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ECONOMIC TRENDS AND LOCATION PATTERNS OF WOMEN HIGH-TECH ENTREPRENEURS

Heike Mayer, Urban Affairs and Planning, Virginia Tech

ABSTRACT

This paper examines economic trends and spatial location patterns for female high-technology entrepreneurs in four U.S. regions. The results show that women entrepreneurs are more likely to start firms in female-typed high-tech sectors than in male-typed high-tech sectors. Female-typed high-tech firms are smaller and less profitable than their male-typed counterparts. The examination of intra-metropolitan location patterns of women-owned high-tech firms revealed a tilt towards the suburbs. The male-typed high-tech firms tend to cluster in regional high-tech corridors thereby taking advantage of important resources and localization economies. The findings confirm previous studies about the female nature of women’s business ownership.

INTRODUCTION

The number of women starting and owning businesses increased dramatically over the last couple of decades. Women-owned businesses are the fastest growing population of entrepreneurs in the United States and in other countries. Between 1997 and 2004, the growth in the number of majority women-owned businesses was nearly two and half times the rate of all U.S. privately-held firms and employment in these firms grew more than three times faster according to estimates from the Center for Women’s Business Research. Women-owned firms have become an important economic force in the U.S. economy.

Traditionally female entrepreneurs founded businesses in the retail and service sector (Loscocco & Robinson, 1991), but increasingly women establish ventures in non-traditional industries such as high-technology manufacturing and services, construction, transportation, communications, and public utilities (Langowitz, 2003; Center for Women’s Business Research, 2004). Brush et al. (2004) call these female business owners the “new generation of women entrepreneurs” (p. 151) and characterize them as younger and more likelier to own firms in fast growth sectors such as high-technology. Women’s educational attainment has increased dramatically (Fagenson & Jackson, 1993) and the group of 25 to 34-year-old women are now more likely to have a four-year college degree than their male counterparts (Cortright, 2005).

There are few studies researching women-owned businesses in general (Brush, 1992; Baker, Aldrich, & Liou, 1997). In addition, Brush (1992) found that research is lacking that compares female entrepreneurs within industry sectors and not many studies have examined intra-metropolitan location patterns. This paper attempts to make two important contributions: First, it will provide much needed research on women-owned high-technology firms in general, and more specifically, about the community of women high-technology entrepreneurs in four U.S. regions. Second, it will examine spatial patterns of women entrepreneurs. Utilizing a geographic approach to entrepreneurship studies can help answer questions about the environmental context in which entrepreneurs operate and what challenges and opportunities this context provides for local economic development planning and policymaking.

LITERATURE REVIEW

Women business ownership has been a research field for a long time and scholars from disciplines as diverse as geography, sociology, and business administration have focused on this topic. The majority of the literature primarily compared men to women and found that women business owners are very similar
to their male counterparts, especially regarding basic demographic characteristics and issues associated with starting the business (Brush, 1992). Where they differ, however, is along dimensions of education, work experience, skills, approaches to venture creation, business goals, problems and performance (Brush, 1992). This may suggest that male-female differences might influence the entry and the performance of women business owners for certain industry sectors more than others.

Indeed, women tend to own firms with lower sales volumes and lower incomes than their male counterparts (Loscocco & Robinson, 1991). Loscocco and Robinson explain that women’s lack of experience and their concentration in least profitable sectors (such as services, retail) are responsible for such gender differences. Furthermore, they note that within male-typed sectors, women tend to occupy niches that men typically do not enter.

Despite such a strong pattern of occupational segregation into female-typed sectors, women are increasingly entering high-growth industry sectors such as manufacturing, technology, public utilities, etc. While there is generally a gap in research comparing women entrepreneurs within sectors, only a few studies have focused on such “non-traditional” entrepreneurs. Anna et al. (Anna, Chandler, Jansen, & Mero, 1999) utilize social learning theory and an occupational choice perspective and found that non-traditional female business owners are very different from the ones operating in traditional sectors in terms of venture efficacy, career expectations, perceived social support, and sales. They base their analysis on Loscocco and Robinson (1991) who differentiated between male-typed fields (non-traditional) such as manufacturing, construction, and high-technology from female-typed (traditional) fields (retail and services). Grundy and Welsch (2001) focused on ambitious, high-growth women entrepreneurs (as measured by sales) and found that they focus more on market expansion, new technologies, a more structured approach to organizing their business, a greater focus on business ownership, and willingness “to incur greater opportunity costs for the success of their firms.” (p. 454). In short, the literature has found differences among women entrepreneurs, but there appears to be a gap in a more detailed understanding of women business owners within a particular sector.

