wisdom about Silicon Valley in the late 1990s, we also contribute to the academic literature on entrepreneurship in economics and management. Below, we discuss how prior work has separately emphasized the role of both entrepreneurial opportunities and opportunity costs in influencing entrepreneurial activities. In this paper, we bring together these perspectives to motivate our empirical approach. We then present our results and conclusions.

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 exploited by individuals. There is a substantial academic literature in economics and management on entrepreneurial opportunities that we consider below to motivate our empirical analysis.

Prior management research has argued that entrepreneurship requires the existence and exploitation of entrepreneurial opportunities (Shane and Venkataraman 2000). While most prior research on entrepreneurship focused on individual level characteristics, scholars have recently investigated the role of available opportunities in influencing entrepreneurial activities (Eckhardt and Shane 2003). The key question in this emerging literature is: Upon recognizing an entrepreneurial opportunity, why do

some individuals exploit the opportunity while others choose not to? Shane and Venkataraman (2000:223) argue that the expected payoff from an entrepreneurial opportunity is weighed against “the opportunity cost of other alternatives”.

Similarly, 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). Furthermore, Evans and Leighton (1989) find that low wages are associated with entry into entrepreneurship, using evidence from the National Longitudinal Survey and the Current Population Survey.

This logic provides several insights that are useful for thinking about entrepreneurship in the late 1990s and subsequent downturn in Silicon Valley and the rest of the United States. First, the economic boom of the 1990s provided strong consumer and firm demand for products and services provided by startups, thus increasing entrepreneurial earnings. 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 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. Estimates from the 1998 Survey of Small Business Finances indicate that more than 75 percent of small businesses used computers (Bitler, Robb and Wolken 2001, and Bitler 2002), and estimates from the 2000 Computer and Internet Usage Supplement (CIUS) to the Current Population Survey (CPS) indicate high rates of computer ownership among self-employed

business owners (U.S. Small Business Administration 2003). Small- and medium-sized businesses are also found to make relatively large investments in computers and communication equipment (Buckley and Montes 2002) and 25 to 45 percent of total capital expenditures are for computers among relatively young employer firms (Haltiwanger 2004).⁵ There is also direct evidence that access to personal computers increases entrepreneurship (Fairlie 2005). Personal computers may make it easier for a potential entrepreneur to create an experimental business plan, obtain information about tax codes and legal regulations, conduct research on production techniques and competition, and may be useful to new business owners for accounting, inventory, communications, and advertising.⁶

On the other hand, earnings in the wage and salary sector were increasing very rapidly during this period (increasing *w*) 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 *percent* in December 2000. Overall, the late 1990s were a period when the returns to the wage and salary sector were at unprecedented levels.⁷

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

⁵ Large investments in computer equipment, however, may only occur after the initial stages of business formation. Investments in computers per employee increase rapidly with firm size (Buckley and Montes 2002), and computer investment as a share of total capital expenditures increases rapidly with firm age, at least through the first five years (Haltiwanger 2004).

⁶ Estimates from the Survey of Small Business Finances indicate that the four most common uses of computers in small businesses are for administrative purposes, bookkeeping, email and managing inventory (Bitler 2002).

⁷ 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, Fleishman and Rebitzer 2006). On the other hand, high levels of job mobility might also result in a higher chance of starting a business.

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 may have been much easier to find during the late 1990s, especially in hi-tech areas such as Silicon Valley.⁸ 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 money. In the end, there is no clear theoretical prediction from economic or management theory regarding whether the boom of the 1990s was a time of heightened entrepreneurship. While economic theory provides us with a simple model to weigh the benefits of entrepreneurship against the costs, it reveals no clear predictions about entrepreneurship rates in a “boom” economy like that of 1990s Silicon Valley. While management scholars have focused on entrepreneurial opportunities, they have often deemphasized the opportunity costs of entrepreneurship which may influence the exploitation of these opportunities.

THE UNIQUENESS 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. 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

⁸ Strong network ties in Silicon Valley may have also increased access to financial capital. See Shane and Cable (2002) for evidence on the impact of network ties on financing of new firms.

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).

Although there are many reasons to suspect that Silicon Valley differs from rest of the United States in the creation of hi-tech businesses, these factors are notoriously difficult to measure. Admittedly, the matched CPS data are not ideal for examining these questions. Instead, our empirical strategy is to compare entrepreneurship in Silicon Valley in the pre period (late 1990s) to entrepreneurship in Silicon Valley in the post period (early 2000s) to implicitly control for these difficult-to-measure factors. Although the factors listed above did not change much during our sample period, economic conditions sharply declined, reducing the opportunity cost of entering entrepreneurship. The pre/post comparison isolates the impact of changing opportunity costs on entrepreneurship by controlling for the factors that make Silicon Valley unique.

In sum, we employ the logic of entrepreneurial opportunities and opportunity costs to assess the level of high technology entrepreneurship in Silicon Valley from 1996-2005. 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 argue that the higher opportunity cost of entering entrepreneurship in Silicon Valley may have actually resulted in lower entrepreneurship 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 actually increased as more individuals exploited entrepreneurial opportunities.