There is a void in the literature on examining women entrepreneurs in high-technology industry sectors. The previously mentioned studies have not focused specifically on high-technology industries. Existing research examines this sector from the perspective of work culture, which is mostly described as masculine (Kelly, 1984; Massey, 1995). Some of these studies focus on the connection between social inclusion in high-technology and regional economic competitiveness (Gray & James, Forthcoming); others have looked at specific sectors such as the life sciences and the relationship between organizational structure and women’s career advancement. One study found that women have better career chances in smaller, flexibly organized life science firms than in hierarchically organized university laboratories (Smith-Doerr, 2004). Other research focused on the use of information technology and how that has enabled women to succeed at entrepreneurship (Martin & Wright, 2005; Fairlie, 2005).

A related set of studies examines women’s participation in the venture capital industry, both from an investor and an investee perspective. This line of research found that women are underrepresented in decision making positions within the venture capital industry and women-led firms have received only 4.1 percent equity financing during the 1990s (Greene, Brush, Hart, & Saporito, 2001; Brush, Carter, Gatewood, Greene, & Hart, 2004). Given the fact that high-technology firms are capital intensive and often dependent on equity investments, these studies are highly relevant to this work.

Almost no study has focused on inter-metropolitan and intra-metropolitan spatial location patterns of women-owned high-technology firms. This is surprising since ample evidence exists that entrepreneurship is strongly linked to geographic clustering (for an overview see Thornton & Flynn (2003)). Location matters and some have found that female entrepreneurs in rural areas differ from those in urban areas and that they face greater challenges than those in urban areas (Sullivan, Halbrendt, Wang, & Scannell, 1997; Merrett & Gruidl, 2000). High-technology sectors are especially prone to geographic
clustering because of their reliance on a skilled and specialized labor pool, knowledge spillovers, and the path dependent nature of the founding of new firms (Cooper & Folta, 2000; Feldman, 2001). Examples of regional agglomerations include Silicon Valley, Boston’s Route 128, North Carolina’s Research Triangle Park, and the high-technology industry in Austin, Texas (Luger & Goldstein, 1990; Saxenian, 1994; Oden, 1997). The broader theoretical context of why firms in high-technology industries cluster is provided by macro-economic explanations. In particular, post-Fordist theories have stressed that global competition demanded firms to become more responsive by adopting flexible organizational structures which depend on regionally embedded networks that constitute industrial districts (Piore & Sabel, 1984). Proximity, mutual trust, networks facilitate the geographic clustering (Harrison, 1992).

Cooper and Folta (2000) discuss the costs and benefits of location and state that being located within a cluster of similar firms allows entrepreneurs to access specialized labor, receive more easily specialized inputs, capital, and knowledge spillovers. Also, the proximity to customers and the psychological (mentoring) support a location can provide prove important to nascent firms. The flip side of the location within a cluster is that the cost of the location (office space, etc.) may be fairly high. Taken the latter aspect into account and combining it with the notion that women’s businesses are more likely to be smaller and less profitable than male-owned firms, women may be more challenged in their location choices. As a result, we may see more dispersed location patterns for female-owned firms and the connection to home-based work. While home-based work may have cost benefits, it may also provide an opportunity for women entrepreneurs to combine work and life issues in a more efficient and seamless way. The drawback of this kind of home-based locational arrangement is that dispersed location patterns in the home (and that also often means in suburban residential areas) may contribute to the isolation from the core of the industrial district and a resulting disconnect from important resources in the local economy and the industry cluster such as networks of customers, suppliers, competitors, labor pools, and sources for funding. It may also reinforce stereotypes about the domestic nature of work. In contrast to the dispersed, isolated location of home-based businesses, firms that are located among similar firms and commercial activity may incur substantial benefits, including opportunities to network, which may in turn lead to access to resources and markets. Other benefits consist of labor pool access, knowledge spillovers, easier access to customers, markets, and competitors. Blake and Hanson (2005) noted the importance of a community of resources (i.e. capital providers, lawyers, etc.) to the growth of women-owned firms. Being centrally located would make it easier for the firms to access these resources. In addition, a central location might impose some symbolic legitimacy towards creditors, customers, and others. This might be especially important for women-owned high-technology firms that operate in sectors that have traditionally been dominated by men.