Our study makes several theoretical and empirical contributions to the extant literature. First, we extend the insights from previous work by investigating the existence and exploitation of entrepreneurial opportunities. We also emphasize the point that increases in the number of entrepreneurial opportunities are often associated with increases in the opportunity cost of exploitation, which complicates the theoretical and empirical relationship between opportunities and entrepreneurial activity. Finally, we introduce and implement a new measure of entrepreneurship which indicates that Silicon Valley, long

described as the most important location for entrepreneurship in the world, was not as entrepreneurial during the strong economic growth period of the late 1990s as previously assumed. These novel results, if confirmed in other studies, will have an impact on both academic and popular views of entrepreneurship in the United States.

In the next section, we discuss our data and then proceed to introduce our measure of entrepreneurship, the empirical approach, and results. We conclude with implications for future research and limitations of our data.

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 1996-2005 Current Population Surveys (CPS), we create a new measure of entrepreneurship. The new measure of entrepreneurship captures the rate of business creation at the individual owner level.⁹ The underlying datasets that are used to create the entrepreneurship measure are the basic monthly files to the Current Population Survey (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 to 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. Thus, individuals who are interviewed in January, February, March and April of one year are interviewed again in January, February, March and April of the following year. 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

⁹ National and state-level estimates are reported in Fairlie (2008) as the "The Kauffman Index of Entrepreneurial Activity (KIEA)."

race, sex and age codes from the two months. All non-unique matches are also removed from the dataset. Monthly match rates are generally between 94 and 96 percent, 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. There are only slight differences between the matched sample and the full sample with the matched sample generally being slightly younger, less educated and more disadvantaged.

MEASURING ENTREPRENEURSHIP

Potential measures of the number of existing business owners or businesses are readily available from several nationally representative government datasets. For example, the Economic Census: Survey of Business Owners provides estimates of the total number of businesses every 5 years, and the CPS provides estimates of the total number of self-employed business owners every month.¹⁰ 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.¹¹

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 non-business owners that start a business each month.¹² 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. The 15 or

¹⁰ Regularly published estimates from the CPS by the U.S. Bureau of Labor Statistics, such as those reported in *Employment and Earnings*, however, exclude incorporated business owners, which represent roughly one third of all business owners.

¹¹ 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, Bygrave and Autio 2003).

¹² 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).

more hours restriction also rules out the possibility of business ownership as "disguised unemployment" (Carter and Sutch 1994).¹³ A disadvantage of commonly used sources of data based on tax records, such as the Survey of Business Owners and non-employer business statistics, is that a large share of businesses are very small scale and do not represent the primary work activity of the owner (e.g. captures 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.¹⁴ Reports presenting results for detailed geographical areas have been published recently, such as Advanced Research Technologies, LLC (2005) report to the U.S. Small Business Administration (SBA) and Burton: Center for American Progress (2005). The exclusion of non-employer firms, however, is likely to lead to a substantial undercount of the rate of entrepreneurship because non-employer firms represent 75 percent of all firms (U.S. Small Business Administration 2001, Headd 2005) and a significant number of new employer firms start as non-employer 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 non-employer 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. In other words, we do not expect the total number of business owners and the total number of businesses to be perfectly comparable at a point in time so the rate of creation could also differ. Multiple businesses owned by one individual count only once in individual-level data and businesses with multiple owners count only once in business-level data. These discrepancies are relatively minor, however. Estimates from the 1992 CBO indicate that the total number of business owners is only 12 percent larger than the total number of businesses (U.S. Census Bureau 1997). Similarly, Boden and Nucci (1997) find that less than 3 percent of small business records in the CBO pertain to owners of multiple businesses.

TECHNOLOGY

¹³ See Fairlie (2005) for a detailed analysis of entrepreneurship rates by different hours criteria.

A refinement to the measure possible with the CPS is focusing on hi-tech workers. Using the detailed industry codes available in the CPS we can narrow the sample 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. 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.

Hi-tech industries represent 23 percent of the workforce in Silicon Valley, which is more than double the percentage for the rest of the United States. As expected, we also find that workers in these industries are also very educated. Nearly 50 percent of workers in these industries have at least a 4-year college degree. For all other industries, only 27 percent of workers have at least a 4-year college degree.

4. Entrepreneurship in Silicon Valley

As noted above, there is no evidence in the previous literature from a large, nationally representative dataset on patterns of entrepreneurship in Silicon Valley. Figure 6 and Table 1 report estimates of entrepreneurship rates for Silicon Valley, the rest of California, the California total, and the United States from the matched CPS data.¹⁵ 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 period. The cutoff between time periods coincides with the highest point reached by the NASDAQ, which was on March 10, 2000.

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 entrepreneurship rate in Silicon Valley was 0.39 percent compared to 0.43 percent in the United States. The rate of entrepreneurship for

¹⁴ Estimates from the SUSB are reported by the Small Business Administration, Office of Advocacy (see www.sba.gov/advo/research/data.html).

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 entrepreneurship 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 percent to 0.41 percent.¹⁶ 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.

The comparison of entrepreneurship rates between Silicon Valley and the United States is different when examining total business creation. Table 1.B reports estimates of entrepreneurship rates for Silicon Valley, the rest of California, the California total, and the United States from the matched CPS data including all industries. Total business creation rates were slightly higher in Silicon Valley than the national average during the boom period of the late 1990s. From January 1996 to February 2000, the entrepreneurship rate in Silicon Valley was 0.31 percent compared to 0.29 percent in the United States. Following the trend for hi-tech entrepreneurship, total business creation rates increased in Silicon Valley from the pre- to post-boom periods. These trends resulted in total entrepreneurship rates that were higher in Silicon Valley than in the United States in the post-boom period. Similar to the findings for hi-tech industries, however, we do not find evidence that total entrepreneurship rates were substantially higher in Silicon Valley than elsewhere during the economic boom of the late 1990s. Overall business creation was only slightly higher during this period and increased substantially above the national rate only in the post-boom period. We return to focusing on hi-tech industries.

5. Entrepreneurship in the Late 1990s

¹⁵ We follow the convention of defining Silicon Valley as the San Jose, San Francisco and Oakland MSAs (see Fallick, Fleischman and Rebitzer 2006 for example). Entrepreneurship rates were lower for the San Jose MSA alone, but the rate is not as precisely estimated because of smaller sample sizes.

¹⁶ An examination of annual entrepreneurship rates from 1996 to 2005 does not reveal a clear time trend other than higher rates in the post boom period.

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 entrepreneurship in Silicon Valley during the strong economic growth period of the late 1990s. Following this analysis, we examine entrepreneurship rates in the post-boom period. 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?

COMPARISON TO OTHER MSAS

Recent estimates of business creation indicate large regional differences across the United States (Advanced Research Technologies 2005). Interestingly, San Francisco and San Jose, however, are not the cities with the highest levels of entrepreneurial activity. 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. The highest ranked cities were Glenwood Springs, CO, Cape Coral, FL, and Bend, OR. These estimates of business formation, however, cover the entire 1990s and include all industries, but only include employer firm startups. Estimates from the CPS may reveal different regional patterns because they focus on hi-tech industries and include all hi-tech business starts with and without employees. The inclusion of non-employer startups in the CPS may be especially important for hi-tech industries.

To focus on the late 1990s and hi-tech industries, entrepreneurship rates are estimated for the largest MSAs in the United States by combining data from January 1996 to February 2000. Table 2 reports estimates for the 20 largest MSAs for this period. 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 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. In fact, many large MSAs had higher rates in the late 1990s, which may be due to the exceptionally tight labor market in Silicon Valley during this period.

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 large concentration of immigrants and entrepreneurship rates are higher among immigrants than the native-born (Schuetze and Antecol 2006). The importance of immigrants to Silicon Valley has been noted in the previous literature (Saxenian 1999, 2000). Silicon Valley is also known to have a very highly educated workforce and education is found to be positively correlated with entrepreneurship (Moutray 2007, van der Sluis, van Praag and Vijverberg 2004). Thus, the difference between entrepreneurship rates in Silicon Valley and the United States may be even larger once the large concentration of immigrants, high education levels, and other demographic characteristics of the workforce are taken into consideration. To investigate this question further, we first compare the demographic characteristics of Silicon Valley residents to the national average.

Table 3 reports estimates for several demographic characteristics of the hi-tech workforce for Silicon Valley and the United States.¹⁷ Nearly 32 percent of hi-tech workers living in Silicon Valley are immigrants, with 20.9 percent coming from Asian countries. In contrast, the U.S. hi-tech workforce is 12 percent immigrant with 5.3 percent 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 percent of the workforce has a college or graduate degree compared to the 42.9 percent in the United States. Controlling for a potentially more entrepreneurial population living in Silicon Valley may result in even lower entrepreneurship rates relative to the United States.

AN EMPIRICAL MODEL OF ENTREPRENEURSHIP: IDENTIFYING THE DETERMINANTS OF ENTREPRENEURSHIP

¹⁷ The patterns are similar when examining the total population in Silicon Valley and the United States.

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 entrepreneurship 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. 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.

Table 4 reports marginal effects estimates from several probit regressions for the probability of entrepreneurship in hi-tech industries.¹⁸ The base specification is reported in the first column. The probit estimates indicate that women are less likely to become hi-tech entrepreneurs than men controlling for other characteristics. 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. 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 2008). To our knowledge,

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.

this is the first estimate of the effect of immigration on hi-tech entrepreneurship from nationally representative data.

The relationship between entrepreneurship 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. The general and specific knowledge and skills acquired through formal education may be useful for starting a business. The owner's level of education may also serve as a proxy for his/her overall ability or as a positive signal to potential customers, lenders or other businesses making it easier to start a business. Home owners are less likely to enter self-employment.¹⁹

As noted above, 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 1 and Figure 6 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 entrepreneurship than the United States. The coefficient estimate is large, negative and statistically significant. It implies that rate of entrepreneurship

¹⁹ Previous studies find that home prices, home ownership and property restitution increase the likelihood of business creation and self-employment (Black, de Meza and Jeffreys 1996, Johansson 2000, Earle and Sakova 2000, and Fairlie 2005). The results may differ for hi-tech industries because of higher levels of wealth and lower levels of capital needed to start businesses.

in Silicon Valley was 0.078 percentage points lower than the rest of the country. The actual entrepreneurship rates were 0.39 percent for Silicon Valley and 0.43 percent 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.