**RESEARCH QUESTIONS**

Given the lack of research on women-owned high-technology businesses, I decided to examine female entrepreneurship in four noted high-technology locations. The four regions are San Francisco/Silicon Valley, Boston, Washington D.C. and Portland (Oregon). These regions compare and contrast on various characteristics including geography, life cycle of the industry, and nature of the high-technology industry. San Francisco/Silicon Valley and Portland represent the West Coast while Boston and D.C. represent the East Coast. Silicon Valley’s and Boston’s high-technology economies are fairly mature and their roots go back to the early electronics and radio industries before and after WWII (Saxenian, 1985, 1994; Kenney, 2000). Portland’s and Washington D.C.’s high-technology economy is emerging, having its roots in the 1970s and 1980s (Feldman & Francis, 2003; Breshnahan & Gambardella, 2004; Mayer, 2005, 2005). In addition to differences in their evolutionary paths, these regions differ regarding their competitive advantages and high-tech specializations (Cortright & Mayer, 2001). I was also very interested in the differences between female-typed and male-typed women-owned high-technology firms within these regions. Examining female entrepreneurship from an industry image perspective has some precedence in entrepreneurship studies. The thinking behind these studies is that there are different kinds of images associated with certain industries and sectors. Dant, Brush and Iniesta (1996) applied this perspective to
The franchising industry and compared female- to male-typed sectors. Barrett (1995) employed a similar approach and compared manufacturing (male) to service (female) industries. Blake and Hanson (2005) examined qualitatively the experience of females entering male-oriented sectors. All of these studies utilized an anecdotal approach to classifying the female and male images for an industry sector.

**METHODODOLOGY**

The analysis is based on a dataset of 11,772 records for women-owned high-technology firms in the four regions. The dataset was obtained from Dun and Bradstreet in 2005, and contains detailed descriptive information for each firm, including the year the firm was founded, its industrial classification code (NAICS), employment, and annual sales volume. Location information is noted in the data as the physical address of each firm. In order to visualize the location patterns of women-owned high technology firms in the four regions, the data obtained from Dun & Bradstreet was geo-coded by address using Geographic Information System Software (ESRI ArcGIS 9.1). We selected the business records for women-owned high-technology firms by utilizing the occupation-based high-technology definition developed by Chapple et al. (2004) and Paytas and Berglund (2004) for the four regions of interest.

For the purposes of classifying firms as either “traditional” or “nontraditional”, it was first necessary to devise an image typology of sectors. We used a more systematic approach to classifying the high-technology industries into traditional (female) and non-traditional (male) segments than previous studies (Barrett, 1995; Dant et al., 1996). The metric we chose to represent the degree to which a sector was “female-typed” or “male-typed” was the ratio of female employment to male employment, based on national data on occupations by sex from the 2003 data on job patterns for minorities and women from the U.S. Equal Employment Opportunity Commission (2006).

**RESULTS AND DISCUSSION**

**Regional Comparison**

Mention Silicon Valley or Boston’s Route 128 corridor, the odds are that most people will associate the high-technology industry and the economic boom in the 1990s with these regions. These particular regions have become prominent because of the location and concentration of high-technology industries. Silicon Valley and Boston are two of the most prominent examples and they represent established high-technology economies. Recently, other regions have emerged. Often they are second-tier and less prominent, but with significant industrial prowess. Washington D.C. and Portland, Oregon belong to this group. In contrast to Silicon Valley and Boston, second-tier regions do not have the typical ingredients such as world-class universities and venture capital funding that make for high-tech economic growth. Instead, these regions are emerging high-technology locations and they have bootstrapped their economies by leveraging private firms or government agencies as “surrogate universities” (Mayer, 2005). Because the regions differ regarding their evolutionary paths, an examination of women’s business ownership in high-technology will be insightful.

Examining the overall patterns of women’s business ownership, we can see that women-owned firms are more represented in Silicon Valley with 15.14 percent share of all firms. Boston surprisingly boasts the lowest share (9.34 percent) while women own more than 13 percent of all firms in Washington D.C. and in Portland (see Table 1). This is not surprising since Portland leads the nation with having the greatest share (57.7 percent) of 50% or more women-owned firms according estimates from the Center for Women’s Business Research. According to these estimates, Portland is also among the top 10 metro areas that have experienced the fastest growth of women-owned firms from 1997 to 2004.