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 unemployed and those not in the labor force are more likely than wage and salary workers to start businesses in the following month. 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 entrepreneurship 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.

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 4 reports estimates. The coefficients are not sensitive to the exclusion of these observations, which represent 11.8 percent 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.

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

Entrepreneurship rates in Silicon Valley rose from 0.39 percent in the January 1996 to February 2000 period to 0.41 percent in the March 2000 to December 2005 period (see Table 1). 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 entrepreneurship 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 increased by less 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 post periods 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, resulting in a substantial drop in the opportunity costs of starting a business. Thus, an increase in entrepreneurship rates in Silicon Valley from the pre to post periods provides further evidence that entrepreneurship rates were 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 5). 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 entrepreneurship 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 1 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). The estimates on the Silicon Valley post variable do not change relative to the main specification. Entrepreneurship rates in Silicon Valley increase in the post period as the opportunity costs decline.

To partially address this question, we include additional controls for previous unemployment and non-labor force participation in Specification 4. As discussed above, the inclusion of these variables partially controls for opportunity costs. The inclusion of these controls changes the sign on the post-Silicon Valley dummy from positive to negative. Higher entrepreneurship rates in Silicon Valley in the post-boom period disappear when we control for different rates of unemployment. As noted above, the unemployment rate in Silicon Valley rose from slightly more than 2 percent in the beginning of 2001 to 7.4 percent 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.²⁰

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 detailed demographic characteristics of the entrepreneurs. Thus, the hypothesis that Silicon Valley was and is a place of a high level of entrepreneurial spirit 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 Current Population Surveys (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. Entrepreneurship rates were lower in Silicon Valley during this period even after controlling for the large concentration of immigrants, which places downward pressure on rates of business creation in hi-tech industries. Entrepreneurship rates in Silicon Valley appear to have been suppressed by the exceptionally tight labor markets during this period. Unemployment rates, for example, were extremely low during the late 1990s dampening entrepreneurship rates.

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 entrepreneurship rate in Silicon Valley increased by 0.02 percentage points from the late 1990s to the post-boom period. This is 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 United States.

²⁰ The results are not sensitive to the inclusion of rural or small metropolitan areas.

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.

Implications for Theory and Practice

Besides our provocative empirical findings, our work provides several useful 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 research in management should thus consider the role of opportunity costs in the entrepreneurial decision. Future empirical research in economics and management should investigate the measures and results in this paper more closely and in different contexts.

Our work also has implications for public policy. 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 large concentration of immigrants and a highly-educated workforce are likely to lead to more entrepreneurial activity. But, there is another component to Silicon Valley that is more difficult to measure -- the entire environment or "habitat" appears to be favorable for innovation and entrepreneurship (Lee, et al. 2000). A highly educated and mobile workforce, a risk taking and failure tolerant culture, open business environment, location of top universities and research institutes, extensive support services, quality of life, and other characteristics of the area appear to contribute to the success of Silicon Valley (Lee, at 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 (2003) 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 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 (Gompers, Lerner, and Sharfstein, 2005; Chatterji, 2008), where former employees of incumbent firms start new ventures in the same industry. Employees gain valuable knowledge working at the parent firm, related to specific technologies and markets, which enable them to identify new entrepreneurial opportunities. These spawned ventures are often located near the original parent firm, adding to the agglomeration effects discussed above.

Future research should examine these regional dimensions of entrepreneurship further, utilizing different datasets and empirical approaches. Our paper provides some empirical evidence that regional differences in entrepreneurship can be driven by the interplay between opportunities and opportunity costs in particular areas. However, the crucial role of social capital and agglomeration economies is difficult to measure in our data, leaving many opportunities for future work.

References

- Advanced Research Technologies, LLC. 2005. "The Innovation-Entrepreneurship NEXUS: A National Assessment of Entrepreneurship and Regional Economic Growth and Development," U.S. Small Business Administration, Office of Advocacy Report.
- Bhide, A.V., 2000. *The Origin and Evolution of New Businesses*. Oxford University Press, New York.
- Bitler, Marianne P. 2002. "Does PC Use Pay? Computers and Small Business Performance," RAND Working Paper.
- Bitler, Marianne, Alicia Robb, and John Wolken, 2001. "Financial Services Used by Small Businesses: Evidence from the 1998 Survey of Small Business Finances" Federal Reserve Bulletin, Vol. 87, April 2001.
- Black, Jane, David de Meza, and David Jeffreys. (1996). "House Prices, The Supply of Collateral and the Enterprise Economy." The Economic Journal. 106 (434):60-75.
- Buckley, Patricia, and Sabrina Montes. 2002. "Main Street in the Digital Divide Age: How Small and Medium-Sized Businesses are Using the Tools of the New Economy," U.S. Department of Commerce, Economics and Statistics Administration, Washington, D.C.: USGPO.
- Carter, Susan B., and Richard Sutch. 1994. "Self-employment in the Age of Big Business: Toward an Appreciation of an American Labor Market Institution," Working Papers on the History of Retirement, History of Retirement Project, University of California.
- Cassar, G. 2006. Entrepreneur opportunity costs and intended venture growth. *Journal of Business Venturing*, 21(5): 610-632.
- Chatterji, Aaron K. 2008. "Spawned with A Silver Spoon?: Entrepreneurial Performance and Innovation in the Medical Device Industry." *Strategic Management Journal*, forthcoming
- Council of Economic Advisers, 2001, *Economic Report of the President, 2001* (Washington, DC: U.S. GPO).
- Davis, Steven J., John Haltiwanger, Ron Jarmin, C.J. Krizan, Javier Miranda, Al Nucci and Kristen Sandusky. 2006. "Measuring the Dynamics of Young and Small Businesses: Integrating the Employer and Nonemployer Universes," CES Working Paper No. 06-04, February.
- Earle, John S., and Zuzana Sakova. 2000. "Business start-ups or disguised unemployment? Evidence on the character of self-employment from transition economies," Labour Economics, 7:(5): 575–601.
- Eckhardt, J. T. and S. A. Shane (2003). Opportunities and Entrepreneurship. 29: 333-349
- Evans, D. S. and L. S. Leighton (1989). "Some empirical aspects of entrepreneurship." *American Economic Review* 79(3): 519-535.
- Evans, David and Boyan Jovanovic. 1989. "An estimated model of entrepreneurial choice under liquidity constraints", Journal of Political Economy 97(4):808-27.

- Fairlie, Robert W. 2005. "The Personal Computer and Entrepreneurship" *Management Science*, 52 (2): 187-203.
- Fairlie, Robert W. 2006. "Entrepreneurship among Disadvantaged Groups: Women, Minorities and the Less Educated," The Life Cycle of Entrepreneurial Ventures, International Handbook Series on Entrepreneurship, Volume 3, ed. Simon C. Parker. New York: Springer.
- Fairlie, Robert W. 2008. The Kauffman Index of Entrepreneurial Activity: 1996-2007, The Kauffman Foundation: Kansas City.
- Fallick, Bruce, Charles A. Fleischman, and James B. Rebitzer. 2006. "Job-Hopping in Silicon Valley: Some Evidence Concerning the Microfoundations of a High-Technology Cluster," Review of Economics and Statistics, August 2006, Vol. 88, No. 3, Pages 472-481.
- Goldfarb, Brent D., David Kirsh, and Michael D. Pfarrer. 2005. "Searching for Ghosts: Business Survival, Unmeasured Entrepreneurial Activity and Private Equity Investment in the Dot-Com Era," University of Maryland, Robert H. Smith School Research Paper No. RHS 06-027.
- Gompers, P., Lerner, J., & Scharfstein, D. 2005. Entrepreneurial Spawning: Public Corporations and the Genesis of New Ventures, 1986 to 1999. *Journal of Finance*, 60(2): 577-614.
- Haltiwanger, John. 2004. "What do we know (and not know) about the contribution of young businesses to economic growth," Presentation at the Entrepreneurship in the 21st Century Conference, March 26, 2004, U.S. Small Business Administration, Office of Advocacy.
- Headd, Brian. 2003. "Redefining Business Success: Distinguishing Between Closure and Failure." *Small Business Economics* 21(1): 51-61.
- Headd, Brian. 2005. "Business Estimates from the Office of Advocacy: A Discussion of Methodology," U.S. Small Business Administration, Office of Advocacy Working Paper
- Headd, Brian. 2005. "Measuring Microenterprise: Data on Self-Employment and Nonemployers," Working Paper.
- International Telecommunications Union. 2005. World Telecommunication Indicators Database.
- Johansson, Edvard. "Self-Employment and Liquidity Constraints: Evidence from Finland." *Scandinavian Journal of Economics*, 102(1), March, 2000: 123-134.
- Kenney, Martin. 2000. Understanding Silicon Valley: The Anatomy of an Entrepreneurial Region, Stanford: Stanford University Press.
- Krugman, P. 1991. Increasing returns and economic geography. *Journal of Political Economy*, 99(3): 483.
- Lee, Chong-Moon, William F. Miller, Marguerite Gong Hancock, and Henry S. Rowen. 2000. "The Silicon Valley Habitat," in The Silicon Valley Edge: A Habitat for Innovation and Entrepreneurship, eds. Chong-Moon Lee, William F. Miller, and Henry S. Rowen, Stanford: Stanford University Press.
- Lee, Chong-Moon, William F. Miller, Henry S. Rowen. 2000. The Silicon Valley Edge: A Habitat for Innovation and Entrepreneurship, Stanford: Stanford University Press.