Compared to the overall representation of women-owned firms in the economy, the share of female entrepreneurs in high-technology is sizable and in most cases higher than their share of overall firms (see...
Table 1). The highest shares are in Silicon Valley and in Washington D.C. with 17.2 percent and 18.57 percent respectively. The lowest are in Boston (9.76 percent) and Portland (7.25 percent). This may indicate that Washington D.C. may represent a more established region for women-owned high-technology firms than the literature on the evolution of the region as a whole may suggest. Surprisingly, the annual growth rate for women-owned high-technology firms was the highest for Washington D.C. at 9.27 percent for the period between 1990 and 2004. The rates are comparable ranging between 6 and a little less than 7 percent for the other regions. Washington’s high growth rate in number of women-owned high-tech firms might be associated with the region’s booming economy that was the result of increased government spending on homeland security and the war after the terrorist attacks in 2001. As others have observed Washington D.C. economy is highly dependend on government procurement and outsourcing, providing opportunities for entrepreneurs (Feldman & Francis, 2003; Fuller, 2003; 2004; 2004). Contracting opportunities in D.C. may especially benefit women and minority entrepreneurs. Portland’s high growth rates during the 1990s and 2000s can be explained by the region’s population boom and attractiveness to migrants from other areas in the United States (Mayer & Provo, 2004).

More interesting than the overall growth rates are the trends for male-typed high-technology sectors. Male-typed high-technology firms have been growing the fastest in Washington D.C., closely followed by Portland, Silicon Valley, and Boston. Overall there is not much difference in the growth rates between the established and emerging regions indicating that female business owners in high-tech in all four regions are doing well and are making important contributions to the the economy. In addition, women-owned high-technology firms contribute significantly to job creation in each region. They are typically small firms with a mean size ranging from 3.74 (Portland) to 8.96 (Washington D.C.). Male-typed high-tech firms are typically larger with a mean size that ranges from 4.95 (Portland) to 11.78 (Washington D.C.).

Segmentation within High-Technology

Loscocco and Robinson (1991) examined the gender segregation in the small business sector and found that women business owners are more likely to operate in sectors that are female-typed (retail and personal services in particular). The results of this study indicate that women are more likely to participate in female-typed high-technology sectors such as software publishing, computer systems design services, management and consulting services, and research services. In both regions, women’s presence in female-typed high-technology sectors was greater than 90 percent. Women’s participation as business owners in male-typed high-tech sectors never exceeds 9.2 % (see Table 1). They are less likely to be in male-typed high-technology sectors and less so in emerging regions.

The female-typed high-tech sectors include several wholesale-related high-tech businesses, software publishing firms, parts of the telecommunications and Internet-related services, architectural services, testing laboratories, computer systems design and related services, management consulting firms, and R&D in the social, physical and life science sectors. All these sectors are related to services and not manufacturing. Interestingly, pharmaceutical and medicine manufacturing as well as computer and peripheral equipment manufacturing were female-typed because of their favorable female-male ratios for professional and managerial occupations. The reason for why pharmaceutical manufacturing is a female-typed sector might be the ability of women to enter managerial and professional position in that sector more easily than in other areas such as university laboratories (Smith-Doerr, 2004). Overall, however, the presence of firms in these two manufacturing sectors is significantly smaller than in the service-related sectors such as management consulting, scientific and technical consulting services and computer systems design services. Most women-owned firms within the male-typed category are in engineering services. Women-owned firms are much less represented in the capital-intensive sectors such as semiconductor manufacturing, aerospace manufacturing, navigational instruments, or communications equipment.
Male-typed high-technology firms had the highest sales. These firms tend to be more lucrative than the female-typed sectors indicating what Loscocco and Robinson called a niche perspective, whereby women tend to enter niches that are not picked by men (because they are less profitable). The male-typed high-tech sales volume accounted for 58 percent of the overall sales volume. Of the four regions, Silicon Valley-based firms in the male-typed sector have the greatest returns ($1,057,177 in sales per firm). Washington D.C. scores highly on the sales volume per firm for the female-typed sector. This is partially due to the overall nature of the Washington D.C. high-technology economy which is heavily concentrated on information technology services. In contrast, Silicon Valley is known for both high-technology manufacturing and services. Boston ranks highly in sales per firm for the male-typed firms. The difference in sales for male and female-typed sector mean that those women who enter non-traditional (i.e. male-dominated) fields also see greater returns to their entrepreneurial activity. This confirms previous studies. In particular, Loscocco and Robinson (1991) observed that “those women who are able to penetrate men’s business domains may be most able to approach men’s levels of success. Past research on the gender composition of occupations suggests, furthermore, that there may be serious limits on the number of women who can enjoy the relative benefits of operating a business in a male-dominated industry.” (p. 522)

**Explaining gender segregation in high-tech ownership**

There are several explanations for the observed patterns of gender segregation in high-tech business ownership. Borrowing from Loscocco and Robinson (1991), I will examine in this section how two sets of barriers for women may contribute to the gender segregation we observe within high-technology industries. Specifically women’s inability to gain crucial managerial expertise and work experience in high-technology sectors prevents them from accumulating the necessary human capital, as well as the networks and relationships that would help them connect with customers and suppliers, finding a founding team and specialized labor pool necessary for getting the firm up and running. Second, structural barriers such as capital formation often prevent women to enter capital-intensive male-typed high-technology sectors and/or scale their businesses in these sectors. As a result, we observe that the four regions are dominated by small firms operating primarily in female-typed fields.

The link between work experience and business ownership and the specific relevance of this connection for women has been discussed before. Several studies have noted differences between male and female business owners regarding their work experience and educational backgrounds (Brush, 1992). Women tend to have more work experience in female-typed fields such as teaching, retail, office administration or secretarial areas rather than in male-typed occupations related to management, scientific, or technical positions. This may limit them in their entry into high-tech in general and more specifically into male-typed high-tech sectors. Evetts (1993) examined women’s advancement into management positions in engineering and argues that “management constitutes a career hurdle for women engineers” (p. 19) and that women had a more difficult time building managerial careers that could prepare them for entrepreneurship and business ownership. A reason for why this is the case was that managerial and executive careers in high-technology sectors demand a unidimensional commitment of the person. In other words, a person would need to progress from an engineering work position to an engineering management position without leaving the job or interrupting the career because of family reasons. Women, however, tend to have more interrupted careers than men, and this may prevent them from entering managerial posts in high-technology firms. Evetts also notes that organizational characteristics and stereotypes prevent women – who increasingly have acquired the necessary credentials and skills – from entering management positions in masculine fields such as high-tech. The real and perceived “glass ceiling” for women may have a different dimension for female-typed and male-typed high-technology sectors. Within the male-typed sectors, women may not get a chance at obtaining managerial and professional positions that would set them up to lead a firm in the sector. Within the female-typed high-tech sectors – especially in management consulting services where women are well represented, women may have more opportunities to enter positions that can prepare them for
entrepreneurship. As in the overall economy, women’s entry into high-tech business ownership seems to be shaped by their work experience and educational background. This study confirms Loscocco and Robinson’s findings about women’s segmentation into female-typed fields for the high-technology sectors.

Besides barriers rooted in the individual and the work organization, structural barriers such as the inability to obtain financial funding for the business may play a role why women business owners tend to be concentrated in female-typed high-tech sectors. Most female-typed high-tech sectors discussed in this study may not require extensive capital. In contrast, most male-typed sectors – especially manufacturing firms – require a substantial amount of up-front financing to set up the capital-intensive operations. Financial aspects in business ownership are the biggest obstacle to success for women-owned firms (Brush, 1992). High-technology industries require substantial amounts of investments because they are often capital-intensive and innovation-driven. Mostly, fast-growing and promising high-technology firms are funded by equity investments such as venture capital or angel funds. Women, however, have been significantly left out of these types of investments. According to Brush et al. (2004) “throughout the decade of the 1990s, women received less than 5% of all venture capital money invested. Of 1,200 companies that received venture funding in 1996, only 30 (2.5%) were women-led enterprises. During the 10-year period from 1988 to 1998, 290 (3.5%) of the total of 8,298 venture capital investments were made in women-led businesses” (p. 11). The same researchers found that women tend to be underrepresented and have high turnovers in decision making positions in venture capital firms (Brush et al., 2004). Lacking money to start and expand a firm is a serious impediment for women’s ability to enter male-oriented high-tech sectors.