Moutray, Chad. 2007. "Educational Attainment and Other Characteristics of the Self-Employed: An Examination using the Panel Study of Income Dynamics Data," U.S. Small Business Administration Working Paper.

Parker, Simon C. 2004. The Economics of Self-Employment and Entrepreneurship. Cambridge: Cambridge University Press.

Reynolds, Paul D., William D. Bygrave, and Erkkö Autio. 2003. Global Entrepreneurship Monitor: 2003 Executive Report. Babson College, London Business School and the Kauffman Foundation.

Saxenian, Annalee. 1999. Silicon Valley's New Immigrant Entrepreneurs, San Francisco: Public Policy Institute of California.

Saxenian, Annalee. 2000. "Networks of Immigrant Entrepreneurs," in The Silicon Valley Edge: A Habitat for Innovation and Entrepreneurship, eds. Chong-Moon Lee, William F. Miller, and Henry S. Rowen, Stanford: Stanford University Press.

Schuetze, Herbert J., and Heather Antecol. 2006. "Immigration, Entrepreneurship and the Venture Start-up Process," The Life Cycle of Entrepreneurial Ventures, International Handbook Series on Entrepreneurship, Volume 3, ed. Simon C. Parker. New York: Springer.

Shane, Scott, and Daniel Cable. "Network Ties, Reputation, and the Financing of New Ventures." *Management Science* 48, no. 3 (2002): 364-81.

Shane, S. and S. Venkataraman (2000). "The Promise of Entrepreneurship as a Field of Research." *Academy of Management Review* 25(1): 217-226.

Sorenson, O. & Audia, P. G. 2000. The Social Structure of Entrepreneurial Activity: Geographic Concentration of Footwear Production in the United States, 1940-1989. *American Journal of Sociology*, 106(2): 424.

Stuart, T. & Sorenson, O. 2003. The geography of opportunity: spatial heterogeneity in founding rates and the performance of biotechnology firms. *Research Policy*, 32(2): 229-253.

U.S. Small Business Administration, Office of Advocacy. 2001. "Private Firms, Establishments, Employment, Annual Payroll and Receipts by Firm Size, 1998-2001" Table reported at http://www.sba.gov/advo/stats/us_tot.pdf.

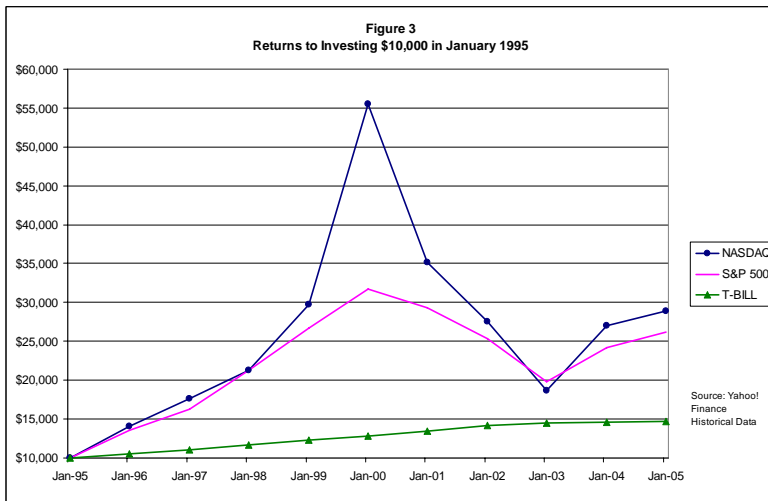
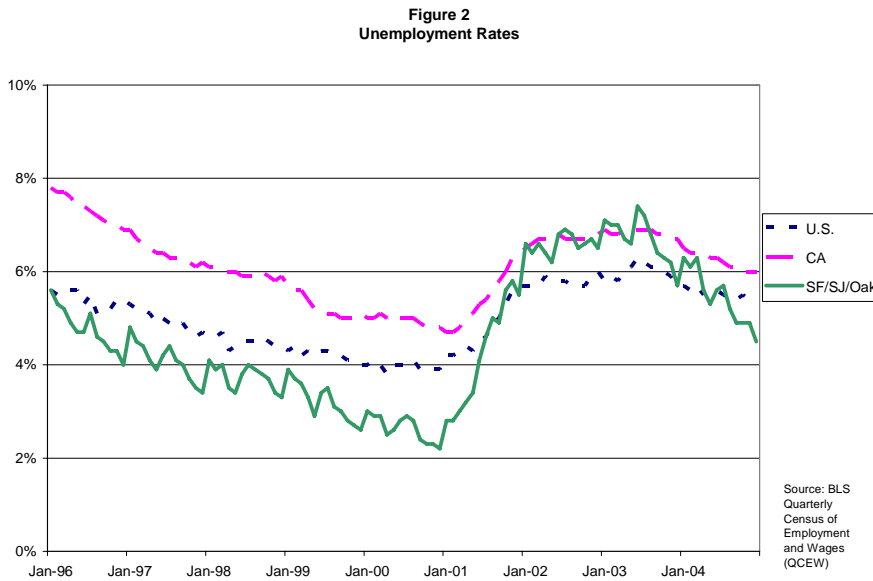
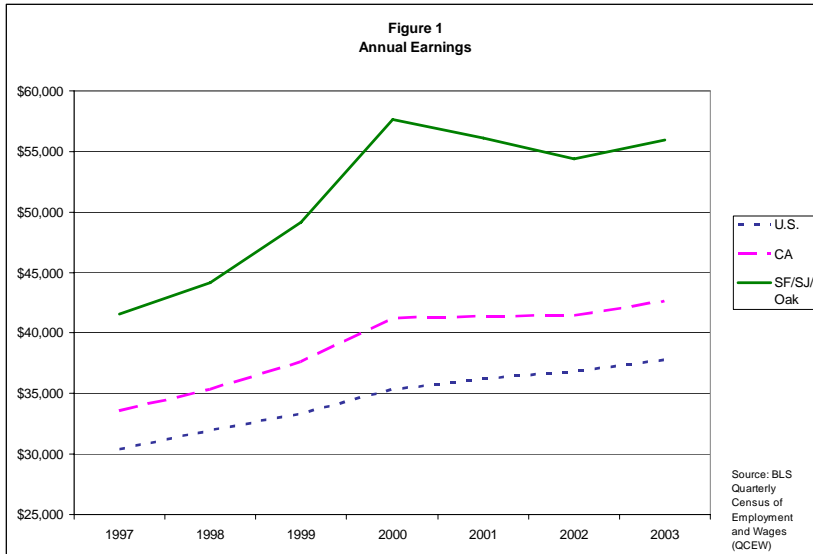
U.S. Small Business Administration, Office of Advocacy. "Self-Employment and Computer Usage," April 2003.

van der Sluis, J., van Praag, M., and Vijverberg, W. 2004. *Education and Entrepreneurship in Industrialized Countries: A Meta-Analysis*. Tinbergen Institute Working Paper no. TI 03-046/3, Amsterdam: Tinbergen Institute.

Zhang, Junfu. 2006. "Easier Access to Venture Capital in Silicon Valley: Some Empirical Evidence," Public Policy Institute of California Working Paper.

Appendix A
Hi-Tech and Related Industries

2002 CENSUS CODE	DESCRIPTION	2002 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, & technical services	5419 exc 54194



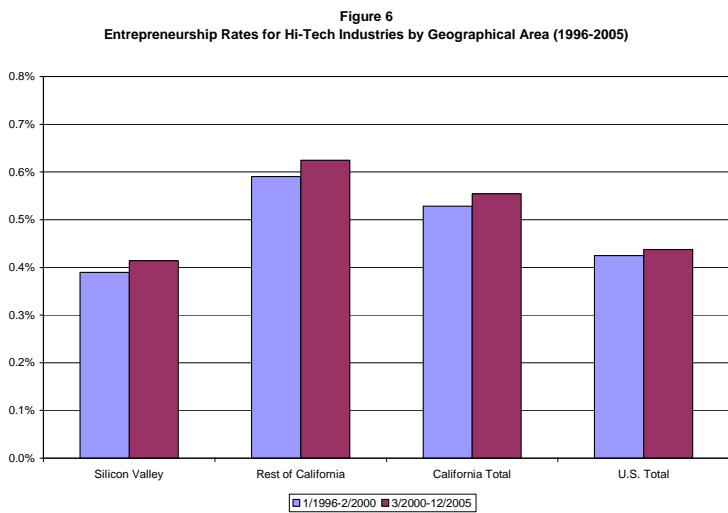
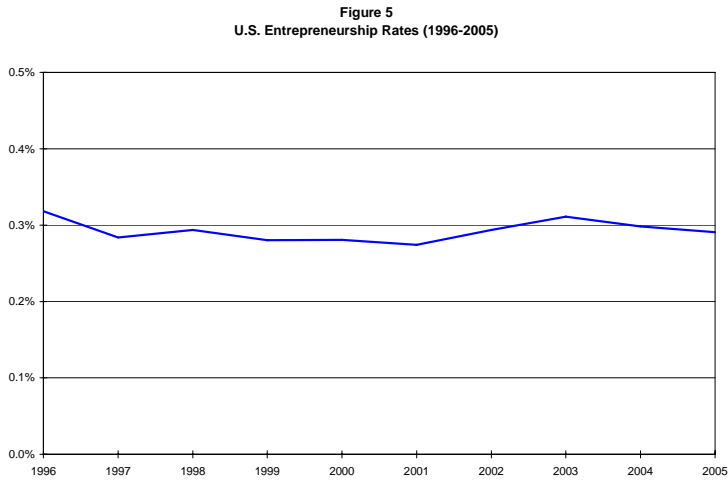
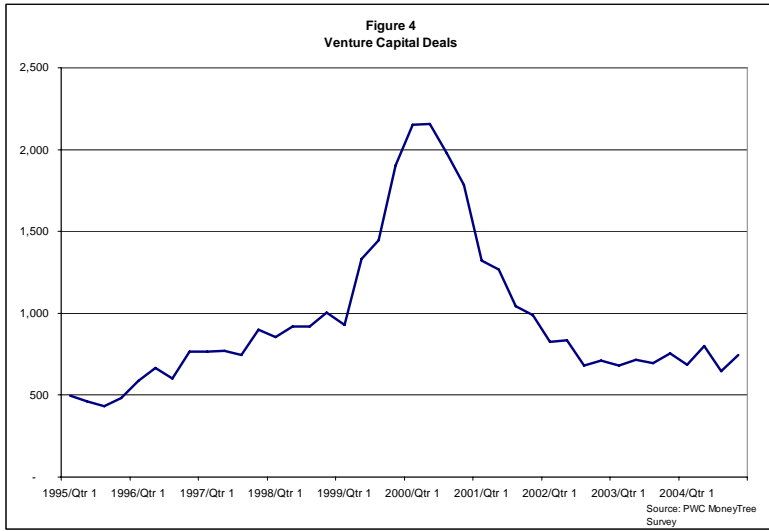