Location

Where do women-owned high-technology firms locate within the four regions? Are there differences in location patterns between female-typed and male-typed high-technology firms? We try to answer these questions from a descriptive standpoint. We visualized the geographic location patterns of women-owned businesses in a series of maps (see Figures 1 and 2). The first set of maps shows the overall distribution of women-owned high-technology firms by region. The second set of maps illustrates the intra-metropolitan location pattern of male-typed high-technology firms. Various location patterns become obvious on these maps. For the overall distribution of the women-owned high-technology firms, each region seems to display specific concentration patterns. In San Francisco/Silicon Valley, most women-owned firms seem to be located in downtown San Francisco, in the heart of Silicon Valley (particularly in Palo Alto, Mountain View, Sunnyvale, and Santa Clara), and around Newark in Alameda County. For Boston the concentration patterns are in downtown Boston, along Route 128 but with a concentration to the South, and most pronounced in the outer suburbs around Maynard and West Concord. In Washington D.C. a clear concentration exists in the Northern Virginia region of the metropolitan area. In particular, women-owned firms seem to cluster outside the Beltway in suburban boom areas such as Reston, Herndon, McLean, Chantilly, and Fairfax. Another concentration pattern is found on the Maryland side, in particular along the 270 corridor. In Portland, Oregon, women-owned high-tech firms are clustered in close-in suburbs to the West of downtown in areas around highway 26, in Beaverton, Tigard, West Linn, Tualatin and Sherwood.

A common pattern to the intra-metropolitan location of women-owned firms in these four region is the suburban nature of the location of these businesses. The suburban nature of the location of firms may primarily be due to the fact that some of the businesses are home-based firms operating out of suburban residential communities. Another explanation may be that the growth patterns of high-technology development in these regions have primarily been suburban in nature. Boston’s Route 128 corridor emerged as the preferred location of high-tech firms. Silicon Valley’s heart is in the areas around Palo Alto, Sunnyvale, Mountain View, and Santa Clara. Washington D.C. information technology firms – often referred to as Beltway Bandits – are concentrated in the Northern Virginia suburbs and the region’s
biotech companies can be found along the 270 corridor in Rockville, Maryland. Portland’s Silicon Forest has its geographic heart along highway 66 where companies such as Intel, Tektronix, and InFocus are located. And these are also the areas where women-owned high-technology firms are located.

I was interested in examining the geographic concentration patterns for male-typed high-technology firms (see Figure 2). Mapping the firms reveals different concentration patterns than the maps of the overall distribution revealed. In the case of Boston, there appears to be no pattern of concentration that is specific for male-typed women-owned high-tech firms in comparison to the total distribution. Silicon Valley and Newark emerge as central locations for male-typed firms in San Francisco/Silicon Valley. Northern Virginia retains its centrality for this segment of women-owned high-tech firms. And in Portland, male-typed women-owned high-tech firms remain clustered in the suburbs to the west of downtown. The concentration patterns of male-typed high-tech firms in Silicon Valley, D.C. and Portland may point towards benefits resulting from localization economies and opportunities to draw on specialized labor pools, customers and suppliers, and opportunities to network with like-minded firms. In addition, male-typed firms owned by women that are located within these industrial corridors may obtain some sort of symbolic legitimacy and might contribute to changing stereotypes associated with females entering non-traditional sectors. In contrast, firms located outside of these corridors may experience disadvantages resulting from isolation from important resources.

CONCLUSION

This paper examined female business ownership patterns in four regions and found that women entrepreneurs are more likely to start firms in female-typed sectors. These findings are consistent with the results of previous studies about the female nature of women’s business ownership. This finding confirms previous studies. In sum, during a time when overall growth rates in women’s business ownership point to the emergence of a “new generation of women entrepreneurs” especially in non-traditional industry sectors, we still observe gender segregation patterns in business ownership within fields like high-technology.

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NOTES

1. Chapple et al’s definition of high-tech is based on the outdated Standard Industrial Classification (SIC) system. We utilized Paytas and Berglund’s (2004) translation to the new system, called North American Industrial Classification System (NAICS). Within the dataset, not every NAICS code defined as high-technology was represented because women may not own businesses in these sectors. The metropolitan regions were defined using the 2000 categories developed by the Office of Management and Budget (Census, 2006). In the text I often refer to Silicon Valley, but the geographic definition contains the metropolitan statistical areas of San Jose and San Francisco. The two metropolitan areas are closely connected through economic linkages.

2. Our Dun & Bradstreet data identified the sector of a firm at the 6-digit NAICS level; however, the EEOC data were only reported at the 5-digit NAICS level. As a consequence, each 6-digit sector’s “gender type” is inherited from its parent 5-digit sector.

REFERENCES


## Table 1: Regional Comparison

<table>
<thead>
<tr>
<th></th>
<th>Established High-Tech Regions</th>
<th>Emerging High-Tech Regions</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Silicon Valley</td>
<td>Boston</td>
</tr>
<tr>
<td><strong>Firms</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Number of Firms</td>
<td>149,441</td>
<td>223,984</td>
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<tr>
<td>Total Number of Women-Owned Firms (WOB)</td>
<td>22,619</td>
<td>20,914</td>
</tr>
<tr>
<td>Share of WOB (in %)</td>
<td>15.14%</td>
<td>9.34%</td>
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<tr>
<td>Total Number of Women-Owned High-Tech Firms</td>
<td>3,891</td>
<td>2,041</td>
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<tr>
<td>Share of Women-owned High-Tech Firms of all WOB</td>
<td>17.2%</td>
<td>9.76%</td>
</tr>
<tr>
<td>Total Number of Women-Owned High-Tech Firms in Female-Typed Sectors</td>
<td>3,556</td>
<td>1,903</td>
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<tr>
<td>Total Number of Women-Owned High-Tech Firms in Male-Typed Sectors</td>
<td>335</td>
<td>138</td>
</tr>
<tr>
<td>Annual Growth Rate of Women-Owned High-Tech Firms, 1990-2005</td>
<td>9.35%</td>
<td>8.43%</td>
</tr>
<tr>
<td>Annual Growth Rate of Women-Owned High-Tech Firms in Female-Typed Sectors, 90-05</td>
<td>9.68%</td>
<td>8.63%</td>
</tr>
<tr>
<td>Annual Growth Rate of Women-Owned High-Tech Firms in Male-Typed Sectors, 90-05</td>
<td>6.68%</td>
<td>6.10%</td>
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<tr>
<td><strong>Sales</strong></td>
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<td>Total Sales Volume in Women-Owned High-Tech Firms</td>
<td>$3,271,661,847</td>
<td>$1,217,894,646</td>
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<tr>
<td>Total Sales Volume for Female-Typed High-Tech Firms</td>
<td>$2,917,507,401</td>
<td>$1,050,843,481</td>
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<td>Sales per Firm in Female-Typed High-Tech Sectors</td>
<td>$820,446</td>
<td>$552,204</td>
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<td>Sales per Employee in Female-Typed High-Tech Sectors</td>
<td>$161,653</td>
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<tr>
<td>Sales Volume for Male-Typed High-Tech Businesses</td>
<td>$354,154,446</td>
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<td>Sales per Firm in Male-Typed High-Tech Sectors</td>
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<td>Sales per Employee in Male-Typed High-Tech Sectors</td>
<td>$97,968</td>
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<td><strong>Employment</strong></td>
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<tr>
<td>Total Number of Employees in Women-Owned High-Tech Firms</td>
<td>21,663</td>
<td>11,337</td>
</tr>
<tr>
<td>Total Number of Employees in Female-Typed High-Tech Firms</td>
<td>18,048</td>
<td>9,787</td>
</tr>
<tr>
<td>Total Number of Employees in Male-Typed High-Tech Firms</td>
<td>3,615</td>
<td>1,550</td>
</tr>
<tr>
<td>Mean Employment for Women-Owned High-Tech Firms</td>
<td>5.57</td>
<td>5.55</td>
</tr>
<tr>
<td>Mean Employment for Female-Typed High-Tech Firms</td>
<td>5.08</td>
<td>5.14</td>
</tr>
<tr>
<td>Mean Employment for Male-Typed High-Tech Firms</td>
<td>10.79</td>
<td>11.23</td>
</tr>
</tbody>
</table>

Source: Author’s calculations from Dun & Bradstreet database
<table>
<thead>
<tr>
<th>Established High-Technology Regions</th>
<th>Emerging High-Technology Regions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1.2: Boston, MA Metro Area</td>
<td>Figure 1.4: Portland, OR Metro Area</td>
</tr>
<tr>
<td>Figure 1.3: Washington, DC Metro Area</td>
<td></td>
</tr>
</tbody>
</table>

**Data Source:** Dun & Bradstreet (2004)
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<tr>
<td>Figure 2.2: Boston, MA Metro Area</td>
<td>Figure 2: Female Business Ownership in Nontraditional (Male-Typed) Sectors by Census Tract</td>
</tr>
<tr>
<td></td>
<td>Data Source: Dun &amp; Bradstreet (2004)</td>
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