Table 1
Entrepreneurship Rates for Hi-Tech Industries by Geographical Area (1996-2005)

Year	Silicon Valley		Rest of California		California Total		U.S. Total	
	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 Current Population Survey. (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.

Table 1.B
Entrepreneurship Rates by Geographical Area (1996-2005)

Year	Silicon Valley		Rest of California		California Total		U.S. Total	
	Entrep. Index	Sample Size	Entrep. Index	Sample Size	Entrep. Index	Sample Size	Entrep. Index	Sample Size
1/1996-2/2000	0.31%	29,158	0.37%	155,091	0.36%	184,249	0.29%	2,223,833
3/2000-12/2005	0.35%	40,860	0.35%	214,949	0.35%	255,809	0.29%	3,459,028

Notes: (1) Sample includes all industries. (2) See notes to Table 1.

Table 2
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	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 1.

Table 3
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 1.

Table 5
Probit Regressions for Hi-Tech Entrepreneurship, CPS (1996-2005)

Explanatory Variables	(1)	(2)	(3)	(4)
Silicon Valley	-0.00075 (0.00005)		-0.00039 (0.00005)	-0.00027 (0.00004)
Silicon Valley Post Period	0.00024 (0.00006)	0.00040 (0.00005)	0.00025 (0.00006)	-0.00018 (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) All specifications include controls for gender, race/ethnicity, nativity, age, marital status, education level, family income, urban status, month effects and year effects.

Table 4
Probit Regressions for Hi-Tech Entrepreneurship, CPS (1996-2000)

Explanatory Variables	(1)	(2)	(3)	(4)
Female	0.00026 (0.00002)	-0.00086 (0.00002)	-0.00084 (0.00002)	-0.00080 (0.00002)
Black	-0.00162 (0.00004)	-0.00178 (0.00004)	-0.00170 (0.00004)	-0.00166 (0.00004)
U.S.-born Latino	-0.00222 (0.00006)	-0.00232 (0.00006)	-0.00258 (0.00006)	-0.00233 (0.00006)
U.S.-born Asian	-0.00452 (0.00013)	-0.00465 (0.00012)	-0.00495 (0.00012)	-0.00444 (0.00012)
Native American	0.00258 (0.00010)	0.00148 (0.00010)	0.00137 (0.00010)	0.00162 (0.00010)
Immigrant Latino	-0.00250 (0.00008)	-0.00323 (0.00008)	-0.00351 (0.00008)	-0.00308 (0.00008)
Immigrant Asian	-0.00289 (0.00005)	0.04520 (0.00066)	0.04351 (0.00066)	0.03909 (0.00069)
Immigrant other	-0.00012 (0.00004)	-0.05339 (0.00079)	-0.05150 (0.00079)	-0.04565 (0.00083)
Age (00s)	-0.02395 (0.00066)	0.04520 (0.00066)	0.04351 (0.00066)	0.03909 (0.00069)
Age squared	0.04154 (0.00077)	-0.05339 (0.00079)	-0.05150 (0.00079)	-0.04565 (0.00083)
High School graduate	-0.00003 (0.00006)	0.00089 (0.00006)	0.00095 (0.00006)	0.00101 (0.00007)
Some college	0.00167 (0.00006)	0.00244 (0.00006)	0.00244 (0.00006)	0.00261 (0.00007)
College graduate	0.00326 (0.00006)	0.00420 (0.00006)	0.00424 (0.00006)	0.00423 (0.00007)
Graduate school	0.00517 (0.00006)	0.00572 (0.00006)	0.00579 (0.00006)	0.00565 (0.00007)
Home owner	-0.00124 (0.00002)	-0.00098 (0.00002)	-0.00092 (0.00002)	-0.00110 (0.00002)
Unemployed		0.00814 (0.00003)	0.00805 (0.00003)	0.00808 (0.00003)
Not in the labor force		0.01417 (0.00002)	0.01416 (0.00002)	0.01393 (0.00003)
Silicon Valley	-0.00078 (0.00005)	-0.00036 (0.00004)	-0.00010 (0.00004)	-0.00032 (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. (2) Additional controls include month, year, and urban status dummies.